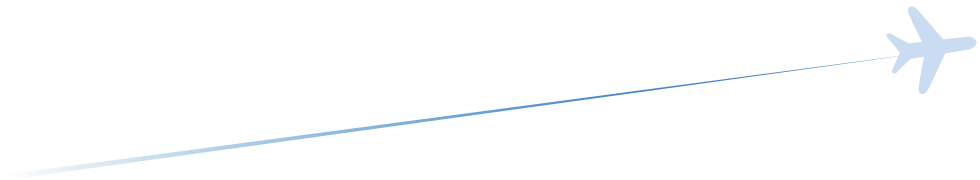

SESAR Solution PJ.10-01A SPR/INTEROP-OSED V2/V3 - Part V - Performance Assessment Report (PAR)

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PROSA

SEPARATION MANAGEMENT IN EN-ROUTE AND IN TMA

This Performance assessment report (PAR) is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 734143 under European Union's Horizon 2020 research and innovation programme.

Abstract

This document provides the Performance Assessment Report (PAR) for Solution PJ.10-01a.

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

It provides results from the V2 and V3 exercises led by ENAV and skyguide.

In the V2 phase the solution PJ.10-01a assesses the concept of Multi sector planning (MSP) for the En-Route operational environment while in the V3 phase the work is focused on the Extended TMA environment.

In this documents are described the scope of the solutions, results at exercises' level and extrapolation/aggregated results.

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1 [1]Executive Summary

This document provides the Performance Assessment Report (PAR) for the solution PJ.10-01a

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

Description:

The SESAR Solution PJ.10-01a aims at developing the concept of Multi sector planning (MSP)

The MSP defines a new organisation of controller team(s) and new operating procedures to enable the planning controller to provide support to several tactical controllers operating in different adjacent en-route or eTMA sectors.

In the frame of the solution, SESAR partners seek to determine the benefits related to this concept in the following environment:

- eTMA in high complexity environment
- En-Route in medium to high complexity

More Information can be found in Chapter 2!

Assessment Results Summary:

The following tables summarises the assessment outcomes per KPI (Table 1) and mandatory PI.

) puts them side-by side against Validation Targets in case of KPI from PJ19 [24]. 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] *In order to separate eTMA and En-Route Operational Environments scopes, the solution 10-01a has been split into two solutions :*

- *10-01a1 : PJ.10-01a1 High Productivity Controller Team Organisation in eTMA*
- *10-01a2 : PJ.10-01a2 High Productivity Controller Team Organisation in En Route*

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

KPI	Validation Targets – Network Level (ECAC Wide)	Performance Benefits Expectations at Network Level (ECAC Wide or Local depending on the KPI)[2]	Confidence in Results[3]
FEFF1: Fuel Efficiency – Fuel burn per flight	13,6 kg/flight	With the reduction of flight duration, fuel consumption and CO2/NOx are expected to be reduced	Low
PRD1: Predictability – Variance of Difference in actual & Flight Plan or RBT durations	0.372 %	Less coordination leads to a reduction of trajectory revisions. Better adherence to the planned trajectory	Low
CEF2: ATCO Productivity – Flights	0.667 % (TMA) 4% (ER)	Reduction of the number of planning	High

[2] Negative impacts are indicated in red.

[3] 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

per ATCO -Hour on duty		controller in the ops room	MSP concept already implemented in TMA environment.
SAF1: Safety - Total number of fatal accidents and incidents with ATM Contribution per year	None	Reduction of the controller workload and situational awareness increased	High

Table 1: KPI Assessment Results Summary

Mandatory PI	**Performance Benefits Expectations at Network Level (ECAC Wide or Local depending on the KPI)[4]**	**Confidence in Results[5]**
SAF1.X: Mid-air collision – En-Route	Unchanged	High
SAF2.X: Mid-air collision – TMA	N/A	
SAF3.X: RWY-collision accident	N/A	
SAF4.X: RWY-excursion accident	N/A	
SAF5.X: TWY-collision accident	N/A	
SAF6.X: CFIT accident	N/A	
SAF7.X: Wake related accident	N/A	
SEC1: A security risk assessment has been carried out	N/A	
SEC2: Risk Treatment has been carried out	N/A	
SEC3: Residual risk after treatment meets security objective.	N/A	
SEC7: Personnel (safety) risk after mitigation	N/A	

[4] Negative impacts are indicated in red.

[5] 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

Mandatory PI	Performance Benefits Expectations at Network Level (ECAC Wide or Local depending on the KPI)[4]	Confidence in Results[5]
SEC8: Capacity risk after mitigation	N/A	
SEC9: Economic risk after mitigation	N/A	
FEFF2: CO2 Emissions.	8,38 kg/flight	Low
FEFF3: Reduction in average flight duration.	107 secondes/flight	Low
NOI1: Relative noise scale	N/A	
NOI2: Size and location of noise contours	N/A	
NOI4: Number of people exposed to noise levels exceeding a given threshold	N/A	
LAQ1: Geographic distribution of pollutant concentrations	N/A	
CAP3.1: Peak Departure throughput per hour (Segregated mode)	N/A	
CAP3.2: Peak Arrival throughput per hour (segregated mode)	N/A	
CAP4: Un-accommodated traffic reduction	N/A	
RES1: Loss of Airport Capacity Avoided	N/A	
RES1.1: Airport time to recover from non-nominal to nominal condition	N/A	
RES2: Loss of Airspace Capacity Avoided.	N/A	
RES2.1: Airspace time to recover from non-nominal to nominal condition.	N/A	
RES4: Minutes of delays.	N/A	
RE5: Number of cancellations.	N/A	
CEF1: Direct ANS Gate-to-gate cost per flight	N/A	
AUC3: Direct operating costs for an airspace user	N/A	

Mandatory PI	Performance Benefits Expectations at Network Level (ECAC Wide or Local depending on the KPI)[4]	Confidence in Results[5]
AUC4: Indirect operating costs for an airspace user	N/A	
AUC5: Overhead costs for an airspace user	N/A	
CMC1.1: Available/Required training Duration within ARES	N/A	
CMC1.2: Allocated/ Optimum ARES dimension	N/A	
CMC1.3: Transit Time to/from airbase to ARES	N/A	
CMC2.1: Fuel and Distance saved (for GAT operations)	N/A	
CMC2.2: GAT planning efficiency of Available ARES	N/A	
HP1: Consistency of human role with respect to human capabilities and limitations	Unchanged	Medium
HP2: Suitability of technical system in supporting the tasks of human actors	Unchanged	Medium
HP3: Adequacy of team structure and team communication in supporting the human actors	Unchanged	Medium
HP4: Feasibility with regard to HP-related transition factors	Unchanged	Medium
FLX1: Average delay for scheduled civil/military flights with change request and non-scheduled or late flight plan request	N/A	

Table 2 Mandatory PIs Assessment Summary

Additional Comments and Notes:

N/A

2 Introduction

2.1 Purpose of the document

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

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

In addition to the results, this document presents the assumptions and mechanisms (how the validation exercises results have been consolidated) used to achieve this performance assessment result.

2.2 Intended readership

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

Produced by the Solution project, the main recipient in the SESAR performance management process is PJ.19, which will aggregate all the performance assessment results from the SESAR2020 solution projects PJ.10, and provide the data to PJ.20 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.

PJ.19 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

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)[6] within STELLAR, gathering experts and providing best practices.

2.4 Glossary of terms

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

2.5 Acronyms and Terminology

Acronym	Definition
AMAN	Arrival Manager
ANSP	Air Navigation Service Provider
AOR	Area of Responsibility
ARN	Air traffic services Route Network
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATM	Air Traffic Management
ATS	Air Traffic Service
ATSU	Air Traffic Service Unit
CDT	Conflict Detection Tools
CNS	Communication Navigation and Surveillance
CONOPS	Concept of Operations
CPDLC	Controller-Pilot DataLink Communication
CR	Change Request
EAP	Extended ATC Planner
EATMA	European ATM Architecture
E-ATMS	European Air Traffic Management System

Acronym	Definition
ECAC	European civil Aviation Conference
EC	Executive controller
eTMA	Extended Terminal Manoeuvring Area
FRA	Free Route Airspace
HPAR	Human Performance Assessment Report
IAF	Intermediate Arrival Fix
IFL	Intermediate Flight Level
INTEROP	Interoperability Requirements
KPA	Key Performance Area
MSA	Muti Sector Area
MSP	Multi-Sector Planner
OI	Operational Improvement
OPAR	Operational Performance Assessment Report
OSED	Operational Service and Environment Definition
PC	Planner controller
PAR	Performance Assessment Report
PIRM	Programme Information Reference Model
QoS	Quality of Service
RBT	Reference Business Trajectory
RMT	Reference Mission Trajectory
RVSM	Reduced Vertical Separation Minima
SAC	Safety Criteria
SAR	Safety Assessment Report
SecAR	Security Assessment Report
SESAR	Single European Sky ATM Research Programme
SID	Standard Instrument Departure
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SPR	Safety and Performance Requirements
STAR	STandard Arrival Route
SWIM	System Wide Information Model

Acronym	Definition
TMA	Terminal Manoeuvring Area
TC	Tactical Controller
TS	Technical Specification

Table 3: Acronyms and terminology

3 Solution Scope

3.1 Detailed Description of the Solution

The SESAR Solution PJ.10-01a "High productivity controller team organisation" aims at developing the roles, responsibilities and tools related to the introduction of the Multi-sector planning[7] role in En Route and eTMA airspace.

For a complete description, see the OSED [49].

3.2 Detailed Description of relationship with other Solutions

Solution Number	Solution Title	Relationship	Rational of the relationship and calculation of the solution's aggregation
			Interdependencies with external solution (to PJ10) An initial assessment were performed and led to the identification of a potential interdependency between solution 10.01a (MSP) and 09.02 (EAP). After a cross analysis, both solutions do not address the same timeframe in term of planning activities. Therefore, it was concluded that PJ.10-01a had no interdependency with external solutions
PJ.10-02A	Improved performance in the provision of separation	Independent – No cross effect	**Interdependencies with external solution (to PJ10)** The interdependency between solution 10.01a (MSP) and 10-02a (Separation tools) is linked to the

[7] Note that in this document ATCOs role defined as "Executive Controller" refers also to generic term "Tactical Controller"

			fact MSP have been developed in the solution 10-02a. that some specific tools for For the purpose of SESAR activities and in order to streamline cost of platform development, platform/tools are developed for several solutions (PJ.10-01a, PJ.10-02a).
PJ.10-01c	Collaborative control	Mutually exclusive	**Interdependencies with internal solution (to PJ10)** An initial assessment were performed and led to the identification of a potential interdependency between solution 10.01a (MSP) and 10.01c (collaborative control). Meanwhile both solutions address the same OE (En-Route for 10.01c and extended TMA (1st level of En-Route) for 10.01A), the solution 10.01c is focused on coordination, which is considered as baseline in solution 10.01a The conclusion was that solution 10.01a had no interpendency with other solution.

Table 4: Relationships with other Solutions

For a complete description of the solution interactions, see the OSED [49]

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
NATS	Exercise EXE 04.07.08-VP304 04 07 08 D010 VP 304 VALR NATS 00.03.00	20/11/2015

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-10-01a-V2-001	Exercise EXE-10-01a-V2-01 – ENAV	R9	V2	Completed
EXE-10-01a-V3-001	Exercise EXE-10-01a-V3-01 – SKG	R9	V3	Completed

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-10.01A-V2-VALP-001	CM-0303	Real time simulation exercise to validate the MSP concept in En route and free route operational environment.	HP1 HP2 HP3 HP4 SAF CEF2	V2
EXE-10.01A-V3-VALP-001	CM-0304b	Real time simulation to validate the MSP role in extended TMA	CEF2 SAF1.x HP1 HP2 HP3 HP4	V3

			FEFF2 FEFF3 PRD1	

Table 7: Summary of Validation Results.

4.2 Conditions / Assumptions for Applicability

The solution seeks to develop the operational concept related to a new role of MSP in extended TMA starting from the experience gained the MSP concept already applied in TMA at V3 level.

The solution also aims at developing the operation concept related to a new role of MSP in en Route and particular focussing on an Multi Sector Planner acting on three En Route sectors in High complexity Free Route environment. This assessment is performed at V2 level.

4.2.1 V2 Phase

4.2.1.1 Operating environments

The following tables summarizes the applicable operating environment.

OE	Applicable sub-OE	Special characteristics
ER	MC	Rome ACC (En-route sectors with Free route)

4.2.1.2 Benefit assessment Date

The En-route MSP concept assessment has been performed at V2 level.

Based on available results, further investigations are recommended before deployment phase.

BAD	Specific geographical and/or stakeholder deployment
2026 (IOC)	En-Route airspace (Medium to High Complexity)
2030 (FOC)	En-Route airspace (Medium to High Complexity)

4.2.1.3 Geographical scope

The geographical scope is focussed on En-route sectors with medium density/complexity traffic conditions

4.2.2 V3 Phase

4.2.2.1 Operating environments

The following Table 8 summarises the applicable operating environments.

OE	Applicable sub-OE	Special characteristics
eTMA	VHC	Zurich ACC (extended TMA)

Table 8: Applicable Operating Environments.

Note that eTMA is considering the first En Route sectors getting traffic from the airports in the TMA and delivering traffic to the airports in the TMA sectors In the PRR [8], these operating environments are defined according to complexity and traffic volume by a **traffic complexity score** which is as follows:

- Very high complexity : greater or equal to 10
- En-Route High Complexity: traffic complexity score higher than 6 and lower than 10
- En-Route Medium Complexity: traffic complexity score higher than 4 but lower than 6.

Note: it should be noticed that meanwhile the traffic complexity score is defined as VHC for the ACC Zurich, results from the validation exercise show that the MSP concept will be in use during situation for which traffic complexity score is medium to high complex. For very high complexity situations, the current team organisation (1 planner controller – 1 tactical controller) is the most appropriate one.

4.2.2.2 Benefit assessment Date

It is worth noting that the MSP concept in already in operation in some TMA (ex: Stockholm, Copenhague, Munich…), operating. with medium complexity.

The solution seeks to develop the operational concept related to a new role of MSP in extended TMA starting from the experience gained the MSP concept already applied in TMA. Results'analysis from validation activities indicated that some existing function in current ATC system should be upgraded.

The eTMA MSP concept assessment is performed at V3 level.

The following Table 9 summarises the essential deployment details.

BAD	Specific geographical and/or stakeholder deployment
2026 (IOC)	eTMA / En-Route airspace (Medium to High Complexity)
2030 (FOC)	eTMA / En-Route airspace (Medium to High Complexity)

Table 9: Deployment details.

Equipage details and how equipage influences benefits in the ramp-up phase is given in Table 10.

Min flight equipage rate	Opt flight equipage rate	BAER	AUs that need to equip	Start of flight equipage	End of flight equipage
N/A	N/A	N/A	N/A	N/A	N/A

Table 10: Influence of Equipage on benefits.

4.2.2.3 Geographical scope

While the MSP is already in operation in some TMA, the Solution is developed first for the intermediate sectors between departures/approach sectors and upper En-route sectors in medium to high complexity environments and secondly for upper En-route sectors in high complexity environments.
As mentioned in section 4.2.2.1, meanwhile the ACC Zurich can be considered as an environment with Very High Complexity, the use of MSP will be in use when the associated traffic complexity is medium to high.

In the PRR 2012 [8] , these operating environments are defined according to complexity and traffic volume by a **traffic complexity score** which is as follows:

- En-Route High Complexity: traffic complexity score higher than 6
- En-Route Medium Complexity: traffic complexity score higher than 4 but lower than 6.

Hence the geographical scope of the PAR (and CBA) will focus on ACC centres that match one of these conditions

The analysis of the Performance Result Report [8] allows identifying the ACCs to be used to extend the results at ECAC level in particular for the eTMA aspect:

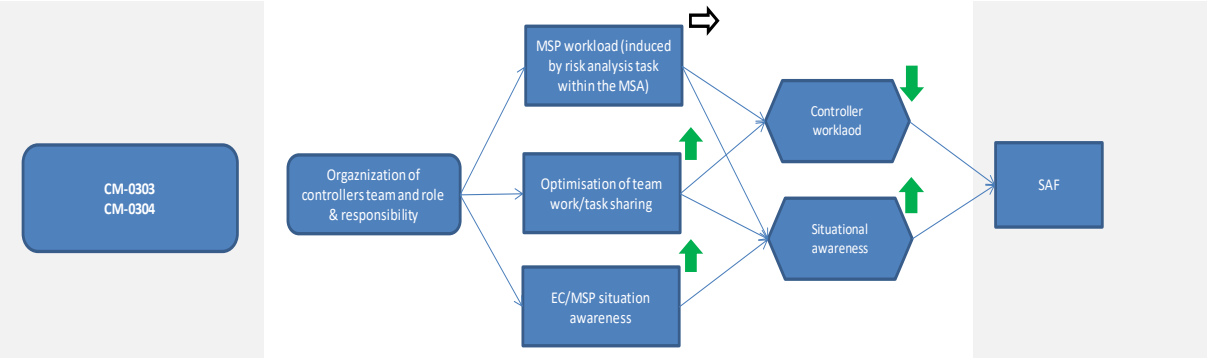
London	Karlsruhe	Amsterdam	Paris	Ankara
Bordeaux	Wien	Milano	Geneva	Zurich
Brussels	Marseille			

4.3 Safety

4.3.1 Safety Criteria and Performance Mechanism

Compared to a nominal Planner- Controller, the MSP will have access to a more macroscopic view of the air traffic situation enabling a better understanding of the aircraft route and increasing the awareness of situation

The use of MSP is expected to safely optimize the operational resources available: reducing /balancing the workload per flight may allow to increase the number of flights that an individual controller can handle safely with no negative impact on workload



The Safety Criteria-SAC defined for the Solution are:

SAC	Contribution to the Safety performance of the solution	Barrier / Precursor
SAC-10.01a-eTMA/ER-001	The number of planning conflicts shall not increase despite the 4.667% increase in ATC Cost Effectiveness per Flight enabled by PJ.10-01a (mainly due to the reduction of ATCOs needed in the MSA	MF 5.1
SAC-10.01a-eTMA/ER-002	The number of ATC-induced tactical conflicts shall not increase despite the 4.667% increase in ATC Cost Effectiveness per Flight enabled by PJ.10-01a (mainly due to the reduction of ATCOs needed in the MSA	MF 7.1
SAC-10.01a - eTMA/ER-003	The number of imminent infringements shall not increase despite the 4.667% increase in ATC Cost Effectiveness per Flight enabled by PJ.10-01a (mainly due to the reduction of ATCOs needed in the MSA)	MF 5.9

The table below maps the SACs to exercises in which they are validated.

Exercise	Associated SACs
EXE-10.01A-V2-VALP-001	SAC-10.01a-eTMA/ER-001 SAC-10.01a-eTMA/ER-002 SAC-10.01a-eTMA/ER-003
EXE-10.01A-V3-VALP-001	SAC-10.01a-eTMA/ER-001 SAC-10.01a-eTMA/ER-002 SAC-10.01a-eTMA/ER-003

Table 11: SAC mapping to each exercise

4.3.2 Data collection and Assessment

From the Safety Criteria listed in the previous section and following the SRM process, Safety Objectives (SO) and Operational Hazards have been developed and identified. Therefore, the Safety Criteria are implicitly achieved through the demonstration of the aforementioned and through the definition of Safety Validation Objectives, which are documented in the Safety Assessment Report.

SAC-10.01a-eTMA/ER-001			
Exercise	OI Steps	OE	Results
EXE-10.01A-V2-VALP-001	CM-0303	ER HC	To be filled by ENAV
EXE-10.01A-V3-VALP-001	CM-0304b	eTMA HC	The number of planning conflicts did not increase in the runs devoted to the solution scenario (introduction of MSP)
SAC-10.01a-eTMA/ER-002			
Exercise	OI Steps	OE	Results
EXE-10.01A-V2-VALP-001	CM-0303	ER HC	To be filled by ENAV
EXE-10.01A-V3-VALP-001	CM-0304b	eTMA HC	Number of Induced tactical conflicts were slightly reduced in the solution scenario compared to the reference one. Therefore no increase is observed
SAC-10.01a-eTMA/ER-003			
Exercise	OI Steps	OE	Results
EXE-10.01A-V2-VALP-001	CM-0303	ER HC	To be filled by ENAV
EXE-10.01A-V3-VALP-001	CM-0304b	eTMA HC	No imminent infringement were observed during the solution scenarios. Therefore there is no increased observed with the introduction of the MSP

4.3.2.1 V2 phase

The Safety Criteria as defined for the V2 phase in the Safety Assessment Plan and listed in the section 4.3.1 will be achievable only if the safety requirements identified in the Safety Assessment Report will be complied with.

An overview of the qualitative results related to the safety validation objectives success criteria as defined in the VALP are reported in the following table.

Success Criterion	Description	Results
CRT-10-01a-V2-VALP-003-001	The ATCO perceived level of safety is not negatively impacted by the change of working method and by the change from EC/PC to MSP/nEC configuration.	ATCOs perceived that they did not have major difficulties in managing the traffic safely after each simulation run. However specifically the ones playing the role of MSP, perceived that they could not play a clear and active role in contributing to the safety. This observation is confirmed by a low level of acceptability of the MTCD support, which played a central role in the new working method
CRT-10-01a-V2-VALP-003-002	The number of conflicts is not increased by the introduction of the new working method.	There was a higher number of conflicts in the simulation run dealing with the transition between the configuration 1 MSP-3EC, to the configuration to 1MSP-2EC/1PC-1EC. The working method were not supportive in allowing a smooth transition.
CRT-10-01a-V2-VALP-003-003	The number of conflicts is not increased by the introduction of the new seating configuration.	At perception level the sitting configuration of the MSP was not considered satisfactory by the ATCOs. However the sitting configuration per se did not cause a higher number of conflicts.
CRT-10-01a-V2-VALP-003-004	The ATCO perceived level of safety is not negatively impacted by the new communication procedures used by the MSP to communicate with ECs and other PCs.	ATCOs were not satisfied of the support offered by the e-coordination tool in compensating for the fact that the PC is not able anymore to listen to the communication between EC and pilots, and cannot build anymore a good situation awareness.
CRT-10-01a-V2-VALP-003-005	The overall number of phone coordinations is not increased with the change of working method from EC/PC to MSP/nEC configuration.	In the available simulation setting, the measurement of the number of phone coordinations was not very significant. A large part of voice communications could just be made face to face, taking advantage of physical proximity, of the possibility to speak up and of the limited number of controllers in the operating room. In hindsight we can say that this specific validation objective was too ambitious to produce a useful outcome.

4.3.2.2 V3 phase

The exercise attempted to demonstrate *inter alia* that:

- The safety is at least not deteriorated with the introduction of the MSP

No full qualitative results were identified for the OI CM-0304b. Therefore the objective from Safety perspective was to identify impediments, if any, to deploy the MSP operational concept in operational.

However partial qualitative results shows that:

- The number of conflicts is not increased by the introduction of the new seating configuration,
- The number of conflicts is not increased by the introduction of the new working method.

The overall methods and techniques used during the exercise were as follows:

- Observation during the sessions from HF specialists
- Specific questionnaires to the participant controllers & FMPs
- Sessions debriefing

Results are provided in the following documents:

- PJ.10-01a Validation Report V2/V3 [54]
- SPR-INTEROP/OSED Part II V2/V3 (Safety assessment report) [50]

4.3.3 Extrapolation to ECAC wide

4.3.3.1 V2 phase

N/A

4.3.3.2 V3 phase

N/A

4.3.4 Discussion of Assessment Result

In today's operation, planning controller performs following tasks:

- Co-ordinate entry and exit conditions on EC request using SYSCO.
- Resolve boundary problems by re-coordination on EC request using SYSCO.
- Provide with tools support early conflict detection and resolution (depending on the Conflict Detection and Resolution tools horizon) if this early resolution brings operational benefit (either on the ground side or the airborne side)
- Check flight-plans/RBT/RMTs for possible conflicts and complexity issues within its area of responsibility.
- Plan conflict-free flight path through his/her area of responsibility and in so far as practicable, plan taking into account if the aircraft is also subjected to other network constraints in order to facilitate the execution of the RBT/RMT.

- Coordinate with the ATC Sector Executive Controller about planned conflict solution strategies.
- Implement solution strategies by communicating trajectory changes to the aircraft on delegation from ATC Sector Executive role (use of CPDLC).
- Monitor flights regarding adherence to flight plan/RBT/RMT.
- Monitor the air situation picture.
- In coordination with the ATC Supervisory or Local Traffic Management roles determine the need for additional Executive Controller(s) in the case where forecast overload situations are developing.
- Input trajectory changes into the Flight Data Processing System when delegated by the Executive Controller using advance input capabilities through advanced HMI (flight label, list..).
- Co-ordinate with adjacent control areas/sectors for the delegation of airspace or aircraft.
- Coordinate with several Executive Controllers within its area of responsibility about planned conflict solution strategies based on system derived solution proposals. Only when needed/non-expected actions as most actions are visible directly in the system.

The principle of 4 eyes/4 ears is not fully maintained in an MSP configuration, however this is something already happening today in EC/PC normal configuration. In the case of MSP configuration (1 PC for 2 ECs), despite some feeling that in certain situation EC could felt alone, this has not been revealed as a safety issue, if the use of MSP configuration is made in situation of traffic (traffic load and complexity) that do not alter the perceived safety.

Above 125%, EC and MSP had the feeling that they could not have the full support of this latter. Existing tools (airspace violation and terrain monitoring, increase of CPDLC technology should lower frequency occupancy) should be further improved if MSP should deal with higher density of traffic

The transition MSP <-> 2EC was analyzed and did not identify any issues that could impediment MSP commissioning. Moreover, in a situation where the traffic would increase and an additional sector should be opened, the ACC Supervisor would have the possibility to add one executive controller before requesting one EC+ one PC at a later stage. The effect would be that the split of frequencies would be done at an earlier stage and then would smoothen the hand-over workload.

4.3.5 Additional Comments and Notes

N/A

4.4 Environment / Fuel Efficiency

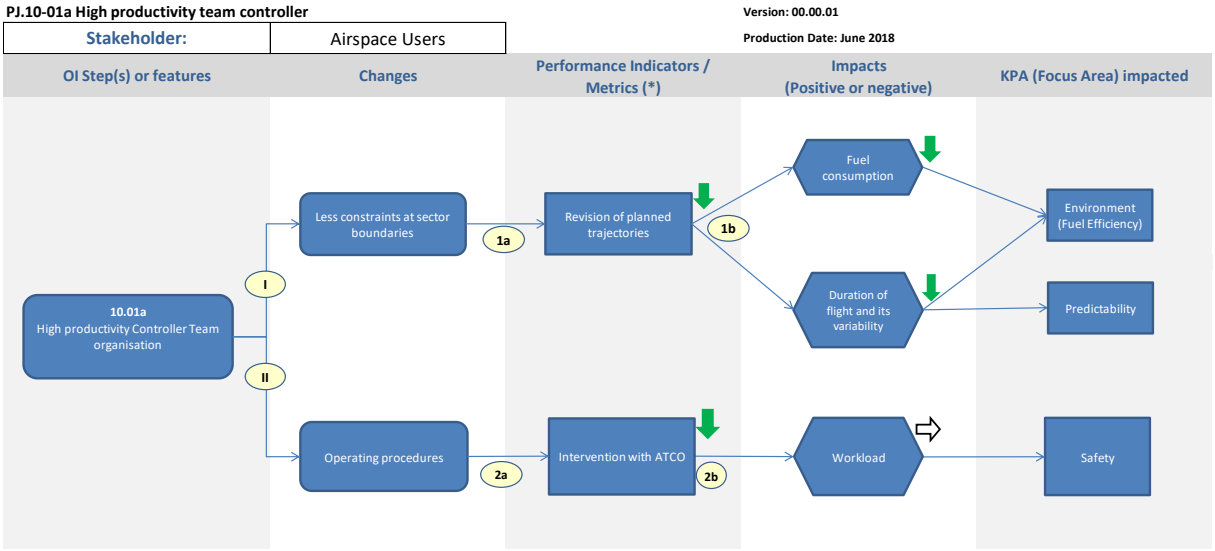
Often fuel efficiency is improved through a reduction of flight or taxi time. This time benefit is also assessed, in this section, as it is additional input for the business case.

4.4.1 Performance Mechanism

As presented in section 4.2, the solution PJ.10-01a will be implemented in eTMA and En-Route (Free-Route environment) which enables highly flexible routing for aircraft.

Compared to a nominal Planner- Controller, the MSP will have access to a more macroscopic view of the air traffic situation enabling a better understanding of the aircraft route. These additional information on the operational environment will enable him to acquire a better understanding of the global situation and therefore optimise flight profile.

The following figure highlights that the resulting higher adherence to the initial planned trajectory will improve fuel consumption and flight emissions (CO2/NOx) which are linked to Environment / Fuel efficiency. In flight duration and its variability: there will be less trajectory revisions in extended TMA and En-Route. Therefore, the RBT is more stable and shorter.



4.4.2 Assessment Data (Exercises and Expectations)

4.4.2.1 V2 phase

Meanwhile gain in fuel is expected in En-Route, this KPI was not assessed at V2 level.

4.4.2.2 V3 phase

The Validation Exercise attempted to demonstrate *inter alia* that:

- The MSP role contributes to increase the **Productivity Controller Team Organisation** due to an improvement in quality of service of ATS through **reduction sector boundaries' constraints.**
- For Airspace Users, this quality of service increase will be lead to a **decrease of flight duration and variability** and consequently a decrease of flight's **fuel consumption**.

The overall methods and techniques used during the exercise were as follows:

- Data logging and log analysis.

The distance flown in the simulated airspace in MSP configuration compared to EC/PC configuration are similar and there is no significant gain.

This is mainly due to the eTMA airspace configuration and traffic flows evolving in this airspace.

These eTMA sectors are mainly managing traffic departing from or arriving to Zurich airport and some regional airports in this area. Traffic is mainly evolving vertically to follow SID and STAR patterns. The potential gain of distance or time is coming from some optimization made at planning level by the MSP especially when managing traffic affecting both sectors of a MSA.

It was not possible to apply the KEP/KEA computation.

However some figures showing the mean distance and time flown in the MSA are as follows:

Validations	Distance flown (NM)	Duration (min:sec)	Distance gain (NM)	Time gain (min:sec)
Reference Scenario EN	53.08	08:20		
Solution Scenario MSP EN	43.86	06:36	17%	01:44
Reference Scenario SW	102.95	16:24		
Solution Scenario MSP SW	99.50	16:00	3%	00:24

Table 12: Flown distance and duration – Reference and Solution Scenarios

Scenarios	Fuel Gain
Solution Scenario MSP EN / Reference	70.14 kg
Solution Scenario MSP SW / Reference	19.6 kg

Table 13: Fuel gain – Solution versus Reference Scenarios

During the RTS different runs in the solution scenario were performed with traffic flight ranging from 100% to 150% of the traffic flight defined for reference scenario in order to check the possibility for controllers to handle additional flights.

Table 13 illustrates the average gain in fuel for each flight in the solution scenario with traffic between 125%-150% of the traffic defined in the reference solution.

With the assumption that the fuel saved is proportional to the reduction of flown distance and that the proportion of controlled flight by configuration is ~50%- ~50%, the reduction in fuel is about 10% with the introduction of the MSP

The results show a large dispersion in term of distance gain and time gain, therefore it is not possible to draw realistic conclusions on these figures due to the limited number of runs and the specific eTMA environment are not relevant.

4.4.3 Extrapolation to ECAC wide

The rationale presented in section “4.2.2.3 Geographical scope” applies.

Based on the metrics obtained in the skyguide Exercise, the results can be extrapolated to the selected ACCs identified in section 4.2.2.3 and taking account their respective weight (daily traffic controlled compared to the daily traffic for Zurich).

Proportion of flight crossing the eTMA is assumed to be the same for each ACC identified in section 4.2.2.3 and equal to 30% (observed in the Zurich context). Number of flight crossing the identified ACC is ~12,5 millions

In the context of the PAR/CBA, the extrapolation shall be calculated over the number of years of operations retained for this Solution, taking into account the specific traffic forecast available for each ACC of the list for the considered period (see 4.2.2.2 Benefit assessment Date).

The extrapolation at ECAC level and over the period 2012-2035 relies on the most likely scenario defined in STATFOR studies.

Therefore the gain in fuel at ECAC level is

59.31% (number of flights crossing eTMA in the 12 identified ACC) *

30% (proportion of flight crossing eTMA) *

33.33% (applicability time – 8 hours /day)*

((70.14+19.6)/2) ~ 2.66kg fuel burn per flight save in a year at ECAC level .

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
FEFF1 Actual Average fuel burn per flight	N/A	N/A	2.66 kg	N/A	N/A
FEFF2 Actual Average CO_2 Emission per flight	N/A	N/A	8.37 kg	N/A	N/A
FEFF3 Reduction in average flight duration	N/A	N/A	107 sec	N/A	N/A

Table 14: Fuel burn reduction per flight phase.

4.4.4 Discussion of Assessment Result

The level of confidence in the results is low

Having in mind that aircraft consume fuel during the climb or descent phases, the results provided in section "Assessment data" is a pessimistic view of the performance of the concept from an environment/fuel efficiency perspective.

The extrapolation for the ACC listed in section 4.2.3 was performed with the assumptions that:

- ACC were similar in terms of airspace structure, system (supporting tool), airspace management (FUA) to the one defined for both exercises.
- List of ACC with complexity similar to the Swiss one would remain constant over the period 2012-2035

4.4.5 Additional Comments and Notes

N/A

4.5 Environment / Noise and Local Air Quality

N/A

4.6 Airspace Capacity (Throughput / Airspace Volume & Time)

Objective of the Multi Sector Concept is oriented towards Cost effectiveness. Therefore despite some potential increase of capacity measured during the validation, no formal conclusion can be triggered form the exercise in term of capacity gain. Therefore the overall performance expected from the MSP concept in eTMA is coming from the Cost efficiency linked to the optimal use of ATCO resources in MSP configuration.

It has to be noticed that in MSP configuration, there was no reduction of workload.

An increase of 20% up to 50% capacity in normal conditions has been tested during the validation in medium/high complex environment.

4.6.1 Assessment Data (Exercises and Expectations)

4.6.1.1 V2 phase

Not assessed.

4.6.1.2 V3 phase

Not assessed.

4.6.2 Assessment Data (Exercises and Expectations)

4.6.2.1 V2 phase

Not assessed.

4.6.2.2 V3 phase

Not assessed.

4.6.3 Extrapolation to ECAC wide

There is no ECAC wide extrapolation required for this KPI.

4.6.4 Discussion of Assessment Result

N/A.

4.6.5 Additional Comments and Notes

N/A.

4.7 Airport Capacity (Runway Throughput Flights/Hour)

N/A

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

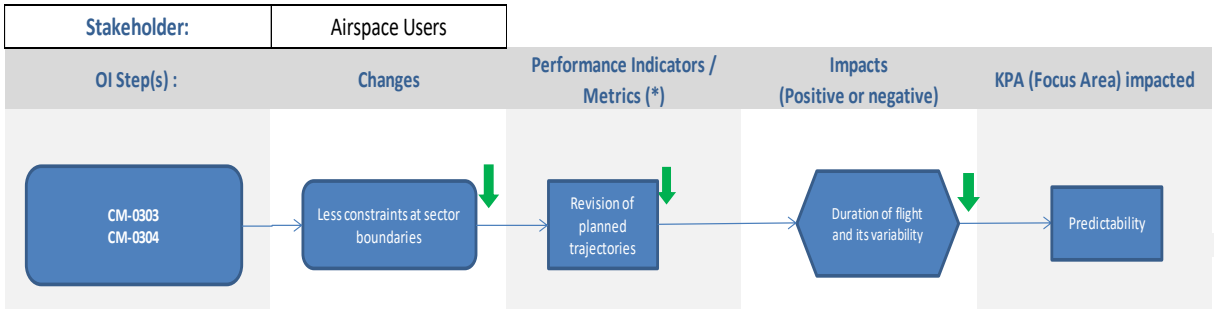
N/A

4.9 Predictability (Flight Duration Variability, against RBT)

4.9.1 Performance Mechanism

Initially this KPI was not identified by PJ19 .

Compared to a nominal Planner - Controller, the MSP will have access to a more macroscopic view of the air traffic situation enabling a better understanding of the aircraft route. This additional information on the operational environment will enable him to acquire a better understanding of the global situation and therefore optimise flight profile.



4.9.2 Assessment Data (Exercises and Expectations)

4.9.2.1 V2 Phase

Not assessed.

4.9.2.2 V3 phase

In extended TMA flight profiles are mainly determined and driven by SID and STAR procedures. Therefore the solution team had decided to perform a qualitative assessment of this KPI.

The exercise attempted to demonstrate inter alia that:

- The MSP role brings an improvement in quality of service of ATS through a reduction of coordination, a better predictability of flights

The table hereafter illustrates the predictability from a qualitative aspect and was derived from the average number of coordination performed by ATCO.

	Number of Coordinations									
	North	North	East	East	EN MSP	South	South	West	West	SW MSP
reference Scenario	7.5	4.5	7.5	4		7	6	8.5	3.5	
MSP Scenario 2 UC#1	4		4		6	2		3		7
MSP Scenario 3 UC#2	4.25		3		7.5	3.5		4.5		4.25
MSP Scenario 4 UC#3	5.5		4		5	3.25		3.5		6
MSP Scenario 5 UC#4	5		5		7.75	4.5		4		8

	Number of Coordinations	% reduction
reference Scenario	6.06	0.00%
MSP Scenario 2 UC#1	4.33	28.52%
MSP Scenario 3 UC#2	4.50	25.77%
MSP Scenario 4 UC#3	4.54	25.09%
MSP Scenario 5 UC#4	5.71	5.84%

As described in the table, the number of coordination dropped by ~21 % between the reference (6,06 coordination per flight) and the solution scenarios (4,77 coordination per flight).

To estimate benefits in terms of reduction of variability, the time gains presented in section 4.4.2.2 has been used. This metric is not exactly the metric associated with KPI PRD1 but it may provide some clue about the potential impact of the solution in the reduction of flight time variability.

4.9.3 Extrapolation to ECAC wide

As mentioned in the previous section, only qualitative results have been derived from the exercice led by Skyguide in the frame of the V3 phase.

Therefore the extrapolation at ECAC level consist in assuming that a reduction of 1.07 min (AVERAGE (01:44; 00:24)) in standard deviation for affected flights can be expected with the introduction of the MSP.

Current block to block variability is 49 min^2 ➔ current standard deviation is √49 = 7 min. Improved block to block variability (standard deviation) is expected to be 7 min – 1.07 min = 5.93 min ➔ Improved absolute variance = 5.93^2 = 35.20 min^2. Thus, the improved absolute difference variance is 35.20 – 49 = 13.80 min^2.

Having in mind that this reduction applies applies only to flight crossing the eTMA, we expect a reduction of

59.31% (number of flights crossing eTMA in the 12 identified ACC) *

30% (proportion of flight crossing eTMA) *

33.33% (applicability time – 8 hours /day) *

(13.80) = 0.82 min^2 / flight ➔ 0.82/49 = 1.67%.

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in

PRD1	N/A	N/A	1.67%	N/A	N/A

4.9.4 Discussion of Assessment Result

The predictability has been assessed at V3 level in extended TMA.

The level of confidence is **low** in extended TMA as the result was estimated (and not directly measured).

4.9.5 Additional Comments and Notes

N/A

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

N/A

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

N/A

4.12 Flexibility

N/A

4.13 Cost Efficiency

4.13.1 Performance Mechanism

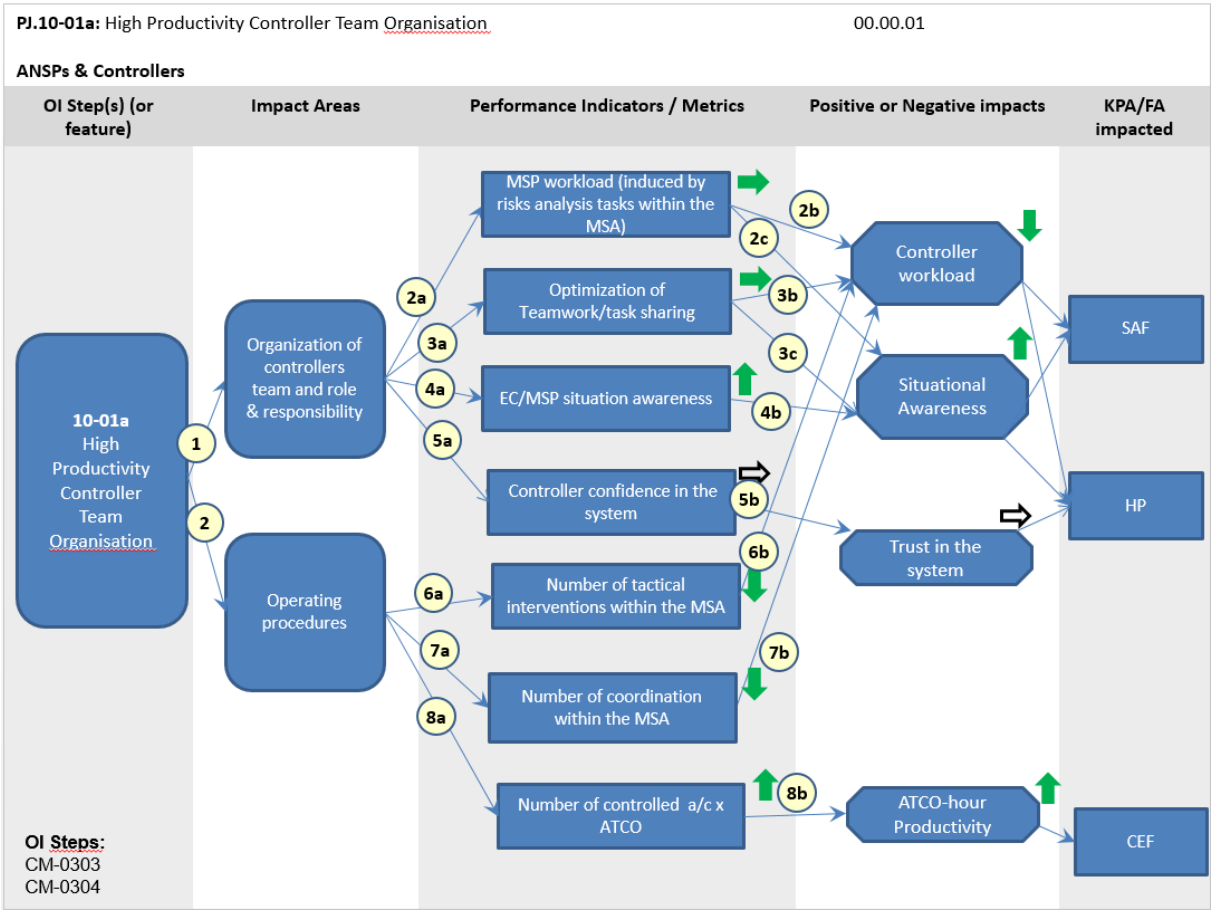
Cost efficiency benefits derive from increased controller productivity, which usually are an effect of reducing controller workload. However, in the frame of the MSP concept, objective is to at least maintain actual capacity with a new team organization, meaning one Planner Controller for two Executive Controllers in eTMA (EXE-10.01a-V2-VALP-001) environment and one Planning Controller for three Executive Controllers (EXE-10.01a-V2-VALP-001).

The introduction of a new SESAR Solution PJ.10-01a's Planning role; the Multi-Sector Planning (MSP); will transform the traditional Planner-Executive (1PC-1EC) two-person ATC sector team into a more flexible organization that could reach up to one Planner-n Executive controller. This MSP will therefore be responsible for the airspace that is under the executive control of two or more independent Executive Controllers (1PC-nEC) in both En-Route and eTMA environment.

The Multi Sector Planning Controller will provide support to several Executive Controllers operating in different AORs, including ensuring suitable coordination agreements between these sectors and assisting in managing the workload of the Executive Controllers.

In comparison to the traditional organization, this new working method will enable ANSP to better adapt their staffing to the aircraft demand. Consequently, they will be able to optimize the number of ATCO handling the traffic.

The synthesis of the performance benefits is illustrated in the following figure:



4.13.2 Assessment Data (Exercises and Expectations)

4.13.2.1 V2 phase

Based on available results, data suggests that in the MSP configuration with 3 ECs, ATCOs working in the MSA are able to manage a slightly higher percentage of flights comparing to the current operational scenario. This trend was even more positive in the transition scenario (MSP+2 ECs only).

However, this data should be carefully considered due to the sub-optimal set of performance indicators recorded in the exercise. Particularly, this data are not corroborated by a decrease of workload that was recorded high across all the exercise.

Therefore, no conclusions can be derived on the actual value related to the CEF2 (ATCO Productivity – Flights per ATCO -Hour on duty) assessment and further investigations are recommended.

4.13.2.2 V3 phase

The introduction of the MSP role will allow a decrease of the number of Planner Controller deployed to handle the traffic.

In addition, one of the Planner Controller's responsibility is to co-ordinate entry and exit conditions on with adjacent control areas/sectors for the delegation of airspace or aircraft. As presented in the solution, decreases the number of PCs needed, due to the increase of responsibility area attributed to the MSP it will lead to a decrease of coordination with adjacent sectors.

Therefore, the Validation Exercise will attempt to demonstrate *inter alia* that:

- The MSP role contributes to the increase the **Productivity Controller Team Organisation** due to a decrease of both **Tactical Intervention** and **Coordination within the MSA**.
- The MSP role will therefore contribute to an increase **the average of the number of flights handled per ATCO**, in other words, the **ATCO productivity** will increase.

In order to assess the performance gain from the solution, the indicator was measured with and without the solution:

- $\frac{Number\ of\ aircraft\ handled}{ATCO\ hours}$

The overall methods and techniques used during the exercise were as follows:

- Data logging and log analysis.

Results:

In the reference scenario the average number of flights in a day that ATCO should handle in eTMA is ~600, which gives ~25 flights/hour. The cost efficiency in the reference scenario is 25/4 = 6.25 flights per ATCO in duty for 1hr

In the runs the ATCO could handled 20% of additional flights in a MSP configuration, ie ~30 flights/hr.

In the context of the Zürich ACC, the post analysis and discussions showed that the MSP could be operationnally in use 8 hours a day and could absorb additional flights (up to 25%) for 2 hours.

Therefore in the solution scenario, the configuration are:

- 4 ATCO controlling 25 flights/hr in eTMA for 16hr
- 3 ATCO controlling 25flights/hr in eTMA for 6hr
- 3 ATCO controlling 30 flights/hr in eTMA for 2hr

The average number of ATCO per hour is therefore (16*4+6*3 +2*3)/24 = 3.67

In the solution scenario, the average number of flight to be handled would be (16 * 25 + 6 * 25 + 2* 30) /24 = 25.4

The cost efficiency in the solution scenario would be 25.4 / 3.7 = 6,93

Compared to initial value, the increase is ~10,9 %

4.13.3 Extrapolation to ECAC wide

4.13.3.1 V2 phase

N/A

4.13.3.2 V3 phase

The rationale presented in section “4.2Conditions / Assumptions for Applicability” applies.

The cost efficiency is applied to the 12 ACC identified in section 4.2.2.3

We assume that the introduction of the MSP could at least be in use 8 hours a day in the identified ACC in the section 4.2.3.

Same rationale in terms of applicable traffic (30%) as for FEFF and PRD applies.

Therefore the gain in ATCO Productivity at ECAC level is

59.31% (number of flights crossing eTMA in the 12 identified ACC) *

30% (proportion of flight crossing eTMA) *

10,9% ~ 1,9% at ECAC level.

4.13.3.3 Aggregation of results

As mentioned in the guidance [32] provided by SJU, aggregation of V2 and V3 figures is performed for solution PJ.10-01a once results derived from exercises have been extrapolated at ECAC level.

The overall CEff is 1.9 %

4.13.4 Discussion of Assessment Result

The MSP role is already deployed across the ECAC zone to provide service in the TMA.

Two options are present, to reduce the number of ATCO and work at constant capacity or keep the number of ATCO constant in order to cope with an increase of 20% of the traffic.

Therefore the overall confidence estimate for the cost efficiency result is considered **high**.

4.13.5 Additional Comments and Notes

N/A

4.14 Airspace User Cost Efficiency

N/A

4.15 Security

N/A

4.16 Human Performance

4.16.1 HP arguments, activities and metrics

Most of the Human Performance data collected was qualitative, except for some specific items, for which additional quantitative data was sought by means of questionnaires ratings or scores.

Arg.	Activities	Metrics
A1.1.3 Roles and responsibilities are clear and consistent	One HP-safety workshop Two Human-in-the-loop simulations	Questionnaire rating
A1.2.5 Operating methods (procedures) can be followed in an accurate, efficient and timely manner	*Same as above*	*Questionnaire rating*
A1.3.1 The potential for human error is reduced to a tolerable level	*Same as above*	*Qualitative feedback only*
A.1.3.3 The level of workload is acceptable	*Same as above*	ISA ratings Workload score
A.1.3.5 Human actors can maintain a sufficient level of situation awareness	*Same as above*	Situational awareness score
A2.3.5 Workstations (e.g. cockpit layout and consoles) adhere to ergonomic principles	*Same as above*	Questionnaire ratings
A2.3.6 The usability of the user interface is acceptable	*Same as above*	Questionnaire ratings
A3.3.1 Changes to existing roles in the team are identified (including roles that become obsolete).	*Same as above*	*Qualitative feedback only*
A3.2.1 The introduction of new roles to a team is identified.	*Same as above*	*Qualitative feedback only*
A4.1.1 Changes in roles and responsibilities are acceptable to the affected human actors	*Same as above*	Questionnaire ratings

4.16.2 Extrapolation to ECAC wide

There is no ECAC wide extrapolation required for this KPI.

4.16.3 Open HP issues/ recommendations and requirements

The following table reports on the n. of open issues, recommendations and requirements identified as a results of the V2 and V3 validation activities.

PIs	Number of open issues/ benefits	Nr. of recommendations	Number of requirements
HP1 Consistency of human role with respect to human capabilities and limitations	14	15	10
HP2 Suitability of technical system in supporting the tasks of human actors	0	12	6
HP3 Adequacy of team structure and team communication in supporting the human actors	3	8	4
HP4 Feasibility with regard to HP-related transition factors	1	0	0

4.16.4 Concept interaction

No interaction with other solution were identified.

4.16.5 Most important HP issues

PIs	Most important issue of the solution	Most important issues due to solution interdependencies
HP1 Consistency of human role with respect to human capabilities and limitations	Introduction of the role of the MSP	/
	Ability to maintain and update the traffic picture based on info coming from two sectors	

PIs	Most important issue of the solution	Most important issues due to solution interdependencies
	Handover, i.e., team transitions from a team of 1PC-1EC to an MSP team, and transition to an MSP team to two 1PC-1EC teams.	No issue due to solution interdependency
HP2 Suitability of technical system in supporting the tasks of human actors	Adequacy, effectiveness of the coordination functionality	No issue due to solution interdependency
	Adequacy, effectiveness of the filtering functionality	No issue due to solution interdependency
	None	No issue due to solution interdependency
HP3 Adequacy of team structure and team communication in supporting the human actors	Increased communication effort for the MSP	No issue due to solution interdependency
	Clarity of the communications between the MSP and the ECs	No issue due to solution interdependency
	None	No issue due to solution interdependency
HP4 Feasibility with regard to HP-related transition factors	None	No issue due to solution interdependency
	None	No issue due to solution interdependency
	None	No issue due to solution interdependency
	None	No issue due to solution interdependency
	None	No issue due to solution interdependency

4.16.6 Additional Comments and Notes

Please see Human Performance report for additional information.

4.17 Other PIs

N/A

4.17.1 Performance Mechanism

N/A

4.17.2 Assessment Data

Contribution of OI to the solution. The table under illustrates the contribution of each OI to FEFF and CEFF.

OI	Title	Contribution to CEFF	Contribution to FEFF
CM-0303	*Sector Team Operations Adapted to new Responsibilities in En Route, 1 Planning to several Tactical Controllers team structure*	0%	Not assessed
CM-0304b	*Sector Team Operations Adapted to New Responsibilities in the eTMA, 1 Planning to several Tactical Controllers team structure*	*100%*	*100%*

4.17.3 Additional comments and notes

N/A

4.18 Gap Analysis

KPI	Validation Targets – Network Level (ECAC Wide)	Performance Benefits Expectations at Network Level (ECAC Wide or Local depending on the KPI)[8]	Rationale[9]
FEFF1: Fuel Efficiency – Fuel burn per flight	13.6 kg/flight	2.66 kg/flight	Includes only the contribution in extended TMA.
PRD1: Predictability – Variance of Difference in actual & Flight Plan or RBT durations	0.372%	1.67%	Estimation rather than measurement
CEF2: ATCO Productivity – Flights per ATCO -Hour on duty	4% ER 0,667% TMA	1.9 % ER Already in operational for TMA	Includes only the contribution in extended TMA
SAF1: Safety - Total number of fatal accidents and incidents with ATM Contribution per year	Not identified	Assessed No degradation observed	

Table 15: Gap analysis Summary

[8] Negative impacts are indicated in red.

[9] 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).

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

[6] B05 Data Collection and Repository Cycle 2015

[7] Methodology for the Performance Planning and Master Plan Maintenance (edition 0.13)

[8] Performance review report (PRR), Edition 2012

https://www.eurocontrol.int/sites/default/files/publication/files/prr-2012.pdf

[9] Monthly Network Operation report , Edition Nov. 2012

https://www.eurocontrol.int/sites/default/files/publication/performance/201211/network-operations-report-november-2012-overview.pdf

[10]PJ.10-01a SPR-INTEROP/OSED V2/V3 Part I

[11] PJ.10-01a SPR-INTEROP/OSED Part II

[12] PJ.10-01a SPR-INTEROP/OSED Part IV

[13] PJ.10-01a Validation report V2/V3

Content Integration

[14]B.04.01 D138 EATMA Guidance Material

[15]EATMA Community pages

[16]SESAR ATM Lexicon

Content Development

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

System and Service Development

[18]08.01.01 D52: SWIM Foundation v2

[19]08.01.01 D49: SWIM Compliance Criteria

[20]08.03.10 D45: ISRM Foundation v00.08.00

[21]B.04.03 D102 SESAR Working Method on Services

[22]B.04.03 D128 ADD SESAR1

[23]B.04.05 Common Service Foundation Method

Performance Management

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

[25]16.06.06-D68 Part 1 –SESAR Cost Benefit Analysis – Integrated Model

[26]16.06.06-D51-SESAR_1 Business Case Consolidated_Deliverable-00.01.00 and CBA

[27]Method to assess cost of European ATM improvements and technologies, EUROCONTROL (2014)

[28]ATM Cost Breakdown Structure_ed02_2014

[29]Standard Inputs for EUROCONTROL Cost Benefit Analyses

[30]16.06.06_D26-08 ATM CBA Quality Checklist

[31]16.06.06_D26_04_Guidelines_for_Producing_Benefit_and_Impact_Mechanisms

[32]Coordination group – ATM Performance assessment – PAGAR campaign second and last briefing session for PCITs 20180905 1210-1

Validation

[33]03.00 D16 WP3 Engineering methodology

[34]Transition VALS SESAR 2020 - Consolidated deliverable with contribution from Operational Federating Projects

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

System Engineering

[36]SESAR Requirements and V&V guidelines

Safety

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

[38]SESAR, Guidance to Apply the Safety Reference Material, Edition 3.0, April 2016

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

[40]Accident Incident Models – AIM, release 2017

Human Performance

[41]16.06.05 D 27 HP Reference Material D27

[42]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

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

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

Security

[45]16.06.02 D103 SESAR Security Ref Material Level

[46]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[47]16.06.02 D131 Security Database Application (CTRL_S)

5.1 Reference Documents

[48]ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.[10]

Solution PJ10-01a Documents

[49] PJ10-D1.1.007-SESAR Solution 10.01a SPR_INTEROP_OSED_V3_Part-I

[50] PJ10-D1.1.007-SESAR Solution 10.01a SPR_INTEROP_OSED_V3_Part-II

[51] PJ10-D1.1.007-SESAR Solution 10.01a SPR_INTEROP_OSED_V3_Part-IV

[52] PJ10-D1.1.030-SESAR Solution 10-01a VALP

[53] PJ10-D1.1.019-SESAR Solution PJ.10-01a Technical Specification (TS IRS) V3 TRL6

[54] PJ.10-D1.1.050-SESAR Solution 10-01a VALR (eTMA V3 & En route)

Appendix A Detailed Description and Issues of the OI Steps

OI Step ID	Title	Consistency with latest Dataset
CM-0303	*Sector Team Operations Adapted to new Responsibilities in En Route, 1 Planning to several Tactical Controllers team structure*	Dataset 19
CM-0304b	*Sector Team Operations Adapted to new Responsibilities in eTMA, 1 Planning to two Tactical Controllers team structure*	Dataset 19

Table 16: OI Steps allocated to the Solution