# SESAR Solution 02-05 SPR/INTEROP-OSED for V3 - Part V - Performance Assessment Report (PAR)


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## Authoring & Approval

### Authors of the document

| Name/Beneficiary | Position/Title | Date |
|---|---|---|
| **Fabio MANGIARACINA / ENAV** | Solution 02-05 Manager | 01/01/2019 |
| **Giuseppe Romano /ENAV** | Solution Member | 01/01/2019 |
| **Giovanni NEGRO / LEONARDO** | Solution Member | 01/01/2019 |
| **Marco Paino / Techno Sky** | Solution Member | 01/01/2019 |
| **Marco Cappella / NAIS** | Solution Member | 01/01/2019 |
| **Mariapia Molinario /NAIS** | Solution Member | 01/01/2019 |
| **Gabriella Duca / NAIS** | Solution Member | 01/01/2019 |
| **Luigi Perrotta / NAIS** | Solution Member | 01/01/2019 |
| **Francesca Parrotta / NAIS** | Solution Member | 01/01/2019 |

### Reviewers internal to the project

| Name/Beneficiary | Position/Title | Date |
|---|---|---|
| **Fabio MANGIARACINA / ENAV** | Solution 02-05 Manager | 25/07/2019 |
| **Giuseppe Romano /ENAV** | Solution Member | 25/07/2019 |
| **Giovanni NEGRO / LEONARDO** | Solution Member | 19/07/2019 |
| **Marco Paino / Techno Sky** | Solution Member | 18/07/2019 |
| **Marco Cappella / NAIS** | Solution Member | 02/01/2019 |
| **Mariapia Molinario /NAIS** | Solution Member | 25/07/2019 |
| **Gabriella Duca / NAIS** | Solution Member | 18/07/2019 |
| **Luigi Perrotta / NAIS** | Solution Member | 18/07/2019 |
| **Francesca Parrotta / NAIS** | Solution Member | 18/07/2019 |

### Approved for submission to the SJU By - Representatives of beneficiaries involved in the project

| Name/Beneficiary | Position/Title | Date |
|---|---|---|
| **Fabio MANGIARACINA / ENAV** | Solution 02-05 Manager | 31/07/2019 |
| **Giovanni NEGRO / LEONARDO** | Solution Member | 31/07/2019 |

### Rejected By - Representatives of beneficiaries involved in the project

| Name/Beneficiary | Position/Title | Date |
|---|---|---|


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## Document History

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| 00.00.01 | 15 Feb 2017 | | L.Tabernier | Replace Aggregation by Extrapolation + add Safety as requested by their leader |
| 00.00.02 | 26 April 2017 | | L.Tabernier | Chapter 3.2 rename Interaction by Relationship and add the different kind of possible relationship between solutions and also the rational and calculation of the aggregation |
| 00.00.04 | 03 May 2018 | | E. Calvo | Consistency with SESAR2020 Perf. Framework document + update SAF, SEC and HP as requested by their leader + Chapter 3.2 updates |
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# EARTH

EARTH

This Performance Assessment Report is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 731781 under European Union's Horizon 2020 research and innovation programme.

## Abstract

This document is the fifth part of the concept document for the Solution 05 of the Project PJ02 EARTH that addresses several aspects related to the SNI – Simultaneous Non-Interfering operational concept. The work performed in PJ.02-05 is intended to provide a significant enhancement to the OI concerning the concepts of SNI operations assuming the Point-in-Space (Standard & Advanced PinS) procedure concept as enabler for the SNI operation.

The document contains the (V3) Performance Assessment Report related to the concept. The contents are based on the results of the V3 validation exercises performed at the Solution.

It's worth noting that the V3 validation results were recorded in the PAR even if only a 0% contribution can be really considered (at ECAC level).

It's a fact that the experience acquired during the validations, especially from the Flight Trials, and from our operational judgment in ATM, a fully positive impact of independent IFR arrival/departure tailored for Rotorcraft was determined while analysing the different operating scenarios.

Even if, no measures for fixed-wing aircraft approaching/departing from the main runway has been done between Reference and Solution scenarios (OI step AO-0316 is focused on rotorcraft operations only), the operating solution which encompass the possibility to remove the rotorcraft traffics from the arrival/departure sequence, our judgment confirms that this is a solution which positively impacts the airport performance.

Given that, it wasn't possible to extrapolate any values at ECAC level due to lack of reference figures for the Rotorcraft operations into the S2020 Master Plan, and the PAR can only but contain the flight efficiency benefits extrapolated at local level.

Besides, the assumption that positive benefits for fixed-wing were confirmed by removing the rotorcraft from the runway operations are fully supported by SESAR 1 experiences and other research threads not part of the Programme (e.g. GARDEN, OPTIMAL, NICE TRIP, etc.)



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Nonetheless, the benefits, that the Solution measured in the validation exercise, will be valuable for the Cost Benefit Analysis, where the Rotorcraft AU might be considered as essential together with the ANPS.



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## List of Figures

*No table of figures entries found.*



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# 1 Executive Summary

This document provides the Performance Assessment Report (PAR) for Solution 02-05 “*Independent Rotorcraft operations at the Airport*”

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

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**Description:**

*The Solution 02-05 aims to improve access into airports in low-visibility conditions through the development and publication of specific approach and departure procedures for rotorcraft. If rotorcraft have to change from visual to instrument flight rules (IFR) due to adverse weather, busy airports have to manage both fixed wing and rotorcraft at the same time despite their different performances.*

*By introducing an independent IFR procedure for rotorcraft on final approach and take-off (FATO), both aircraft types can fly simultaneous non-interfering (SNI) operations. The independent procedure relies on performance-based navigation - specifically required navigation performance (RNP0.3) - to reach a point-in-space (PinS) to access the final approach and take-off area. The peculiar rotorcraft capabilities of tight turns, steep climb and descent, combined with dedicated IFR procedures based on GNSS and the RNP navigation specification within low-level IFR routes, will not only avoid the interaction of rotorcraft with fixed-wing aircraft, but will also optimise operations in obstacle-rich urban environments and noise sensitive areas.*

**More Information can be found in Chapter 2!**

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**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.


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| 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 | *3.64 kg (0.73%)* | *30.63 kg (0.27%)* | *The result has been obtained in post analysis calculated by the implementation of dedicated IFR Procedures for Rotocrafts; the result has been extrapolated at ECAC WIDE* |
| CAP1: TMA Airspace Capacity – TMA throughput, in challenging airspace, per unit time. | *N/A* | *N/A* | *X* |
| CAP2: En-Route Airspace Capacity – En-route throughput, in challenging airspace, per unit time | *N/A* | *N/A* | *X* |
| CAP3: Airport Capacity – Peak Runway Throughput (Mixed mode). | *N/A* | *N/A* | *The BIM developed for this Solution includes potential benefits for this KPA. Please refer to the SESAR 1 P04.10 Validation Report (D06 ed.00.01.00)* |
| PRD1: Predictability – Variance of Difference in actual & Flight Plan or RBT durations | *0.31%* | *0 % ** <br> *(26.73%) *** | ** The value is due to the impossibility of being able to calculate the variance due to the non-significant traffic sample.* <br> *** The results have been obtained in post analysis calculated by the implementation of dedicated IFR Procedures for Rotocrafts; the results aren't upgraded at ECAC Level and represent the difference in % btw the REF vs SOL ScenariosThe results have been obtained in post analysis* |

[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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| | | | |
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| | | | *calculated by the implementation of dedicated IFR Procedures for Rotocrafts; the results aren't upgraded at ECAC Level* |
| PUN1: Punctuality – % Flights departing within +/- 3 minutes of scheduled departure time due to ATM and weather related delay causes | *N/A* | N/A | *X* |
| CEF2: ATCO Productivity – Flights per ATCO -Hour on duty | *N/A* | *N/A* | *X* |
| CEF3: Technology Cost – Cost per flight | *N/A* | *N/A* | *X* |
| SAF1: Safety - Total number of fatal accidents and incidents with ATM Contribution per year | *N/A* | *N/A* | *X* |

**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* | *X* |
| SAF2.X: Mid-air collision – TMA | *N/A* | *X* |
| SAF3.X: RWY-collision accident | *N/A* | *X* |

[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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| | | |
|---|---|---|
| SAF4.X: RWY-excursion accident | *N/A* | *X* |
| SAF5.X: TWY-collision accident | *N/A* | *X* |
| SAF6.X: CFIT accident | *N/A* | *X* |
| SAF7.X: Wake related accident | *N/A* | *X* |
| SEC1: A security risk assessment has been carried out | *N/A* | *X* |
| SEC2: Risk Treatment has been carried out | *N/A* | *X* |
| SEC3: Residual risk after treatment meets security objective. | *N/A* | *X* |
| SEC7: Personnel (safety) risk after mitigation | *N/A* | *X* |
| SEC8: Capacity risk after mitigation | *N/A* | *X* |
| SEC9: Economic risk after mitigation | *N/A* | *X* |
| FEFF2: CO2 Emissions. | *96.45 kg (0.27%)* | *SEE FEFF1:* <br> *The results have been obtained in post analysis calculated by the implementation of dedicated IFR Procedures for Rotocrafts; the results are upgraded at ECAC Level* |
| FEFF3: Reduction in average flight duration. | *08:23 mm:ss (0.27%)* | *SEE FEFF1:* <br> *The results have been obtained in post analysis calculated by the implementation of dedicated IFR Procedures for Rotocrafts; the results are upgraded at ECAC Level* |
| NOI1: Relative noise scale | *N/A* | *X* |
| NOI2: Size and location of noise contours | *N/A* | *X* |
| NOI4: Number of people exposed to noise levels exceeding a given threshold | *N/A* | *X* |
| LAQ1: Geographic distribution of pollutant concentrations | *N/A* | *X* |
| CAP3.1: Peak Departure throughput per hour (Segregated mode) | *N/A* | *X* |
| CAP3.2: Peak Arrival throughput per hour (segregated mode) | *N/A* | *X* |



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| | | |
|---|---|---|
| CAP4: Un-accommodated traffic reduction | *N/A* | *X* |
| RES1: Loss of Airport Capacity Avoided | *N/A* | *X* |
| RES1.1: Airport time to recover from non-nominal to nominal condition | *N/A* | *X* |
| RES2: Loss of Airspace Capacity Avoided. | *N/A* | *X* |
| RES2.1: Airspace time to recover from non-nominal to nominal condition. | *N/A* | *X* |
| RES4: Minutes of delays. | *N/A* | *X* |
| RE5: Number of cancellations. | *N/A* | *X* |
| CEF1: Direct ANS Gate-to-gate cost per flight | *N/A* | *X* |
| AUC3: Direct operating costs for an airspace user | *N/A* | *X* |
| AUC4: Indirect operating costs for an airspace user | *N/A* | *X* |
| AUC5: Overhead costs for an airspace user | *N/A* | *X* |
| CMC1.1: Available/Required training Duration within ARES | *N/A* | *X* |
| CMC1.2: Allocated/ Optimum ARES dimension | *N/A* | *X* |
| CMC1.3: Transit Time to/from airbase to ARES | *N/A* | *X* |
| CMC2.1: Fuel and Distance saved<br>(for GAT operations) | *N/A* | *X* |
| CMC2.2: GAT planning efficiency of Available ARES | *N/A* | *X* |
| HP1: Consistency of human role with respect to human capabilities and limitations | *N/A* | *X* |
| HP2: Suitability of technical system in supporting the tasks of human actors | *N/A* | *X* |
| HP3: Adequacy of team structure and team communication in supporting the human actors | *N/A* | *X* |
| HP4: Feasibility with regard to HP-related transition factors | *N/A* | *X* |



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| | | |
|---|---|---|
| FLX1: Average delay for scheduled civil/military flights with change request and non-scheduled or late flight plan request | *N/A* | *X* |

**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.

One Performance Assessment Report shall be produced or iterated per Solution.

## 2.2 Intended readership

In general, this document provides the ATM stakeholders (e.g. airspace users, ANSPs, airports, airspace industry) and SJU 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. Additionally, the consolidation process will be carried out annually, based on the SESAR Solution's available inputs.

## 2.3 Inputs from other projects

The document includes information from the following SESAR 1 projects:

- B.05 D72 [5]: SESAR 1 Final Performance Assessment, where are described the principles used in SESAR1 for producing the performance assessment report.

PJ19 will manage and provide:

- PJ19.04.01 D4.1 [3]: Performance Framework (2018), guidance on KPIs and Data collection supports.

- PJ19.04.03 D4.0.1: S2020 Common assumptions, used to aggregate results obtained during validation exercises (and captured into validation reports) into KPIs at the ECAC level, which will in turn be captured in Performance Assessment Reports and used as inputs to the CBAs


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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

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

| Term | Definition | Source of the definition |
|---|---|---|
| **ADS-B Application** | A means by which aircraft, can automatically transmit and/or receive data such as identification, position and additional data, as appropriate, in a broadcast mode via a data link. | ICAO |
| **Airspace Management** | Airspace Management is the process by which airspace options are selected and applied to meet the needs of the ATM community. | ICAO 9854 |
| | Airspace Management is integrated with Demand and Capacity Balancing activities and aims to define, in an inclusive, synchronised and flexible way, an optimised airspace configuration that is relevant for local, sub-regional and regional level activity to meet users requirements in line with relevant performance metrics.<br>Airspace Management primary objective is to optimise the use of available airspace, in response to the users demands, by dynamic time-sharing and, at times, by the segregation of airspace among various airspace users on the basis of short-term needs.<br>It aims at defining and refining, in a synchronised and a flexible way, the most optimum airspace configuration at local, sub-regional and regional levels in a given airspace volume and within a particular timeframe, to meet users requirements while ensuring the most performance of the European Network and avoiding as much as possible any disruption. Airspace Management in conjunction with AFUA is an enabler to improve | P07.02<br>P04.02 |

5 https://stellar.sesarju.eu/?link=true&domainName=saas&redirectUrl=%2Fjsp%2Fproject%2Fproject.jsp%3FobjId%3Dxrn%3Aview%3Axrn%3Adatabase%3Aondb%2Ftable%2F59_anonymous%402333834.13%403834139.13



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| Term | Definition | Source of the definition |
|---|---|---|
| | civil-military co-operation and to increase capacity for the benefit of all users. | |
| **Airspace Configuration:** | Is a pre-defined and coordinated organisation of ATS routes of the ARN and /or terminal routes and their associated airspace structures, including airspace reservations/restrictions (ARES), if appropriate, and ATC sectorisation. | OSED 07.05.02 AFUA Step 1 V3 for V4 |
| **Airspace Restriction** | A defined volume of airspace within which, variously, activities dangerous to the flight of aircraft may be conducted at specified times (a “danger area”); or such airspace situated above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions (a restricted area); or airspace situated above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited (a prohibited area). | OSED 07.05.02 Step 1 for V4 |
| **Airspace Structure** | A specific volume of airspace designed to ensure the safe and optimal operation of aircraft. | OSED 07.05.02 Step 1 AFUA V3 for V4 |
| **Area navigation (RNAV)** | Method of navigation which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these. *Note.— Area navigation includes performance-based navigation as well as other RNAV operations that do not meet the definition of performance-based navigation* | ICAO Doc 9613 PBN Manual |
| **Approach procedure with vertical guidance (APV)** | An instrument procedure which utilizes lateral and vertical guidance but does not meet the requirements established for precision approach and landing operations. These procedures are enabled by GNSS and Baro VNAV or by SBAS. (PBN). | ICAO Doc 9613 PBN Manual |
| **APV Baro-VNAV** | RNP APCH down to LNAV/VNAV minima. | ICAO Doc 9613 PBN Manual |
| **APV SBAS** | RNP APCH down to LPV minima. | ICAO Doc 9613 PBN Manual |
| **Baro-VNAV** | Barometric vertical navigation (Baro-VNAV) is a navigation system that presents to the pilot computed vertical guidance referenced to a specified vertical path angle (VPA), nominally 3°. The computer-resolved vertical guidance is based on barometric altitude and is specified as a VPA from reference datum height (RDH). (PANS OPS). | ICAO Doc 9613 PBN Manual |



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| Term | Definition | Source of the definition |
|---|---|---|
| **CDFA – Continuous Descent Final Approach** | Continuous Descent Final Approach is a technique for flying the final approach segment of an NPA as a continuous descent. The technique is consistent with stabilized approach procedures and has no level-off. A CDFA starts from an altitude/height at or above the FAF and proceeds to an altitude/height approximately 50 feet (15 meters) above the landing runway threshold or to a point where the flare manoeuvre should begin for the type of aircraft being flown. This definition is harmonized with the ICAO and the European Aviation Safety Agency (EASA). | ICAO Documentation |
| **Flight intent** | The future aircraft trajectory expressed as a 4-D profile up to the destination (taking into account of aircraft performance, weather, terrain, and ATM service constraints). It is calculated and "owned" by the aircraft flight management system, and agreed by the Pilot. | ICAO Doc 9854 |
| | In the SESAR Context, Flight Intent corresponds to the "agreed data of RB/MT" : the waypoints of the routes and associated altitude, possible time and/or speed constraints agreed between ATM actors. | WP B04.02 CONOPS Step 1 |
| **Final Approach Point/Fix (FAP/FAF)** | In PANS-OPS ICAO Doc 8168 VOL I, FAF is described as the beginning of the final approach segment of an Non-Precision Approach, and FAP is described as the beginning of the final approach segment of a Precision Approach. Moreover, PANS-OPS ICAO Doc 8168 VOL II states that the APV segment of an APV SBAS procedure starts at the Final Approach Point. So, within this document, since only APV SBAS procedures are considered, the beginning of the final approach segment is called the FAP | PANS-OPS ICAO Doc 8168 VOL I |
| **Final Approach Segment (FAS) Data Block** | The APV database for SBAS includes a FAS Data Block. The FAS Data Block information is protected with high integrity using a cyclic redundancy check (CRC). | PANS OPS |
| **GNSS – Global Navigation Satellite System** | A worldwide position and time determination system that includes one or more satellite constellations, aircraft receivers and system integrity monitoring, augmented as necessary to support the required navigation performance for the intended operation. | ICAO Annex 10 |
| **GBAS – Ground Based Augmentation System** | Augmentation of a global navigation satellite system (GNSS) is a method of improving – "augmenting"– the navigation system's | ICAO Documentation |



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| Term | Definition | Source of the definition |
|---|---|---|
| | performances, such as integrity, continuity, accuracy or availability thanks to the use of external information to the GNSS into the user position solution. | |
| **Low Level IFR Routes** | Low Level IFR Routes dedicated to Rotorcraft integration in dense / constrained airspace. Rotorcraft altitude (2000-4000 ft.) specific Low Level IFR routes are designed and optimised based on route network using RNP-1 / RNP-0.3. The integration in dense and constraint airspace TMA is due to rotorcraft peculiar flight characteristics and type of operation conducted, such as:<br>• Helicopters not pressurised: the Maximum allowed altitude: FL100 (e.g 3000 m)<br>• Most helicopters have no de-icing capability<br>- Risk of encountering icing conditions increases with altitude. Typically standard IFR FL are often too high<br>• Health of on-board patients during medical flights<br>- Recommended altitude for patients in critical condition: not more than 3000 ft. AGL<br>• Safety and environment<br>• Visual flight at very low height (500 ft. or sometimes less) to stay below clouds in marginal weather conditions is frequent accident cause and impacts environment (e.g noise footprint) | ICAO Documentation<br>D11-P04.10<br>Sol 113 |
| **LNAV, LNAV/VNAV, LPV** | Are different levels of approach service and are used to distinguish the various minima lines on the RNAV (GNSS) chart. The minima line to be used depends on the aircraft capability and approval. | EUR RNP APCH Guidance Material |
| **LNAV/VNAV** | The minima line based on Baro-VNAV system performances that can be used by aircraft approved according to AMC 20-27 or equivalent. LNAV/VNAV minima can also be used by SBAS capable aircraft. | EUR RNP APCH Guidance Material |
| **LPV (Localiser Performance with Vertical Guidance)** | The minima-line based on SBAS performances that can be used by aircraft approved according to AMC 20-28 or equivalent | EUR RNP APCH Guidance Material |
| **MAPt** | Missed Approach Point | ICAO Doc 9613 |
| **Navigation specification** | A navigation specification is a set of aircraft and aircrew requirements needed to support a | ICAO Doc 9613 and WP B04.02 CONOPS Step 1 |


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| Term | Definition | Source of the definition |
|---|---|---|
| | navigation application within a defined airspace concept.<br>The navigation specification:<br>• defines the performance required by the navigation system,<br>• prescribes the performance requirements in terms of accuracy, integrity, continuity and availability for proposed operations in a particular Airspace,<br>• also describes how these performance requirements are to be achieved i.e. which navigation functionalities are required to achieve the prescribed performance and associated requirements related to pilot knowledge and training and operational approval.<br>A Performance-Based Navigation Specification is either a RNAV specification or a RNP specification. RNAV specifies a required accuracy whilst RNP specifies, in addition to a required accuracy, an aircraft system alert in case of deviation, with the pilot responsible to remain the aircraft within the RNP accuracy; it allows reducing ATC buffer with the controller still responsible for the separation against traffic. | |
| **Network Management** | Network Management is an integrated activity with the aim of ensuring optimised Network Operations and ATM service provision meeting the Network performance targets.,<br>The Network Management Function is executed at all levels (Regional, Sub-regional and Local) throughout all planning and execution phases, involving, as appropriate, the adequate actors (NM, FM, LTM…) | P07.02<br>P04.02 |
| **Performance-Based Navigation (PBN)** | Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.<br>*Note.— Performance requirements are expressed in navigation specifications in terms of accuracy, integrity,*<br>*continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept* | ICAO DOC 9613 PBN Manual |
| **PinS** | Point in Space is an approach procedure designed for helicopters only that includes both a visual and | ICAO PANS OPS 8168 |


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| Term | Definition | Source of the definition |
|---|---|---|
| | an instrument segment | |
| **Point-in-Space (PinS) Departures** | Point-in-space departure is a departure procedure designed for helicopters only that includes both a visual and an instrument segment. | ICAO PANS OPS 8168 |
| **Point-in-Space (PinS) Approach** | Point-in-space approach is an approach procedure designed for helicopters only that includes both a visual and an instrument segment. | ICAO PANS OPS 8168 |
| **RNAV specification** | See Navigation specification | ICAO PBN Manual 9613 |
| **RNP specification** | See Navigation specification | ICAO PBN Manual 9613 |
| **RNP operations** | Aircraft operations using an RNP system for RNP navigation applications | ICAO PBN Manual 9613 |
| **RNP route** | An ATS route established for the use of aircraft adhering to a prescribed RNP navigation specification | ICAO PBN Manual 9613 |
| **RF – Radius to Fix path terminator** | – An ARINC 424 specification that defines a specific fixed-radius curved path in a terminal procedure. An RF leg is defined by the arc centre fix, the arc initial fix, the arc ending fix and the turn direction. | ICAO PBN Manual 9613 |
| **RNAV Approach** | This is a generic name for any kind of approach that is designed to be flown using the on-board area navigation system. It uses waypoints to describe the path to be flown instead of headings and radials to/from ground-based navigation aids. RNP APCH navigation specification is synonym of the RNAV approach. | ICAO PBN Manual 9613 |
| **RNP APCH – RNP approach** | The RNP navigation specification that applies to approach applications based on GNSS. As illustrated in figure 2 below, there are four types of RNP APCH that are flown to different minima lines published on the same RNAV(GNSS) approach chart. | ICAO PBN Manual 9613 |
| **SBAS – Satellite-Based Augmentation System** | A wide coverage augmentation system in which the user receives augmentation information from a satellite-based transmitter. (ICAO Annex 10). The European SBAS is called EGNOS, the US version is called WAAS and there are also other SBASs in different regions of the World such as GAGAN in India and MSAS in Japan | ICAO Documentation |
| **SNI- Simultaneous Non Interfering** | The SNI is a concept describing the way simultaneous non interfering procedures have to be defined and executed to ensure the different traffic streams do not interfere with each other. This concept is mainly specified for fixed wing | ICAO Documentation |



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| Term | Definition | Source of the definition |
|---|---|---|
| | traffic. In this document, the focus of this concept is set on separating fixed-wing traffic from rotary-wing traffic, namely the SNI concept specific for Rotorcraft/ATCO operation. The simultaneous non interfering procedure for rotorcraft ensures, throughout the whole procedure and especially with regard to the final approach segment as well as the missed approach segment, it does not cause interference in terms of observing and (re)scheduling and separating fixed-wing traffic from rotary-wing traffic by the Air Traffic Controller (ATCO) | |
| **SVS -Synthetic Vision System** | SVS uses the basic elements of synthetic vision—a 3-D representation of terrain, obstacles and runways. | EUROCAE WG-79 |

## 2.5 Acronyms and Terminology

| Acronym | Definition |
|---|---|
| **AC** | Advisory Circular |
| **ADD** | Architecture Definition Document |
| **ADS-C** | Automatic Dependent Surveillance - Contract |
| **AMSL** | Above Mean Sea Level |
| **AMC** | Acceptable Means of Compliance |
| **ANSP** | Air Navigation Service Provider |
| **APCH** | Approach |
| **APV** | Approach Procedure with Vertical guidance |
| **ATC** | Air Traffic Control |
| **ATCO** | Air Traffic Controller |
| **ATM** | Air Traffic Management |
| **AU** | Airspace User |
| **BADA** | Base of Aircraft Data |
| **CAA** | Civil Aeronautics Authority |
| **CDA** | Continuous Descent Approach |
| **CDFA** | Continuous Descent Final Approach |



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| Acronym | Definition |
|---|---|
| CDO | Continuous Descent Operation |
| CDTI | Cockpit Display of Traffic Information |
| CNS | Communications, navigation and surveillance |
| CM | Context Management |
| COORD | Coordinator |
| CPDL-C | Controller Pilot Data Link Communications |
| CRC | Cyclic Redundancy Check |
| CTR | Control Zone |
| DA/H | Decision Altitude/ Height |
| DA | Decision Altitude |
| DB | Database |
| DOD | Detailed Operational Description |
| DRA | Direct Route Airspace |
| DSS | Desk System Suite Hardware |
| E-ATMS | European Air Traffic Management System |
| EGNOS | European Geostationary Navigation Overlay Service |
| ENB | Enabler |
| E-OCVM | European Operational Concept Validation Methodology |
| ETSO | European Technical Standard Order |
| EU-OPS | This refers to European Union (EU) regulations specifying minimum safety and related procedures for commercial passenger and cargo fixed-wing aviation |
| EXE | Executive |
| FAF | Final Approach Fix |
| FAP | Final Approach Point |
| FAS | Final Approach Segment |
| FAS DB | Final Approach Segment Data Base |
| FATO | Final Approach & Take-Off areas |
| FCS | Flight Control System |
| FMS | Flight Management System |



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| Acronym | Definition |
|---|---|
| **FNHD** | Finmeccanica Helicopters Division |
| **FPDO** | Flight Procedures Design Organization |
| **FTA** | Fix Tolerance Area |
| **GPA** | Glide Path Angle |
| **GPS** | Global Positioning System |
| **GNSS** | Global Navigation Satellite System |
| **HMI** | Human Machine Interface |
| **HP** | Human Performance |
| **HRP** | Heliport Reference Point |
| **ICAO** | International Civil Aviation Organization |
| **ICP** | Initial Climb Procedure |
| **IDF** | Initial Departure Fix |
| **IFR** | Instrument Flight Rule |
| **ILS** | Instrument Landing System |
| **INTEROP** | Interoperability Requirements |
| **I/O** | Input/Output |
| **IRS** | Interface Requirements Specification |
| **JRE** | Java Runtime Environment |
| **LLR** | Low Level IFR Routes |
| **LPV** | Localizer Performance with Vertical Guidance |
| **LNAV** | Lateral Navigation |
| **MAHF** | Missed Approach Holding Fix |
| **MAP** | Missed Approach |
| **MAPt** | Missed Approach Point |
| **MCA** | Minimum Crossing Altitude |
| **MCDU** | Multipurpose Control & Display Unit |
| **MET** | Meteorological |
| **MLS** | Microwave Landing System |
| **MOC** | Minimum Obstacle Clearance |
| **M/M** | Medium complexity / Medium density |



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| Acronym | Definition |
|---|---|
| **NOTAM** | Notice To AirMen |
| **OCA** | Obstacle Clearance Altitude |
| **OCA/H** | Obstacle Clearance Altitude/Height |
| **OFA** | Operational Focus Areas |
| **OIS** | Visual Identification Surface |
| **OSED** | Operational Service and Environment Definition |
| **PANS-OPS** | Procedures for Air Navigation Services – Aircraft Operations |
| **PBN** | Performance Based Navigation |
| **PC** | Personal Computer |
| **PDG** | Procedure Design Gradient |
| **PDG** | Procedure Design Gradient |
| **PFD** | Primary Flight Display |
| **PI** | Performance Indicator |
| **PinS** | Point-in-Space |
| **PRE** | Predictability |
| **QFU** | Aviation Q-code for magnetic heading of a runway |
| **R&D** | Research & Development |
| **R/C** | Rotorcraft |
| **RAIM** | Receiver Autonomous Integrity Monitoring |
| **RF** | Radius to Fix |
| **RHP** | Runway Holding Point |
| **RNAV** | Area Navigation |
| **RNP** | Required Navigation Performance |
| **RTS** | Real Time Simulator |
| **RWY** | Runway |
| **SBAS** | Satellite-Based Augmentation System |
| **SESAR** | Single European Sky ATM Research Programme |
| **SID** | Standard Instrument Departure |
| **SJU** | SESAR Joint Undertaking (Agency of the European Commission) |



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| Acronym | Definition |
|---|---|
| SME | Subject Matter Expert |
| SNI | Simultaneous non-interfering |
| SPR | Safety and Performance Requirements |
| SPR | Safety and Performance Requirements |
| SPV | Supervisor |
| SSR | Secondary Surveillance Radar |
| STAR | Standard Instrument Arrival |
| SUT | System Under Test |
| TAD | Technical Architecture Description |
| TIA | Turn Initiation Area |
| TMA | Terminal Manoeuvring Area |
| TS | Technical Specification |
| TSO | Technical Standard Order |
| UC | Use Case |
| VALP | Validation Plan |
| VALR | Validation Report |
| VALS | Validation Strategy |
| VNAV | Vertical Navigation |
| VP | Verification Plan |
| VR | Verification Report |
| VS | Verification Strategy |
| WIMS | Weather Information Management System |
| WL | Workload |
| WP | Waypoint |

**Table 3: Acronyms and terminology**


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# 3 Solution Scope

## 3.1 Detailed Description of the Solution

This Solution 02-05 aims at improving the access into a congested[6] airport (CTR airspace Class D in a TMA airspace Class A) through the development and the publication of enhanced IFR rotorcraft procedures, "PBN based" (e.g. RNP 0.3 all phases of flight), with "Vertical Guidance" LPV (Localizer Performance with Vertical Guidance) which represent the best operational solution to allow the access of rotorcraft to the heliports (existing VFR FATOs when VMC minima not achieved) included into the airport boundaries without interfering (***SNI operations***) with already existing traffic (fixed-wing). The LPV procedures when designed as compliant with the **SNI Simultaneous Non-Interfering criteria** (SNI operations) facilitate the introduction of rotorcraft in the congested airports.

The SNI is a mode of operation for mixed IFR traffics at airport, not a specific type of procedure. It means that if an approach/departure procedure is compliant with the ICAO SNI criteria (ICAO DOC 9643 - SOIR) it can be flown simultaneously and in a non-interfering way, being strategically separated by the existing procedures.

The main objectives achievable thanks to the possible implementation of the Simultaneous-Non-Interfering operations:

- to allow rotorcraft to fly under IFR rules without being constrained by visual flight rules (VFR) and/or visual meteorological conditions (VMC);
- to remove (to strategically separate) the IFR rotorcraft from runway traffic by using rotorcraft specific procedures which can be flown simultaneously and in a non-interfering way.
- to allow to fly shorter trajectories from the IAF (usually located in the TMA airspace) to the airport. In this outlook, and in the context of SESAR 2020, specifically within the Solution 02-05, the SNI concept is considered as the key factor to facilitate the integration of the rotorcraft operations in the future ATM environment. Furthermore, Rotorcraft operations are of concern when adverse weather is below the VFR minima and IFR departure and approach procedures must be used.

**A short description of the Solution can be found in the Executive Summary!**

[6] A dedicated IFR SNI concept can provide an alternative IFR capability **also** to small airports (in proximity of airspace class G) where the installation of traditional navigation aids is not financially viable or unfeasible due to other specific constraints. In this way any rotorcraft operations, and in particular the HEMS rotorcraft operations, will no longer be limited to VFR/VMC conditions and night operations will become safer.



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## 3.2 Detailed Description of relationship with other Solutions

| Solution Number | Solution Title | Relationship | Rational for the relationship |
|---|---|---|---|
| PJ.14-03-01 | GBAS | Depends On Pre-requisite | GBAS: input/requirements about rotorcraft-specific GBAS application for Solution 05.<br>Actually GBAS REQs were proposed to PJ.14 on the base of the ones identified for the aircraft operations. However the GBAS is not mandatory to mature the Solution 02-05 |
| PJ.18-02a | Trajectory Based Operations (TBO) | Cross Effect | Positive cross effect (little) in PRD, FEFF<br>**CMCC FEFF1 PRD1 CAP1 CAP2 CEF2**<br>***Coefficients for the aggregation process have also to be collected*** |
| PJ.01-06 | Enhanced Rotorcraft operations in the TMA | Cross Effect | Positive cross effect (little) due to the fact that the SNI operations (parallel or convergent) are enabled by the Point-In-Space procedure concept, addressed within PJ.01-06 |

**Table 4: 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, etc.) relevant for this assessment are listed below.

| Organisation | Document Title | Publishing Date |
|---|---|---|
| ENAV (VP-815/FTS) | 04.10-IT1_VALR-Validation Report | 15/12/2015 |
| LEONARDO (VP-816/RTS) | 04.10-IT1_VALR-Validation Report | 15/12/2015 |
| ENAV (VP-818/LT) | 04.10-D09-Second Iteration validation activities - Validation Report | 28/07/2016 |

**Table 5: Pre-SESAR2020 Exercises**

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

| Exercise ID | Exercise Title | Release | Maturity | Status |
|---|---|---|---|---|
| EXE-02.05-V3-VALP-002 | Real Time Simulation 2 - SBAS non interfering operations for rotorcraft | R8 | V3 | Achieved |
| EXE-02.05-V3-VALP-003 | Real Time Simulation 3 - (Airborne limited) SBAS non interfering operations for rotorcraft | R8 | V3 | Achieved |
| EXE-02.05-V3-VALP-004 | Live Flight Trial 4 - SBAS non interfering operations for rotorcraft | R9 | V3 | Achieved |
| EXE-02.05-V3-VALP-005 | Live Flight Trial 5 - GBAS non interfering operations for rotorcraft and evaluation of on-board SVS | R9 | V3 | Achieved |

**Table 6: SESAR2020 Validation Exercises**

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

| Exercise | OI Step | Exercise scenario & scope | Performance Results | Notes |
|---|---|---|---|---|
| EXE-02.05-V3-VALP-002 | AO-0316 | EXE-02.05-V3-VALP-002: V3 Real Time Simulation coordinated by ENAV in collaboration with LEONARDO Helicopters Division | Human Performance, | RTS |



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| | | | | |
|---|---|---|---|---|
| | | which provided the rotorcraft cockpit simulator | Safety, Flight Efficiency | |
| EXE-02.05-V3-VALP-003 | AO-0316 | EXE-02.05-V3-VALP-003: V3 Real Time Simulation (airborne limited) coordinated by LEONARDO Helicopters Division using the LEONARDO Avionic RIG which s the exact copy of rotorcraft cockpit from AWxx9 rotorcraft family. | Human Performance, Safety, Flight Efficiency | RTS |
| EXE-02.05-V3-VALP-004 | AO-0316 | EXE-02.05-V3-VALP-004: V3 Live Flight Trials coordinate by ENAV in collaboration with LEONARDO which provided the rotorcraft prototype vehicle form AWxx9 family. The exercise assessed PinS procedures SBAS based which enabled the SNI operations at airport. | Human Performance, Safety, Flight Efficiency | Live Flight Trials [SBAS] |
| EXE-02.05-V3-VALP-005 | AO-0316 | EXE-02.05-V3-VALP-005: V3 Live Flight Trials coordinate by ENAV in collaboration with LEONARDO which provided the rotorcraft prototype vehicle form AWxx9 family. The exercise assessed PinS procedures GBAS. As well, the exercise assessed the use of Synthetic Vision Systems as on-board avionic | Human Performance, Safety | Live Flight Trials [GBAS] |

Table 7: Summary of Validation Results.

## 4.2 Conditions / Assumptions for Applicability

*A qualitative description of the constraints and assumptions used below in 4.X.3 when evaluating performance contribution of the Solution. This should also highlight any conditions in which there are considered to be of negative benefits.*

*Check: have the following been considered in respect of assumptions and constraints*

*Types and characteristics of Operating Environments where the Solution (OIs) bring benefits: use the following to complete the table and add any other specific detail.*

- ***En Route*** *- Very High, High, Medium, Low complexity (as per the PJ20 WP2.2 definition [7]). Also, add oceanic and "airspace with military zone" - as some SESAR Solutions are especially targeting these last two environment types.* ***[Milan ACC]***



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- ***Terminal*** *- Very High, High, Medium, Low complexity (as per the PJ20 WP2.2 definition [7]). Also, add the TMA name(s) where possible.* ***[Milan ACC/TMA]***
- ***Airports*** *possible categorisations:*
  - *Include names of all airports where the Solution OIs bring benefits*
  - *Or, very large / large / medium / small / other airports as defined by PJ20 WP2.2 [7]*

    ***[Milan Malpensa MXP/LIMC, Milan Linate LIN/LIML]***
- ***Special OE characteristics, for example***
  - *ATM structures (air routes, TMA/runway configurations, taxiway topologies)*
  - *Geographical situation and terrain*

The following Table 8 summarises the applicable operating environments.

| OE | Applicable sub-OE | Special characteristics |
|---|---|---|
| Enroute | Very High Compexity, High Compexity, Medium Complexity, Low Complexity | Having multiple network routes (e.g. in SESAR 1 di ERN phase was addressed using the concept of Solution #113 Low Level IFR route (RNP1/0.3) for rotorcraft |
| Terminal | Very High Compexity, High Compexity, Medium Complexity, Low Complexity | Having multiple airports which share several waypoints in the same standard arrival/departure network routes |
| Airport | Very Large, Large, Small | Milan Malpensa is a Very Large airport, Linate is a Large airport (used within SESAR 1 R&D activities). However the concerned concept is easily adaptable to small ariprot considering that the PinS procedure concept is intended as a stand-alone concept (e.g. hybrid procedure IFR-VFR/FATO) |

**Table 8: Applicable Operating Environments.**

The following Table 9 summarises the essential deployment details.

| BAD | Specific geographical and/or stakeholder deployment |
|---|---|
| N/A | N/A |
| N/A | N/A |
| N/A | N/A |

**Table 9: Deployment details.**

| Min flight equipage rate | Opt flight equipage rate | BAER | AUs that need to equip | Start of flight equipage | End of flight equipage |
|---|---|---|---|---|---|
| The minimum Rotorcraft Equipage rate | The optimum Rotorcraft Equipage rate | The benefit assessment is based on the | All RC community is affected. It's | To date | Ends on 2040 |


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| | | | | | |
|---|---|---|---|---|---|
| to support SNI concept at airport, is based on actual Rc IFR Avionic configuration. | to better support SNI concept at airport, in the next future, is based on what will be the standard advanced Avionic Rc IFR capabilities, that encompass additional navigation features | next five yrs of Rc operation. | considered IFR Rc operation fleet. | | |

**Table 10: Influence of Equipage on benefits.**



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## 4.3 Safety

### 4.3.1 Safety Criteria and Performance Mechanism

SAfety Criteria (SAC) means explicit and verifiable (qualitative or quantitative) criteria, the satisfaction of which results in tolerable safety following the change.

SACs are derived during V1 through safety assessment of the AIM and as the Solution progresses to V2 and the concept is further refined, the safety assessment at the OSED level will establish the safety objectives to deliver the SAC and the SPR level safety requirements to satisfy the safety objectives. The SACs will be subject to review following the availability of more mature project deliverables.

| SAC Ref | Suggested SAC | Associated Hazard Ref | Associated Hazard |
|---|---|---|---|
| SAC#1 | Re-routing shall not be used when PinS procedure has started to be implemented unless it is not necessary for safety reasons (the sequence will be influenced and changes will have to be made with resulting increased work-load). | Hp#1 | a situation in which the intended trajectories of two or more aircraft are in conflict (MAC) |
| SAC#2 | Any re-routings shall not introduce conflicts between fixed-wing and rotorcraft SNI PinS procedures for arrival or departure planned routes; | Hp#1 | a situation in which the intended trajectories of two or more aircraft are in conflict (MAC) |
| SAC#3 | Any re-routings shall ensure that the rotorcraft arrival\departure procedures (simultaneously and non-interfering) can be safely carried out when the re-routings will be performed | Hp#1 | a situation in which the intended trajectories of two or more aircraft are in conflict (MAC) |
| SAC#4 | The SNI criteria adopted for the designing of the rotorcraft PinS procedures shall ensure that the pilot is informed -through procedure maps- about all the relevant obstacles in the manoeuvring area | Hp#2 | a situation where the intended trajectory of an aircraft is in conflict with terrain or an obstacle (CFIT) |
| SAC#5 | The rotorcraft PinS SNI procedures designing criteria (SOIR ICAO DOC9643, PASNOPS 8168, Annex 14) will enable | Hp#3 | penetration of restricted airspace |



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| | | | |
|---|---|---|---|
| | rotorcraft operations not interfering with the existing standard approach/departure procedures conceived for fixed-wing aircraft. | | |
| **SAC#6** | Local real-time weather details shall be available and taken into account during the operations. | **Hp#4** | encounters with adverse weather |

### 4.3.2 Data collection and Assessment

The exercise did not show any need to update existing airborne regulation or standardization documents.

No specific change in the functional requirements or in the architecture has been identified. In order to flown the same procedures based on GBAS signal instead of SBAS augmentation, the coded procedure has to be implemented according to GBAS FAS data block.

The main need to update the system documents, accordingly to the outcomes of any unexpected behaviours (functional requirements, architecture document) is:

the avionics platform have to be enabled in performing the Pins Approach and Departure procedure, based on RNP 0.3 all phase of flight.

The following recommendations are elicited from the focus groups, observations and questionnaires held during the Live Flight Trial.

- ATCOs suggest to define criterions as separation, phraseology, working methods to be respected;
- ATCOs suggested to have a decision high of 200 ft and a Rotorcraft inbound distance of 2,5NM at least;
- ATCOs underlined the necessity to define an IFR procedure and related equipped IFR FATO;
- The tower RADAR display should visualize the procedure to increase ATCOs situational awareness;
- Further Regulations, with regards to the current one, should be adopted to allow ATCOs to declare the RC independence.

Furthermore, ATCOs control rotorcraft flights seeing them at low altitude while, during the Flight Trial, the rotorcraft flight at higher altitude following the RNP procedures, creating some uncertainty due to their current working method.



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Considering the requirements merging between Real Time Simulation and Live Flight Trials, ATCOs suggested to modify the current RNP procedures regulation. The target of these requirements is to improve the FATO, but always respecting the current constrains.

### 4.3.3 Extrapolation to ECAC wide

N/A

### 4.3.4 Discussion of Assessment Result

N/A

### 4.3.5 Additional Comments and Notes

N/A



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## 4.4 Environment / Fuel Efficiency

The Environment / Fuel Efficiency KPA is expected to be impacted positively by the Solution PJ02.05.

The Flight Efficiency analysis, conducted to determine the benefits obtained in respect to the expectation from the Solution for the purposes of the SESAR 2020 Master Plan-Wave_1, allowed first to compare the different procedures (IFR Standard Approach to RWY vs IFR dedicated to Rotorcraft to FATO) and to assign a numerical difference with an improvement (reduction) of the distance-based plannable trajectory and assuming that the parking slots did not foresee any distance of TAXI in both cases. That means the parking slots were located at the end of each procedure (as assumption).

From this point of view, the positive effect that the OI wants to obtain is the objective to realize an Approach Route into the Milan Terminal Airspace and the following Approach Landing Path for a dedicated area that is disconnected from the Standard Approach Arrival Route Segment for Malpensa Airport.

But above all, the scope is to allow the implementation of a **PinS** (*Point-in-Space*) **Approach/Departure Procedures** which enable **SNI Operations** (*Simultaneous Non Interfering*), that means procedures, that can be planned and flown by an helicopter up to upon landing on a circumscribed area, called **FATO** (*Final Approach & Take-Off areas*), which allow to lead the concept of **Independent** (*parallel or convergent*) **IFR Rotorcraft Operations at airport**.

### 4.4.1 Performance Mechanism

Surely there will be Environment Benefit Mechanisms available in output by the Flight Trials that were planned and performed within the PJ.02-05 Solution. And the expectation will be available from the results (qualitative and quantitative) that have been obtained from the Solution validation activities.

The studies, started since SESAR1 with P04.10 activities focused on the following operational concepts;

- Low Level IFR Routes (Solution #113),
- Standard Point-In-Space procedures (AOM-0104-A, V3 achieved at the end of SESAR 1)
- and SNI Operations (AO-0316).

The S2020 Solution 02-05 focused on the realization of **3** dedicated Approach Procedures (***Cascina Costa RNP 310/320/350***) that allow first of all to “release” the Rotorcraft IFR approach for landing from the dedicated paths for conventional traffic, and not of secondary importance, to allow Rotorcraft to be able to land on the dedicated FATO located at Cascina Costa (LILK) supposed as included into Milan Malpensa Airport boundaries.

The same above descripted applies also to the ad-hoc Departure Procedure (called ***RNP MCE2***) which, disconnected from the other IFR SIDs & Initial Climb Procedures, may either avoid delaying or limiting fixed-wing traffics departing on the same direction or interacting Procedure, as well as allow the Rotorcraft to take-off and follow a dedicated procedure that can better perform both the characteristics of the aircraft and the FATO Departure location above described.

It is worth being noted that all the designed procedures are RNP0.3 capable and SBAS based.


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A second step, using an AW189 Helicopter for some multiple Flight Trials, both the Reference Scenario and all the 3 different Solutions Procedures implemented for the arrivals were tested, as well as the single Departure Procedure called RNP MCE2.

As above detailed, smoother and more efficient traffic flow will determine a positive impact on Fuel Efficiency/Environment (ENV) KPA but mainly on the flight operation of the Helicopters.

### 4.4.2 Assessment Data (Exercises and Expectations)

In SESAR 2020, the final figure expected by the Summary Validation Targets of the Solution PJ.02-05, that will have to cooperate to ensure the ambitions set into the ATM Master Plan, is appointed just to the Fuel Efficiency and Predictability.

The second KPA (PRD1) will be detailed into the dedicated paragraph; here below the Fuel Efficiency will be analysed following the Flight Efficiency analysis.

So, the value obtained in terms of the Flight Efficiency benefit is instead intended to the flown distance reduction and therefore to the performances linked to the Fuel Efficiency (FEFF); at the end, these are the 2 expectations, in terms of KPAs, that awaited by the SESAR 2020 Wave_1's Master Plan from the Solution itself.

From *Table* below, it can primarily be deduced that the plannable distance reduction between the ***Reference Scenario*** and 2 of the Terminal & Approach Procedures (***RNP 310 & 320***) allow a reduction of **4.10 NM.**

But at the meantime and above all, in both the Solution Procedures a descent gradient of 5.4° in the glide path is designed from the FAF, which for a helicopter is a really an added value when compared to the standard 3° of the Reference Procedure. The improvement provides the possibility to have a better performance when compared to a fixed-wing aircraft.

The distance reduction improves even further up to **12.30 NM** when the **RNP 350** Procedure is analyzed and compared with the Reference, because mainly it has the IAF closest to the MEBUR (starting Navigation Point selected to compare the Procedures), from where both the Procedures have the Starting point for the Approach.

| Flight Efficiency Analysis for Fuel Benefits_Terminal & Approach | | | | | | | |
|---|---|---|---|---|---|---|---|
| | *Reference* | *Solution 1* **RNP 310/320** | *Solution 2* **RNP 350** | Δ Kg x AC Ref vs Sol 1 & 2 | Δ Kg x AC Ref vs Sol 3 | Δ % x AC Ref vs Sol 1 & 2 | Δ % x AC Ref vs Sol 3 |
| *FEFF1 (kg Fuel Reduction)* | **163** | **150** | **132** | **-13.10** | **-30.63** | **-8.03%** | **-18.79%** |
| *FEFF2 (CO2 Reduction)* | **513** | **472** | **417** | **-41.25** | **-96.45** | | |
| *FEFF3 (TIME mm:ss* | **0:31:22** | **00:24:42** | **00:22:59** | **06:40** | **08:23** | | |

Giving the assumption as into the Table, the association with the Fuel Consumptions parameters (measured from the Helicopter Management System – FMS) will permit to obtain the above results in terms of Fuel Efficiency benefits.



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### 4.4.3 Extrapolation to ECAC wide

| KPIs / PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | 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 | 0 kg (0.0%) | 30.63kg | 0.27% *SEE comment al pag 11* |
| **FEFF2** Actual Average $CO_2$ Emission per flight | Kg $CO_2$ per flight | Amount of fuel burn x 3.15 ($CO_2$ emission index) divided by the number of flights | YES | 0 kg (0.0%) | 96.45kg | 0.27% *SEE comment al pag 11* |
| **FEFF3** Reduction in average flight duration | Minutes per flight | Average actual flight duration measured in the Reference Scenario – Average flight duration measured in the Solution Scenario | YES | *00:00 (mm:ss)* | 08:23 (mm.ss) | 0.27% *SEE comment al pag 11* |

Table 11 is showing the impact on flight phases (provided when it is possible)

| | Taxi out | TMA departure | En-route | TMA arrival | Taxi in |
|---|---|---|---|---|---|
| **FEFF1** Actual Average fuel burn per flight | N/A | N/A | N/A | 30,63 kg (0.27%) | N/A |
| **FEFF2** Actual Average $CO_2$ Emission per flight | N/A | N/A | N/A | 96,45kg (0.27%) | N/A |
| **FEFF3** Reduction in average flight duration | N/A | N/A | N/A | 08:23 (mm.ss) (0.27%) | N/A |

**Table 11: Fuel burn reduction per flight phase.**

### 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 / Noise and Local Air Quality

**Noise and Local Air Quality is NOT expected to be impacted by the Solution PJ02.05.**

### 4.5.1 Performance Mechanism

N/A

### 4.5.2 Assessment Data (Exercises and Expectations)

N/A

| PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **NOI1**<br>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<br>for Airport OE Solutions | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |
| **NOI2**<br>Size and location of noise contours | Contours of noise level thresholds (e.g. LDEN 55 see ERM document for the list of recommended PIs).<br>Surface of these contours(Km2) | 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<br>for Airport OE Solutions | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |



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| PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **(NOI4)**<br>Number of people exposed to noise levels exceeding a given threshold | Number of people inside noise contours. | Population count 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<br>for Airport OE Solutions | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |
| **LAQ1**<br>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.<br>NOx: Nitrogen oxides, including nitrogen dioxide ($NO_2$) and nitrogen oxide (NO);<br>VOC: Volatile organic compounds (including non-methane hydrocarbons (NMHC));<br>CO: Carbon monoxide;<br>PM: Particulate matter (fraction size PM2.5 and PM10);<br>SOx: Sulphur oxides.<br>Recommended tools: Open-ALAQS | YES<br>for Airport OE Solutions relative to LTO (=>below 3000ft) | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |

### 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)

**Airspace Capacity is NOT expected to be impacted by the Solution PJ02.05.**

### 4.6.1 Performance Mechanism

N/A

### 4.6.2 Assessment Data (Exercises and Expectations)

| KPIs / PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | 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* | *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* | *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)

**Airport Capacity is NOT expected to be impacted by the Solution PJ02.05.**

**Nevertheless, the BIM developed for this Solution includes potential benefits for this KPA. Please refer to the SESAR 1 P04.10 Validation Report (D06 ed.00.01.00)**

### 4.7.1 Performance Mechanism

N/A

### 4.7.2 Assessment Data (Exercises and Expectations)

| KPIs / PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **CAP3**<br>Peak Runway Throughput<br>(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<br>observed throughput during peak demand hours in the mixed-mode RWY operations airports group. | YES | *N/A* | *N/A* | *N/A* |
| **CAP3.1**<br>Peak Departure throughput per hour<br>(Segregated mode) | % 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 hours in the segregated-mode RWY operations airports group. | YES | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |



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| KPIs / PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **CAP3.2**<br>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 | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |
| **CAP4**<br>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.<br>NB: Supports CBA Inputs.<br>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<br>For CBA. | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |

### 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


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N/A


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

**Resilience is NOT expected to be impacted by the Solution PJ02.05.**

### 4.8.1 Performance Mechanism

N/A

### 4.8.2 Assessment Data (Exercises and Expectations)

N/A

| PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **RES1**<br>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 | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |
| **RES 1.1**<br>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 | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |
| **RES2**<br>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 | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |



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| PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **RES2.1**<br>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 | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |
| **RES4**<br>Minutes of delays | Minutes | Impact on AUs measured through delays resulting from capacity degradation[7].<br>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 | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |
| **RES5**<br>Number of cancellations | Nb flights | Impact on AUs measured through Cancellations resulting from capacity degradation[8].<br>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 | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |

[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.

[8] 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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### 4.8.3 Extrapolation to ECAC wide

N/A

### 4.8.4 Discussion of Assessment Result

N/A

### 4.8.5 Additional Comments and Notes

N/A

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## 4.9 Predictability (Flight Duration Variability, against RBT)

### 4.9.1 Performance Mechanism

Predictability KPA is the second benefit expected to be impacted by the Solution PJ.02-05, even if not absolutely in quantitative terms because of greater number of Aircraft and/or Helicopters could be handled for take-off or landing by the new procedure but with the objective to realize an Approach Route into the Milan Terminal Airspace and the following Approach Landing Path for a dedicated area that is disconnected from the Standard Approach Arrival Route Segment for Malpensa Airport.

But above all, the scope is to allow the implementation of a **PinS** (*Point-in-Space*) **Approach/Departure Procedures** which enable **SNI Operations** (*Simultaneous Non Interfering*), that means procedures that can be planned and flown by an helicopter up to upon landing on a circumscribed area, called **FATO** (*Final Approach & Take-Off areas*), which allow to lead the concept of **Independent** (*parallel or convergent*) **IFR Rotorcraft Operations at airport**.

### 4.9.2 Assessment Data (Exercises and Expectations)

The new Procedure allow an approach/departure in a manner not connected to conventional fixed-wing traffics. And for this specific reason and from, the Predictability point of view, it allows to the Helicopters that will plan it for landing onto the FATO Area to have “standard” and “constant” timing to fly the Procedures without any kind of delay or any kind of “arrangement” to avoid any “conflict” (in terms of traffic flows) with the “conventional” flights.

As said above, the benefit involves first of all a “***qualitative***” added value for all IFR traffics because the same will not be limited, and a consequent “***quantitative***” added value for Helicopters because the can have a certain and constant timing for the procedure.

The following table shows the final outputs from the Flight Trials,

| Flight Efficiency Analysis for Fuel Benefits_PRD1 | | | | | |
|---|---|---|---|---|---|
| | *Reference* | *Solution 1* ***RNP 310/320*** | *Solution 2* ***RNP 350*** | Δ % AC Ref vs Sol 1 & 2 | Δ % AC Ref vs Sol 3 |
| ***TIME hh:mm:ss*** *(to "fly" each Arrival Leg & Final Approach Procedure)* | **00:31:22** | **00:24:42** | **00:22:59** | **-21.25%** | **-26.73%** |

**Note:** *It is worth being noted that the achieved results were not settled at ECAC Level because it was not possible to perform the Analysis of Variance (ANOVA) due to the fact that only 1 rotorcraft traffic was considered in the validation traffic sample (e.g. RTS and LT).*



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### 4.9.3 Extrapolation to ECAC wide

| KPIs / PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **PRD1**<br>Variance[9] of Difference in actual & Flight Plan or RBT durations | Minutes² | Variance of Difference in actual & Flight Plan or RBT durations | YES | *0 %* | 0,0% *<br>26.73% ** | ** See Comment at pag 11*<br>*** (not settled at ECAC Level and obtained comparing the REF vs SOL scenario for the dedicated IFR procedure for Rotorcraft)* |

Table 12 is showing the impact on flight phases (provided when it is possible).

| | Taxi out | TMA departure | En-route | TMA arrival | Taxi in |
|---|---|---|---|---|---|
| **PRD1**<br>Variance[10] of Difference in actual & Flight Plan or RBT durations | N/A | N/A | N/A | 26,73% | N/A |

**Table 12: Predictability benefit per flight phase, standard deviation improvement.**

### 4.9.4 Discussion of Assessment Result

N/A

### 4.9.5 Additional Comments and Notes

N/A

[9] Standard Deviation is also accepted.

[10] Standard Deviation is also accepted.


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## 4.10Punctuality (% Departures < +/- 3 mins vs. schedule due to ATM causes)

**Punctuality is NOT expected to be impacted by the Solution PJ02.05.**

### 4.10.1Performance Mechanism

N/A

### 4.10.2Assessment Data (Exercises and Expectations)

N/A

### 4.10.3Extrapolation to ECAC wide

N/A

| KPIs / PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **PUN1**<br>% Flights departing within +/- 3 minutes of scheduled departure time due to ATM and weather related delay causes | % | % Departures so that \|AOBT – SOBT[11]\| < +/- 3 min. Difference in Actual Departure Time vs. Scheduled Time due to ATM and weather related delay causes. | YES | *N/A* | *N/A* | *N/A* |

Table 13 is showing the impact on flight phases (provided when it is possible).

[11] Taking into account those SESAR concepts working on the planning phase, it is possible for different Stakeholders to request departure changes (outside the tolerance window of +/- 3 minutes) subject to approval by all actors involved before the flight execution. If accepted by all concerned actors, the reference plan against which the departure punctuality is measured will be this updated RBT instead of SBT.


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| | Taxi out | TMA departure | En-route | TMA arrival | Taxi in |
|---|---|---|---|---|---|
| **PUN1**<br>% Flights departing within +/- 3 minutes of scheduled departure time due to ATM and weather related delay causes | | | | | |

Table 13: Punctuality benefit per flight phase.

### 4.10.4 Discussion of Assessment Result

N/A

### 4.10.5 Additional Comments and Notes

N/A



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## 4.11 Civil-Military Cooperation and Coordination (Distance and Fuel)

**Civil-Military Cooperation and Coordination is NOT expected to be impacted by the Solution PJ02.05.**

### 4.11.1 Performance Mechanism

N/A

### 4.11.2 Assessment Data (Exercises and Expectations)

N/A

### 4.11.3 Extrapolation to ECAC wide

N/A

| PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **CMC1.1** Available/Required training Duration within ARES | % | Available training duration / Required training duration. It provides an indication on an available training duration within ARES in regard to the individual training event. The existing ATM system does not generate required data. SESAR WP11.1 WOC offers a solution to use the available training duration within ARES as a leading indicator. It is applicable for a performance assessment of pre-tactical ASM process. It could be used as leading PI. | YES | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit) If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |



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| PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **CMC1.2**<br>Allocated/ Optimum ARES dimension | % | (Allocated ARES surface/ Optimum ARES Surface) x (Allocated FL/Optimum FL) It provides an indication of how closely the allocated ARES conforms to the optimum airspace dimensions. Due to different operational requirements among the states, performance monitoring and target setting is applicable at national level. It is applicable for a performance assessment of pre-tactical ASM and could be used as leading and/or lagging PI. | YES | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |
| **CMC1.3**<br>Transit Time to/from airbase to ARES | Minutes | It provides an indication of the transit time for aircraft which participated in an individual sortie. If it is calculated passed of a flight plan data it could be used as leading PI. If it is calculated based on an actual the flight time from airbase to ARES and back , it could be used as a lagging PI.. Flight time between ARESs could be calculated as the transit time. The existing ATM system does not generate required data. SESAR WP11.1 WOC offers a solution to use the transit time a leading indicator. It is applicable for a performance assessment of pre-tactical ASM. | YES/NO | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |
| **CMC2.1**<br>Fuel and Distance saved<br>(for GAT operations) | Kg and NM | Kg of fuel and distance flown for GAT due optimisation of the ATM network through Demand Capacity balancing and to the new ARES design and management | YES | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |



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| PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **CMC2.2** GAT planning efficiency of Available ARES (% GAT flights planning to use ARES / GAT flights for which ARES is available) | % | GAT planning effectiveness use ARES could be captured using the following indicator: % (GAT flights planning to use ARES / GAT flights for which ARES is available). It could be number and time based measure. | YES | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit) If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |

Table 14 is showing the impact on flight phases (provided when it is possible).

| | Taxi out | TMA departure | En-route | TMA arrival | Taxi in |
|---|---|---|---|---|---|
| **CMC1.1** Available/Required training Duration within ARES | | | | | |
| **CMC1.2** Allocated/ Optimum ARES dimension | | | | | |
| **CMC1.3** Transit Time to/from airbase to ARES | | | | | |
| **CMC2.1** Fuel and Distance saved (for GAT operations) | | | | | |
| **CMC2.2** GAT planning efficiency of Available ARES (% GAT flights planning to use ARES / GAT flights for which ARES is available) | | | | | |
| | | | | | |

**Table 14: Civil-Military cooperation and coordination benefit per flight phase.**



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#### 4.11.4 Discussion of Assessment Result

N/A

#### 4.11.5 Additional Comments and Notes

N/A

Founding Members

EUROPEAN UNION EUROCONTROL

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## 4.12 Flexibility

**Flexibility is NOT expected to be impacted by the Solution PJ02.05.**

### 4.12.1 Performance Mechanism

N/A

### 4.12.2 Assessment Data (Exercises and Expectations)

N/A

### 4.12.3 Extrapolation to ECAC wide

N/A

| PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | 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 | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)* *If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |

Table 15 is showing the impact on flight phases (provided when it is possible).



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| | Taxi out | TMA departure | En-route | TMA arrival | Taxi in |
|---|---|---|---|---|---|
| **FLX1**<br>Average delay for scheduled civil/military flights with change request and non-scheduled or late flight plan request | | | | | |
| | | | | | |
| | | | | | |

Table 15: Flexibility benefit per flight phase.

### 4.12.4 Discussion of Assessment Result

N/A

### 4.12.5 Additional Comments and Notes

N/A


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## 4.13 Cost Efficiency

**Cost Efficiency is NOT expected to be impacted by the Solution PJ02.05.**

### 4.13.1 Performance Mechanism

N/A

### 4.13.2 Assessment Data (Exercises and Expectations)

N/A

### 4.13.3 Extrapolation to ECAC wide

N/A

| **KPIs / PIs** | **Unit** | **Calculation** | **Mandatory** | **Benefit in SESAR1 (if applicable)** | **Absolute expected performance benefit in SESAR2020** | **% expected performance benefit in SESAR2020** |
|---|---|---|---|---|---|---|
| **CEF2**[12]<br>Flights per ATCO-Hour on duty | Nb | Count of Flights handled divided by the number of ATCO-Hours applied by ATCOs on duty. | YES | *N/A* | *N/A* | *N/A* |
| **CEF3**<br>Technology cost per flight | EUR / flight | G2G ANS cost changes related to technology and equipment. | YES | *N/A* | *N/A* | *N/A* |
| **CEF1**<br>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<br>From the other two KPIs below | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |

### 4.13.4 Discussion of Assessment Result

[12] 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).



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N/A

### 4.13.5 Additional Comments and Notes

N/A


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## 4.14 Airspace User Cost Efficiency

**Airspace User Cost Efficiency is NOT expected to be impacted by the Solution PJ02.05.**

### 4.14.1 Performance Mechanism

N/A

### 4.14.2 Assessment Data (Exercises and Expectations)

N/A

### 4.14.3 Extrapolation to ECAC wide

N/A

| PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **AUC3**<br>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 | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |
| AUC4<br>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 | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)*<br>*If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |



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| PIs | Unit | Calculation | Mandatory | Benefit in SESAR1 (if applicable) | Absolute expected performance benefit in SESAR2020 | % expected performance benefit in SESAR2020 |
|---|---|---|---|---|---|---|
| **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 | *To be completed if there were any benefits obtained in SESAR1 for this Solution? (YES/NO and value of the benefit)* *If yes, does the SESAR2020 Solution's performance comes in addition to SESAR1 or replace it?* | *To be completed with a single or a range of values if easier* | *To be completed with a single or a range of values if easier (%)* |

### 4.14.4 Discussion of Assessment Result

N/A

### 4.14.5 Additional Comments and Notes

N/A



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## 4.15Security

### 4.15.1The SecRAM 2.0 methodology and the Security Performance Mechanism

Even if the solution has been considered as Non-Prioritized by the SESAR Cyber – Security Task Force, a fully Security Risk Assessment was performed in accordance to the SESAR2020 Security Risk Assessment Methodology (SecRAM) from which Security Requirements have been properly derived.

Due to the confidential nature of security topics, obtained data cannot be shared in detail.

### 4.15.2Security Assessment Data Collection

Just very high-levels considerations have been reported in order to preserve security-sensitive information.

| PIs | Unit | Calculation | Mandatory | Current value |
|---|---|---|---|---|
| **SEC1**<br>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 :<br>The identification of Primary Assets, Supporting Assets, Threat Scenarios and Vulnerabilities;<br>The evaluation of Impacts, Likelihoods and Risks. | YES (different steps are mandatory for different prioritization and maturity levels) | Y, Y, Y, Y, Y, Y, Y |
| **SEC2**<br>Risk Treatment has been carried out | Binary Vector – 2 components with Y/N | Following SecRAM 2.0, Security controls have been identified by Security Experts and implemented in the Solution. | YES (implementation just at higher maturity levels – V4) | Y, N |
| **SEC3**<br>Residual risk after treatment meets security objective. | Risk Level – 2 levels are possible: medium or low | After Security Controls have been implemented, the Risk Level achieved per Supporting Asset decreases (H → M, M→L, H→L). It is important to notice that according to SecRAM the Risk Level achieved should be “Low” otherwise justifications must be provided. | YES | The Risk Level achieved for each Supporting Asset always decreases. |
| **SEC7**<br>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 | Decreased |



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| PIs | Unit | Calculation | Mandatory | Current value |
|---|---|---|---|---|
| **SEC8**<br>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 | Decreased |
| **SEC9**<br>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. | Decreased |

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

### 4.15.3Extrapolation to ECAC wide

There is no ECAC wide extrapolation required for this KPI.

### 4.15.4Discussion of Assessment Result

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

### 4.15.5Additional Comments and Notes

N/A


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## 4.16Human Performance

### 4.16.1HP arguments, activities and metrics

The purpose of the HP assessment process is to ensure that HP aspects related to SESAR2020 technical and operational developments are systematically identified and managed.

The SESAR HP assessment process uses an 'argument' and 'evidence' approach. A HP argument is a 'HP claim that needs to be proven'. The aim of the HP assessment is to provide the necessary 'evidence' to show that the HP arguments impacted have been considered and satisfied by the HP assessment process. This includes the identification of HP requirements and recommendations to support the design and development of the concept.

The purpose of this section is to present the performance assessment results from the Human Performance for Solution PJ.02-05 for V3 phase, addressing Operational Improvement AO-0316 – Increased Airport Performance through independent IFR rotorcraft operations.

The HP assessment process consider the actors involved (ATCOs and Pilots) whose work is directly affected by the introduction of the Solution 02-05 concept

| PIs | Activities & Metrics | Second level indicators | Covered |
|---|---|---|---|
| **HP1**<br>Consistency of human role with respect to human capabilities and limitations | **Real Time Simulation and Live Flight Trial.**<br><br>**Workload, Situational Awareness, Acceptability, Trust and confidence.** | **HP1.1**<br>Clarity and completeness of role and responsibilities of human actors. | **Covered** |
| | | **HP1.2**<br>Adequacy of operating methods (procedures) in supporting human performance. | **Covered** |
| | | **HP1.3**<br>Capability of human actors to achieve their tasks in a timely manner, with limited error rate and acceptable workload level. | **Covered** |
| **HP2**<br>Suitability of technical system in supporting the tasks of human actors | **Real Time Simulation and Live Flight Trial.**<br><br>**Workload, Situational Awareness, Acceptability, Trust and confidence.** | **HP2.1**<br>Adequacy of allocation of tasks between the human and the machine (i.e. level of automation). | **Covered** |
| | | **HP2.2**<br>Adequacy of technical systems in supporting Human Performance with respect to timeliness of system responses and accuracy of information provided. | **Covered** |
| | | **HP2.3**<br>Adequacy of the human machine interface in supporting the human in carrying out their tasks. | **Covered** |


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| PIs | Activities & Metrics | Second level indicators | Covered |
|---|---|---|---|
| **HP3**<br>Adequacy of team structure and team communication in supporting the human actors | **Real Time Simulation and Live Flight Trial.**<br><br>**Workload, Situational Awareness, Acceptability, Trust and confidence.** | **HP3.1**<br>Adequacy of team composition in terms of identified roles. | **Covered** |
| | | **HP3.2**<br>Adequacy of task allocation among human actors. | **Covered** |
| | | **HP3.3**<br>Adequacy of team communication with regard to information type, technical enablers and impact on situation awareness/workload. | **Covered** |
| **HP4**<br>Feasibility with regard to HP-related transition factors | **Real Time Simulation and Live Flight Trial.**<br><br>**Workload, Situational Awareness, Acceptability, Trust and confidence.** | **HP4.1**<br>User acceptability of the proposed solution. | **Covered** |
| | | **HP4.2**<br>Feasibility in relation to changes in competence requirements | **N/A** |
| | | **HP4.3**<br>Feasibility in relation to changes in staffing levels, shift organization and workforce relocation. | **N/A** |
| | | **HP4.4**<br>Feasibility in relation to changes in recruitment and selection requirements . | **N/A** |
| | | **HP4.5**<br>Feasibility in terms of changes in training needs with regard to its contents, duration and modality. | **N/A** |

### 4.16.2Extrapolation to ECAC wide

There is no ECAC wide extrapolation required for this KPI.

### 4.16.3Open HP issues/ recommendations and requirements

An indication of the number of HP issues that are still open and HP benefits identified following the Solution validation exercises, as well as the number of recommendations and requirements defined. For the detailed description, please consult:

- Human Performance Assessment Plan [43]
- Human Performance Assessment Report [42]
- Human Performance Assessment Log [44]



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| PIs | Number of open issues/ benefits | Nr. of recommendations | Number of requirements |
|---|---|---|---|
| **HP1**<br>Consistency of human role with respect to human capabilities and limitations | 0 open issues | 1 recommendation | N/A |
| **HP2**<br>Suitability of technical system in supporting the tasks of human actors | 0 open issues | 2 recommendation | 2 requirements |
| **HP3**<br>Adequacy of team structure and team communication in supporting the human actors | 0 open issues | N/A | N/A |
| **HP4**<br>Feasibility with regard to HP-related transition factors | 0 open issues | N/A | N/A |

### 4.16.4Concept interaction

PJ.02-05 has been identified the solution interacting with the following audience, due to the highlighted dependencies:

- PJ.01-06 - Enhanced Rotorcraft and GA operations in the TMA;
- PJ.14-03-01 – GBAS;
- PJ20 - (Master Plan Maintenance);
- PJ22 - Validation and Demonstration Engineering;
- PJ19 - Content Integration;
- EHA - European Helicopter Association.

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### 4.16.5 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



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| 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 | N/A | N/A |
| | N/A | N/A |
| | N/A | N/A |
| **HP2** Suitability of technical system in supporting the tasks of human actors | N/A | N/A |
| | N/A | N/A |
| | N/A | N/A |
| **HP3** Adequacy of team structure and team communication in supporting the human actors | N/A | N/A |
| | N/A | N/A |
| | N/A | N/A |
| **HP4** Feasibility with regard to HP-related transition factors | N/A | N/A |
| | N/A | N/A |
| | N/A | N/A |
| | N/A | N/A |
| | N/A | N/A |

## 4.16.6Additional Comments and Notes

No further comments


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## 4.17Other PIs

N/A

## 4.18Gap Analysis

| KPI | Validation Targets – Network Level (ECAC Wide) | Performance Benefits Expectations at Network Level (ECAC Wide or Local depending on the KPI)[13] | Rationale[14] |
|---|---|---|---|
| FEFF1: Fuel Efficiency – Fuel burn per flight | *3.64 kg* | *30.63 (kg)* | *The result has been obtained in post analysis calculated by the implementation of dedicated IFR Procedures for Rotocrafts; the result has been extrapolated at ECAC WIDE* |
| CAP1: TMA Airspace Capacity – TMA throughput, in challenging airspace, per unit time. | *N/A (local)* | *N/A (local)* | |
| CAP2: En-Route Airspace Capacity – En-route throughput, in challenging airspace, per unit time | *N/A (local)* | *N/A (local)* | |
| CAP3: Airport Capacity – Peak Runway Throughput (Mixed mode). | *N/A (local)* | *N/A (local)* | |
| PRD1: Predictability – Variance of Difference | *0.31%* | *0% ** <br> *26.73% *** | ** see comment at pag 11* <br> *** not settled at ECAC Level and obtained comparing the REF vs SOL scenario for the* |

[13] Negative impacts are indicated in red.

[14] Discuss the outcome if, and only 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).



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| KPI | Validation Targets – Network Level (ECAC Wide) | Performance Benefits Expectations at Network Level (ECAC Wide or Local depending on the KPI)[13] | Rationale[14] |
|---|---|---|---|
| in actual & Flight Plan or RBT durations | | | *dedicated IFR procedure for Rotorcraft.*<br>*No possibility to calculate a differences btw Rotorcraft and fixed wing AC traffic performances* |
| PUN1: Punctuality – % Flights departing within +/- 3 minutes of scheduled departure time due to ATM and weather related delay causes | *N/A (local)* | *N/A (local)* | |
| CEF2: ATCO Productivity – Flights per ATCO -Hour on duty | *N/A (local)* | *N/A (local)* | |
| CEF3: Technology Cost – Cost per flight | *N/A (local)* | *N/A (local)* | |
| SAF1: Safety - Total number of fatal accidents and incidents with ATM Contribution per year | *N/A* | *N/A* | |

**Table 16: Gap analysis Summary**



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# 5 References

[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



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[18]PJ19.04.01 D4.5 Validation Targets (2018), Edition 01.00.00, April 2018

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

### Human Performance



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[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)

## 5.1 Reference Documents

[41]ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.[15]

[42]SESAR Solution 02-05 SPR-INTEROP/OSED V3 Part IV HPAR (D4.1.012-4)

[43]SESAR Solution 02-05 VALP V3 Part IV HPAP (D4.1.031-4)

[44]SESAR Solution 02-05 VALR V3 (D4.1.042)

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# Appendix A Detailed Description and Issues of the OI Steps

| OI Step ID | Title | Consistency with latest Dataset |
|---|---|---|
| AO-0316 | Increased Airport Performance through Independent (parallel or convergent) IFR Rotorcraft Operations | Consistent with DS19 |

Table 17: OI Steps allocated to the Solution



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