SESAR Solution #118 - SPR/INTEROP-OSED - Part IV - Human Performance Assessment Report

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BASIC EXTENDED ATC PLANNING FUNCTION

Abstract

This document provides the Human Performance Assessment Report (HPAR) for **Solution #118**: **Basic EAP (Extended ATC Planning) function.**

The basic EAP (*b*EAP) function concept describes an **automated tool supporting the basic communication** between the Local DCB position and the Controllers' Work Positions to be deployed in En-route operating environments of **Medium** and **High complexity**.

The basic EAP function is expected to facilitate the implementation of ATFCM measures to better match capacity to predicted demand and to reduce the complexity of traffic presentation in order to suit available capacity.

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1 Executive Summary

This document provides the Human Performance Assessment Report (HPAR) for **Solution #118**: **Basic EAP (Extended ATC Planning) function.**

DISCLAIMER

This HPAR presents the Human Performance assessment results from the SESAR1 validation exercise VP-687 performed in Reims ACC in June 2015 by the project P04.07.08. This issue of the HPAR has been prepared in order to meet the requirements of a SESAR Solution datapack for V3 phase; it is however the simple adaptation of the existing results presented in the V3 Validation Report for exercise VP-687 [41].

Description:

The basic EAP function is expected to facilitate the implementation of ATFCM measures to better match capacity to predicted demand and to reduce the complexity of traffic presentation in order to suit the available capacity.

The Basic EAP (Extended ATC Planning) concept consists in the definition of an automated tool supporting the basic communication between the Local DCB position and the Controllers' Work Positions to be deployed in En-route operating environments of Medium and High complexity.

The HPAR is consolidating Solution #118 Human performance validation results.

2 Introduction

2.1 Purpose of the document

The purpose of this document is to detail the Human Performance assessment results from the validation exercise VP6887 performed for the SESAR Solution #118.

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.

DISCLAIMER

This HPAR presents the Human Performance assessment results from the SESAR1 validation exercise VP-687 performed in Reims ACC in June 2015 by the project P04.07.08. This issue of the HPAR has been prepared in order to meet the requirements of a SESAR Solution datapack for V3 phase; it is however the simple adaptation of the existing results presented in the V3 Validation Report for exercise VP-687 [41].

As no HPAR template was available at the date of writing this report, this report uses the structure of the SESAR 2020 PAR instead.

2.2 Intended readership

The intended audience for this HPAR is:

- The SESAR performance management process is PJ19, which will collect and combine KPI results at network level, and provide the data to PJ20 for considering the performance data for the European ATM Master Plan;
- The key stakeholders targeted by the Solution, i.e.
  - Airspace Users who will be directly impacted by the deployment of the *basic* EAP function in En-Route airspace;
  - Air Traffic Controllers who will benefit from a smoothed workload and less complex traffic situations thanks to the STAM or decomplexification measures enabled by the *basic* EAP function, especially in hotspot areas;
- SESAR 2020 PJ09.02 members
- SESAR 2020 Projects developing solutions that can benefit from the deployment of the *basic* EAP function.

2.3 Inputs from other projects

PJ19 will manage and provide common assumptions and aggregation assumptions which are needed for producing this report.

2.4 Glossary of terms

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

2.5 Acronyms and Terminology

Term	Definition
ANS	Air Navigation Service
ANSP	Air Navigation Service Provider
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
BAD	Benefits Assessment Date
BAER	Benefit Assessment Equipment Rate
BIM	Benefit and Impact Mechanism
CBA	Cost Benefit Analysis
DB	Deployment Baseline
DOD	Detailed Operational Description
E-ATMS	European Air Traffic Management System
ECAC	European Civil Aviation Conference
HPAP	Human Performance Assessment Process
KPA	Key Performance Area
KPI	Key Performance Indicator
N/A	Not Applicable
OI	Operational Improvement
PAR	Performance Assessment Report
PI	Performance Indicator
PRU	Performance Review Unit
QoS	Quality of Service
RBT	Reference Business / Mission Trajectory

SESAR	Single European Sky ATM Research Programme
SESAR2020 Programme	The programme which defines the Research and Development activities and Projects for the SJU.
SJU	SESAR Joint Undertaking (Agency of the European Commission)

Table 1: Acronyms and terminology

3 Solution Scope

3.1 Detailed Description of the Solution

The SESAR **Solution #118 - Basic EAP (Extended ATC Planning) function** is defined in the applicable version of EATMA (Dataset 18) as follows:

Solution #118 — Basic EAP (Extended ATC Planning) function

The basic Extended ATC Planner aims at bridging the gap between Air Traffic Flow and Capacity Management (ATFCM) and Air Traffic Control (ATC) providing real-time and fine-tuning measures to solve ATFCM hotspots and to perform early measures to alleviate complexity closest to ATC activities.

The solution consists of an automated tool and associated procedures supporting the basic communication between the Local DCB position and the Controllers' Work Positions allowing the EAP and the ATC team in identifying, assessing and resolving local complexity situations. The basic EAP relies on a real time integrated process for managing the complexity of the traffic with capability to reduce traffic peaks through early implementation of fine-tuned solutions to solve workload imbalances at the local level, compatible with the short term timeframe of execution phase of the flights.

Operational improvement and expected benefits

The basic EAP (Extended ATC Planning) function introduces an **initial automated interface** together with the related procedures that will facilitate the communication between local DCB position and the Controllers' Work Positions through the provision of optimised solutions to solve workload imbalances compatible with the short term timeframe of execution phase of the flights.

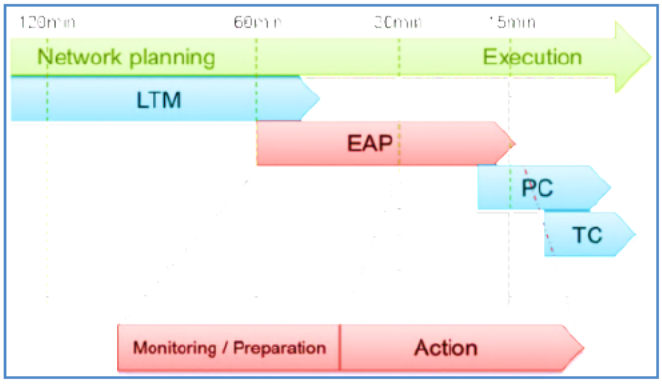

Figure 1: The EAP role fills the gap between ATFCM and ATC

The basic EAP concept introduces also a **new role**, the EAP role (Extended ATC Planning), which is intended to **fill the gap between ATFCM and ATC** as illustrated on Figure 1 above:

- The **EAP is not an additional staff**: it is a **role** covering a set of services/functions that can be assumed by different personnel of the ATSU (already existing actors, like TC or new actors like MSP or LTM);

- It is **highly recommended** that the EAP is holding or has held an **ATCO rating** in the concerned ATSU's airspace

The main benefits expected from the basic EAP function are principally:

- To help providing a better service to airspace users through **reduced delays**, **better punctuality**, less **ATFCM regulations**, whilst maintaining or even **increasing safety**.
- To **increase the controllers' productivity** contributing thus to increase of the overall en-route **capacity** of the ACC.

In addition, the basic EAP concept can be considered as a **potential enabler** for the deployment of functionalities such as **Extended AMAN** or **Free Routing** operations.

3.2 Detailed Description of Interactions with other Solutions

N/A

3.3 Detailed Description and Issues of the OI Steps

OI Step ID	Title	Step	Consistency with latest Dataset
CM-0106	Initial support to INAP: basic EAP (Extended ATC Planning) function	1	Dataset 18

Table 2: OI Steps allocated to the Solution

3.4 List of Enablers

The enablers considered essential by the Solution project are provided below.

Enabler ID	Title	Related OI Step ID	Consistency with latest Dataset
ER-ATC-164	ATC tools to re-organize traffic flows to reduce complexity **in the execution phase**	CM-0106	Dataset 18
PRO-220a	ATC Procedures related to Detection and Resolution of Complexity, Density and Traffic Flow Problems	CM-0106	Dataset 18
PRO-220b	FCM procedures to describe how detection and resolution of complexity, density or traffic flow issues are managed.	CM-0106	Dataset 18

Table 3: Essential Enablers

Note on the OIs and Enablers linked to the Solution #118

The EAP concept has been initially developed by DSNA within SESAR 1 P04.07.08 (OIS CM-0104-A) and validated through the exercise VP-687 in Reims ACC in June 2015 as part of **Solution #19** in **R5**.

However, the R5 review has stated that the OIS **CM-0104-A** has only been **partly addressed** in Solution #19 in R5, and that consequently there was *"a need to submit a CR in Dataset 18 in order to review the scope of CM-0104-A, PRO-220a and PRO-220b (i.e. only address Traffic complexity resolution in the planning phase). The backlog of CM-0104-A, PRO-220a and PRO-220b should also be addressed by a CR in DS17."* The OIS **CM-0104-B** addresses the full EAP concept which is currently developed by **PJ9.02** in which DSNA is involved. In this context, DSNA has discussed with SJU the possible solutions to follow the recommendations of R5 review regarding the OIS CM-0104-A.

The following updates of the EATMA have therefore been decided:

- The creation of a specific solution (#118) to cover the part not covered by solution #19;
- The creation of a specific OIS, **CM-0106**, to cover the part of OIS CM-0104-A not properly addressed in solution #19 and
- The creation of a specific enabler **ER-ATC-164** attached to **CM-0106.**

The results of these changes for solution #118 are illustrated on Figure 2 below.

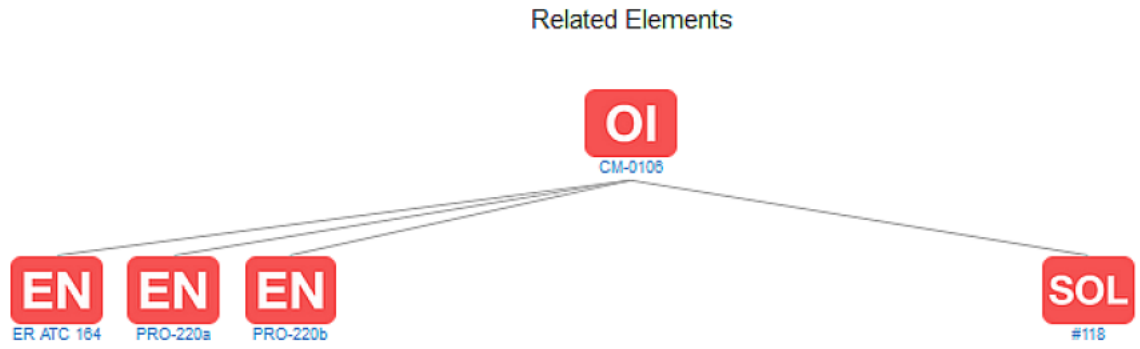

Figure 2: Solution #118 – Related OI and Enablers

4 Solution #118 - Performance Assessment Background

4.1 Assessment Sources

No SESAR 2020 Validation Exercise is planned for Solution #118.

The previous Validation Exercises (pre-SESAR2020) relevant for this assessment are listed below.

Organisation	Document Title	Publishing Date
DSNA	04.07.08 - D78 - Validation Report **V2** VP-687, Edition 00.01.02 ([42]	23/03/2016
DSNA	SESAR Solution#118 – Validation Report **V3** - Basic Extended ATC Planning – 00.01.00 ([41])	31/01/2018

Table 4: Pre-SESAR2020 Exercises

The two VALRs listed above in Table 4 describe the results of the validation exercise **VP687** (as defined in the relevant Validation Plan [41]) prepared by the project P04.07.08) and performed by DSNA in June 2015 in the Reims UAC. To achieve a **V3 maturity level**, the VP687 VALR (D78) has been enriched with the outcomes from the **4ME system**, a tool **operationally deployed in Reims UAC since 2016**, which is used as an enabler for *basic* EAP (to display information on CWPs).

The objectives of the validation exercise VP687 were:

1. To assess the added value of the EAP role for the management of hotspots regarding the following aspects:
   - Human performance, and
   - Capacity
2. To assess the roles and responsibilities of the different actors involved in the STAM process.

Exercise VP687 contributed to validate OFA 05.03.04 "Enhanced ATFCM Processes" and more precisely covered OI **CM-0106** "*Initial support to INAP: basic EAP (Extended ATC Planning) function*".

Project B04.01 has defined the following Validation targets for the OFA:

KPA01.01	Safety	SAF1	% Change in accidents and incidents with ATM contribution per year	-1,89%
KPA02.01	Environment - Fuel Efficiency	ENV1	% Change in average fuel burn per flight	-0,05%
KPA03.01	Airspace Capacity - TMA	CAP1	% Change in TMA throughput per time unit (challenging airspace)	3,00%
KPA03.02	Airspace Capacity - En-Route	CAP2	% Change in En-Route throughput per time unit (challenging airspace)	6,50%

KPA03.03	Airport Capacity	CAP3	% Change in busy hour declared capacity at best-in-class airports	0,00%
KPA05.01	Predictability	PRD1	% change in variance of differences between actual and flight plan or RBT durations	0,00%
KPA06.01	**Cost Effectiveness - ATCO Productivity**	CEF2	% Change in flights per ATCO-hour on duty	2,50%

Table 5: B04.01 Validation targets for OFA05.03.04

In this scope, VP687 investigated the following KPAs:

- **Safety;**
- **Airspace Capacity** – En-route;
- Predictability and more precisely the new KPA defined by B05: **Punctuality;**
- **Cost Effectiveness** was only partially addressed.

4.2 Conditions / Assumptions for Applicability

4.2.1 Operating environments

The Solution #118 - Basic EAP (Extended ATC Planning) function is defined with reference to **En-route operating environments of Medium and High complexity.**

The following Table 6 summarises the applicable operating environments.

OE	Applicable sub-OE	Special characteristics
En Route	En-Route High-Complexity	In the PRR 2013 [47] , 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 2 but lower than 6. This complexity indicator is therefore representative of the level (and characteristics) of the traffic demand in the airspace (and the need for Enhanced DCB including Complexity Management at regional/sub-regional/local level and/or Enhanced Conflict Management and Automation at local level).
	En-Route Medium-Complexity	

Table 6: Applicable Operating Environments

4.2.2 Benefits Assessment Date

The technical solution recommended for the basic EAP function support tools is not fully integrated into the operational equipment and systems deployed in an ACC as illustrated on the Figure 3 below.

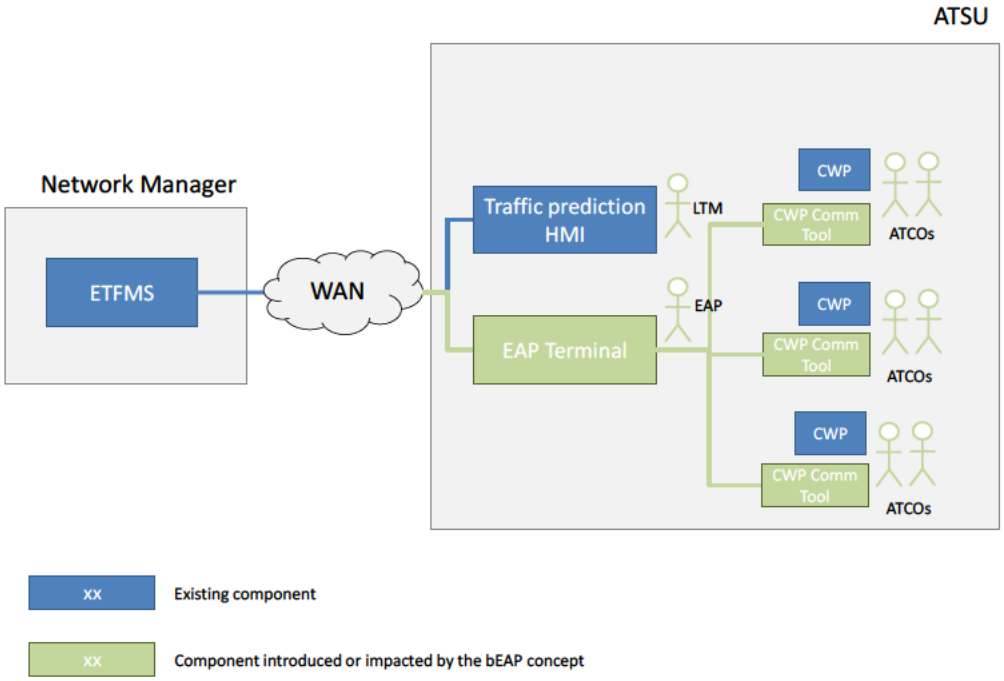

Figure 3: The Solution #118 — Basic EAP (Extended ATC Planning) function

Indeed, the basic EAP support tool is based on software used to fulfil communication needs between the EAP role and the CWPs; therefore it does not necessarily require to be integrated in the existing operational environment and hence will not require expensive and time-consuming safety studies.

Taking account of the time required by the industry to develop a commercial solution, it is assumed that the operational implementation of the basic EAP function should be possible from early 2020 and onwards. This analysis allows concluding that the timeframe up to the Initial Operational Capability (IOC) should be relatively short. It is also assumed that the Full Operational Capability (FOC) should occur the same year.

Hence the Benefits Assessment Date (BAD) is considered to be **2020**.

4.2.3 Geographical Scope

The Solution #118 - Basic EAP (Extended ATC Planning) function is defined for En-route operating environments of Medium and High complexity, with the aim to decrease the traffic complexity level and cope with high level traffic demand through the assessment and resolution of local complexity situations.
In the PRR 2013 [47] , 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 2 but lower than 6.

This complexity indicator is therefore representative of the level and characteristics of the traffic demand in the airspace and the need for Enhanced DCB including Complexity Management at

regional/sub-regional/local level and/or Enhanced Conflict Management and Automation at local level.
The validation results obtained for the bEAP function in the Reims ACC (score between 7 and 8) correspond to a **high complexity En-route environment**.
In order to properly extend these results at ECAC level, it is necessary to consider a geographical scope that will encompass the ACCs managing traffic of similar complexity. Hence the geographical scope of the CBA will focus on high complexity and/or high demand ACCs. The analysis of the Monthly Annual Network Operations Reports **Error! Reference source not found.** and of the Performance Result Report **Error! Reference source not found.** allows identifying the 12 ACCs with the highest delays (See Table 7) that will be used to extend the results at ECAC level.
The following Table 7 summarises the essential deployment details.

Benefits Assessment Date (BAD)	Specific geographical and/or stakeholder deployment
2020[1]	Main target is en-route operating environments of Medium and High complexity ACCs managing traffic complexity similar to Reims UAC (i.e. high complexity and/or high demand ACCs)

Geographical scope of the Benefit Assessment
ATHINAI & MACEDONIA
BARCELONA
BREST UACC
KARLSRUHE UAC
LANGEN ACC
LISBOA ACC UAC
MAASTRICHT UAC
NICOSIA ACC
PARIS ALL ACC
REIMS UACC
WARSZAWA ACC
ZAGREB ACC

Table 7: Deployment details

The quantification of benefits takes also into account the traffic evolution forecast based on the STATFOR analysis of published in February 2017. According to this Medium-term traffic forecast, the most-likely of the 3 scenarios forecast for 2023 is 11.6 million annual IFR flight movements in Europe, which represents **17.2% more than in 2015.**

The Table 8 below presents the forecasted annual growth rate for the 12 ACCs that define the geographical scope for the benefits assessment.

Geographical Scope	STATFOR annual growth forecast (2017-2023)

[1] See Cost Benefits Analysis for Solution#118 ([46])

ATHINAI & MACEDONIA	3.2%
BARCELONA	3%
BREST U ACC	1.8%
KARLSRUHE UAC	1.7%
LANGEN ACC	1.7%
LISBOA ACC UAC	2.5%
MAASTRICHT UAC	1.4%
NICOSIA ACC	4.4%
PARIS ALL ACC	1.8%
REIMS U ACC	1,8%
WARSZAWA ACC	3.0%
ZAGREB	2.6%

Table 8: Forecasted annual growth rate per selected ACC (Source STATFOR 2017)

4.3 Summary of Validation Exercise Performance Results

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

Exercise	OI Step	Exercise scenario & scope	Performance Results	Notes
VP-687	CM-0106 Initial support to INAP: basic EAP (Extended ATC Planning) function	**Reference scenario** consisting in a simple recording of the actual operations in Reims UAC without the basic EAP function.	• 39 STAM requests were performed	Traffic values were similar for the two scenarios
		Solution scenario integrating the EAP role and its associated tools	• 52 STAM requests performed by the EAP. • **No capacity gain/reduction** obtained during the exercise • **The total delay** on measured sectors was dropped down by **65%** • Sight improvement of the Cost Effectiveness due to better ATCO productivity (+2% measured as "Flights per En-Route ATCO-hour") • Working method clear and widely accepted **among controllers**: Working with an	

			electronic device (the CWP tool) was preferred to the paper method • **LTM workload** slightly increased compared to the usage of CHMI	

Table 9: Summary of Validation Results.

4.4 Summary of Validation Exercise Performance Results

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

Exercise	OI Step	Exercise scenario & scope	Performance Results	Notes
VP-687	**CM-0106** Initial support to INAP: basic EAP (Extended ATC Planning) function	**Reference scenario** consisting in a simple recording of the actual operations in Reims UAC without the basic EAP function.	• 39 STAM requests were performed	Traffic values were similar for the two scenarios
		Solution scenario integrating the EAP role and its associated tools	• 52 STAM requests performed by the EAP. • **No capacity gain/reduction** obtained during the exercise • **The total delay** on measured sectors was dropped down by **65%** • Sight improvement of the Cost Effectiveness due to better ATCO productivity (+2% measured as "Flights per En-Route ATCO-hour") • Working method clear and widely accepted **among controllers**: Working with an electronic device (the CWP tool) was preferred to the paper method • **LTM workload** slightly increased	

Exercise	OI Step	Exercise scenario & scope	Performance Results	Notes
			compared to the usage of CHMI	

Table 10: Summary of Validation Results.

5 Solution #118 - Human Performance Assessment

5.1.1 Performance Mechanism

The Benefit and Impact Mechanism illustrated on Figure 4 and Figure 5 below has been investigated for Solution #118.

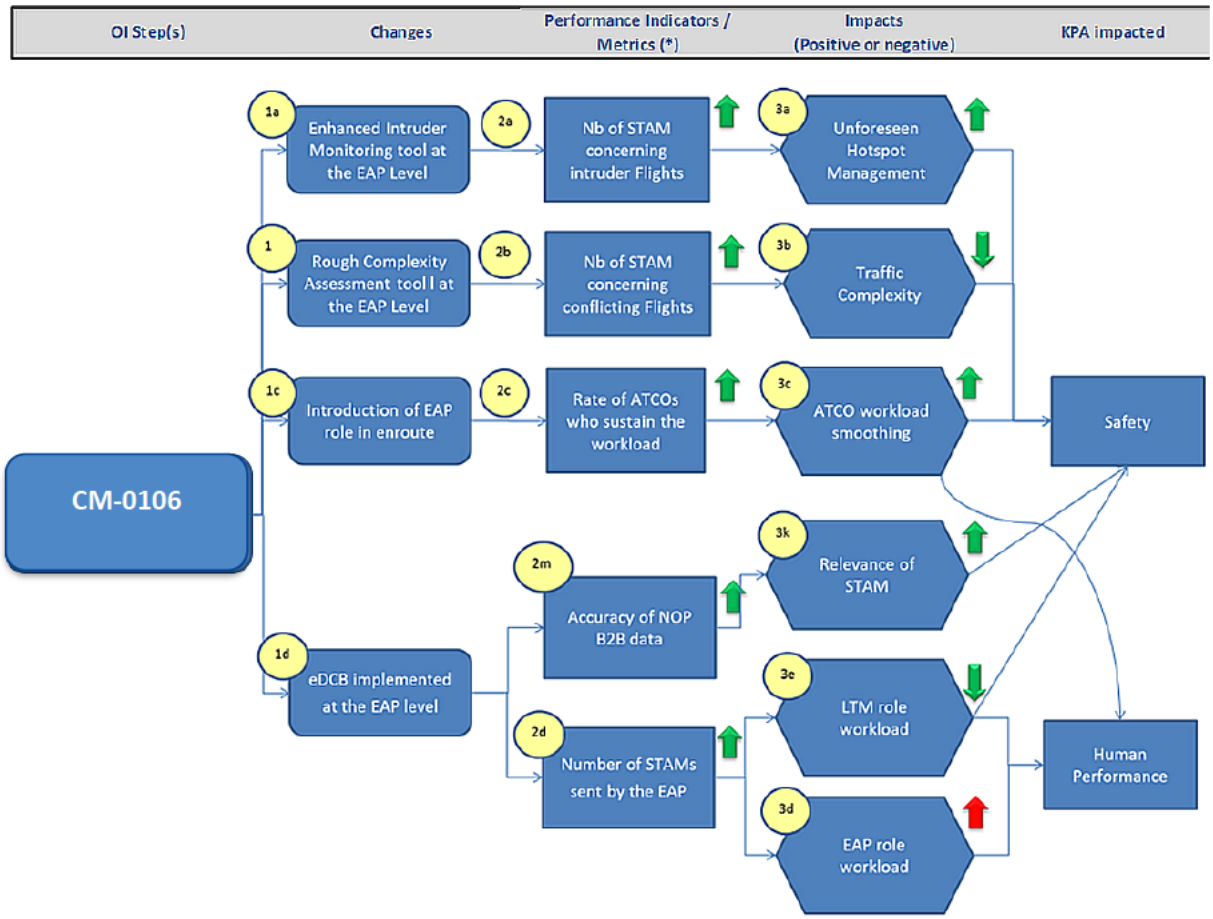

Figure 4: Solution #118 Benefit and Impact Mechanism - Part 1

In respect to **Human Performance**, the following mechanisms apply:

Illustrated on Figure 4:

(1c) The aim of the EAP role in En-Route is to alleviate overloaded ATCOs by transferring flights to a less loaded ATCOs.

(2c) The rate of ATCOs who sustain the workload will then increase.

(3c) The resulting ATC workload will then be smoothed which links to both Safety and **Human Performance.**

(1d) The enhanced local DCB integrates the EAP role to support his tasks

(2d) Thanks to adequate methods, responsibilities and processes, the number of STAMs sent by the EAP will increase

(3d) and **(3e)** Then the LTM workload will decrease while the EAP workload will increase. It is however yet not clear if the sum of their respective workload will be equivalent, LTM decrease compensating the EAP increase.
This links to **Human Performance**.

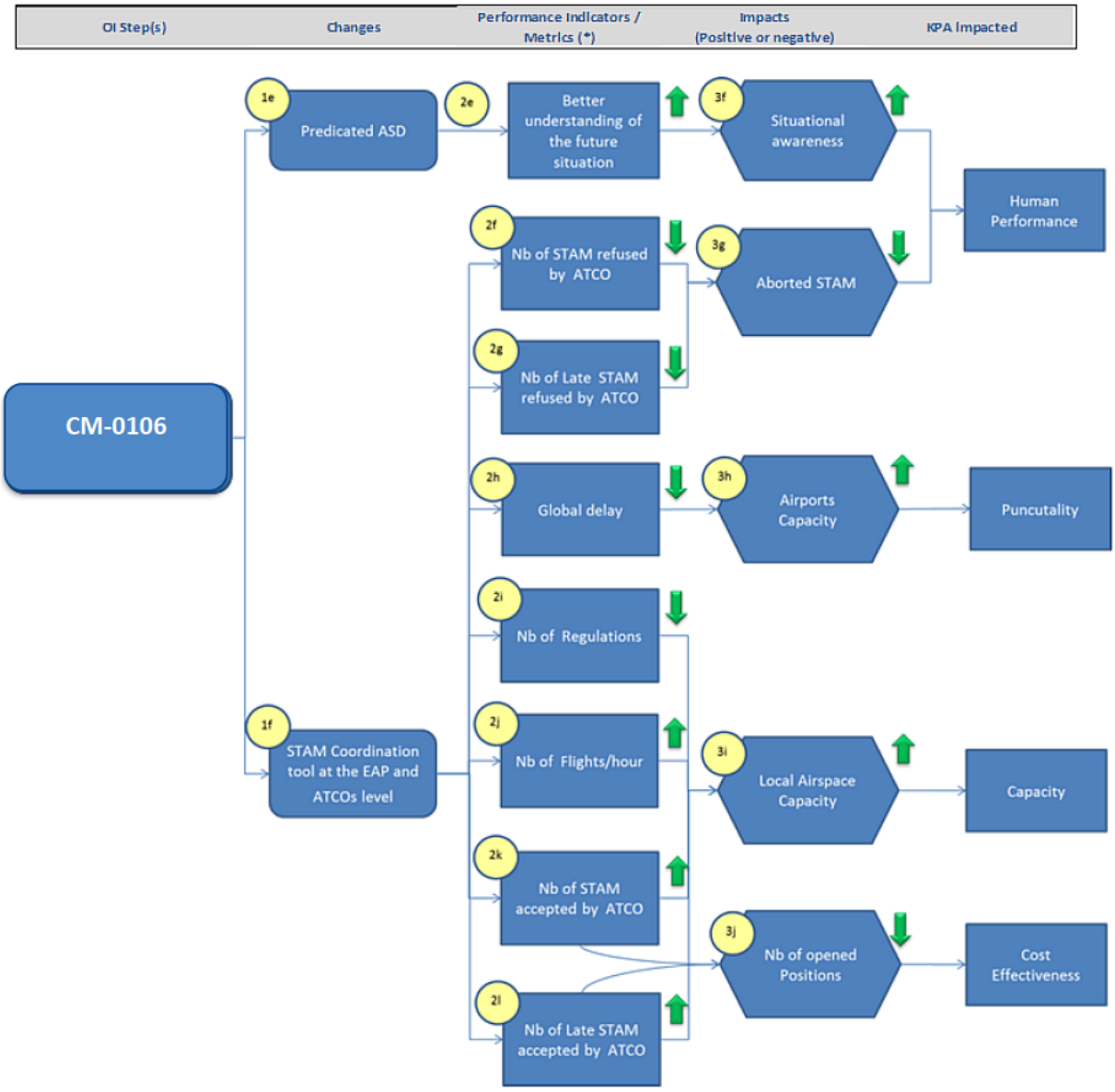

Figure 5: Solution #118 Benefit and Impact Mechanism - Part 2

Illustrated on Figure 5

(1e) The new predicted ASD will allow the EAP to be able to predict all flights' positions in the future based on ETFMS flight plans (FTFM, RTFM or CTFM).

(2e) The EAP will have a better understanding of what will happen in the future, despite the potential uncertainty of the predicted situation.

(3f) This will lead to a better EAP situation awareness reducing then the required time for analysis and so the workload of the EAP which links to **Human Performance**.

(1f) The STAM coordination tool will replace pieces of paper physically brought by the LTM to the CWP. It is a key tool to ease the management of the whole STAM process.

(2f) and **(2g)** The number of standard or late STAM which cannot be implemented by the ATCO will decrease thanks to the coordination tool which will facilitate the STAM negotiation process.

(3g) As a result, the number of aborted STAM due to a lack of coordination will decrease, and then the associated workload to prepare, propose, analyse and reject the STAM will decrease too.
This links to **Human Performance**.

5.1.2 Assessment Data (Exercises and Expectations)

The exercise VP687 has demonstrated that:

- The EAP role contributes to increase controllers' productivity by increasing overall capacity of the UAC;
- The EAP role fits in the **current working method of Air Traffic Controllers**;
- The STAM process maintains **Air Traffic Controllers' workload** to acceptable levels; and that
- The EAP role fits in the **current working method of the LTM.**

The exercise VP687 included the full time involvement of **two Human Factors experts** in charge to observe the execution of the exercises bas follows:

- One HF expert was observing and debriefing with the EAP in real time, whilst
- The second HF expert was observing and debriefing with the ATCOs involved in STAM processes. He was also sometimes in charge to deliver a brief reminder training to the ATCOs about the concept and the CWP tool, before they take their position.

The bEAP concept and its associated tools have generally been well accepted by all participants. This operational acceptance should be put back in the general context of the control room where a better communication between the FMP and the ATCOs is strongly needed. Indeed, sharing information helps ATCOs to understand the rationale behind FMP requests.

In addition, on ATCOs' side, the appealing aspect of the CWP tool might have contributed to the acceptance of the tool. Indeed, the CWP tool was displayed on a touch tablet which and ATCOs were very enthusiastic on this aspect. On another device, the global acceptance might have been lower.

On the EAP side, the acceptance came also from the Air Situation Display (ASD) which allows them to really improve their situation awareness about the traffic complexity.

The method and techniques used during the exercise VP-687 were as follows:

- Observation during the sessions from HF specialists
- Specific questionnaires to the participant controllers & FMPs
- Sessions debriefing
- Data logging and log analysis.

The following metrics have been logged during the experimentations.

Hotspot	Identifier
	Traffic volume
	Start time
	End time
	Flight List with all data in an array
	Deletion time
	Creation time
	Use of the hour sorting function : value of the time frame
	Use of criterions of flights sorting 1, 2 and 3
	Use of the function Update Flight List Hot spot
STAM	Identifier
	Hot spot identifier
	Selected flight id
	Selected flight trajectory
	Cross sectors (Reims sectors)
	Entry/Out time of crossed sectors
	STAM Type
	STAM Value
	Implementing Sector
	Time sending implementing sector
	Time sending back implementing sector at each sending back
	Late STAM?
	off loaded sector
	on loaded sector
	Time sending on loaded sector
	Deletion time
Tablet	STAM Identifier
	Late STAM?
	Display Time
	Answer Time
	Answer value
	No answer

Table 11: Exercise VP-687 – Metrics logged

5.1.3 Aggregation

The exercise VP-687 demonstrated also a positive increase of 2% of the **ATCO productivity** (CEF2.3 Flights per En-route ATCO-Hour) compared to the reference scenario. This KPI which is addressed in the PAR (26) is used to transpose the benefits at network (ECAC wide) level.

The HP benefits assessed in this report have not been quantified, the approach was only qualitative.

5.1.4 Discussion of Assessment Result

N/A

5.1.5 Additional Comments and Notes

N/A

6 References

6.1 Applicable Documents

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[3] B.05 D86 Guidance on KPIs and Data Collection support to SESAR 2020 transition.

[4] B.05 Guidance for Performance Assessment Cycle 2013

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[7] B.04.01 D108 SESAR 2020 Transition Performance Framework

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[40]16.06.02 D131 Security Database Application (CTRL_S)

6.2 Reference Documents

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[42]04.07.08 - D78 - Validation Report VP-687, Edition 00.01.02, 23/03/2016

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[44]SESAR Solution#118 – SPR/INTEROP/OSED V3 - Basic EAP - Part V - PAR- Edition 01.00.01, 15/05/2018

[45]SESAR Solution#118 – Validation Report V3 - Basic Extended ATC Planning – Edition 01.00.01, 15/05/2018

[46]SESAR Solution#118 – CBA V3 - Basic Extended ATC Planning – Edition 01.00.01, 15/05/2018

[47]PRR 2013 - Performance Review Report, An Assessment of Air traffic Management in Europe during the Calendar Year 2013, May 2014

[48]PRR 2014 - Performance Review Report, An Assessment of Air traffic Management in Europe during the Calendar Year 2014, May 2015

[49]PRR 2016 - Performance Review Report, An Assessment of Air traffic Management in Europe during the Calendar Year 2016, Draft final report, April 2017

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