CDM & Sector Team Operations OSED & Requirements - Part 2 SPR

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Abstract

The contractual deliverable D27 of the Project 04.03 – Integrated and pre-operational validation & cross validation covers the OSED, safety, performance and interoperability requirements of the "CDM & Sector Team Operations" quick win. This document represents the part 2 of the D27 and deals with the SPR part. It provides the operational, safety and performance requirements for an En-Route Air Traffic Organizer (ERATO), intended to provide an assistance to air traffic controllers for the detection and resolution of conflicts, and cooperation on a controller working position (CWP).

The initial edition of this document is based upon the common characteristics of the ERATO concept which is currently being developped by the DSNA.

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Executive summary

The contractual deliverable D27 of the Project 04.03 – Integrated and pre-operational validation & cross validation covers

- OSED,
- SPR
- INTEROP

of the “CDM & Sector Team Operations” quick win.

This document represents the part 2 (SPR) of the contractual deliverable D27.

Part 1 covers the OSED.

Interoperability requirements for the CDM & sector team operations quick win have not been identified for the sake of several reasons:

Theses validations are taking place at Brest centre, using the current DSNA legacy platform. The ERATO server is connected with the FDP (Flight Data Processing, called STPV at the DSNA). Thus inherits the interop property of the system it is connected to.

We can sum up in saying, the future INTEROP needs for ERATO will be fully encompassed within the next FDP INTEROP (COFLIGHT, iTEC,……)

CDM and sector team operation project, is focused on the operating work, to observe and confirm the benefit through the way tactical and executive controllers use ERATO tools. Thus, there is no impact on the system INTEROP needs, except what has been explained above, through the exchange of Flight Plan Information for the time being and the Flight Object in the future, including 4D Trajectory data from a/c.

This document provides the operational, safety and performance requirements for an En-Route Air Traffic Organizer (ERATO).

ERATO is a decision aid toolkit for EN-Route air traffic control in an electronic environment that make air traffic control and time management easier. It is composed of four main features (functions):

- Filtering
- Task scheduler
- Extrapolation
- Geographic markers

This toolkit is the French implementation in the legacy platform (CAUTRA) of Medium Term Conflict Detection (MTCD), of monitoring aid and a first step to CORA (Conflict Resolution Assistant) which have been described at European level.

The main expected benefits from ERATO are an improved level of security and an increased capacity on En-Route airspace sectors.

The ERATO toolkit provides assistance upon request to the controllers to detect potential conflicts between flights, to help them plan the resolution of these conflicts in time and to ease the cooperation within controller working position. In any case, the toolkit does not calculate and does not provide strategies for resolving these conflicts. It is the responsibility of air traffic controllers to identify possible solutions and to implement the chosen solution to resolve a given conflict. In this, ERATO is a concept that keeps human in the decision loop.

As part of the EOE (Extended Operational Experiments) planned in West and South/West french ACC in 2011, one of whose objectives is to validate the benefits of the ERATO concept, the toolkit must be integrated into the french legacy platform (CAUTRA).

In the operational environment planned for the introduction of the ERATO concept, there is currently no role for MSP (Multi-Sector Planner) as defined in the document [5], and the Planning Controller responsibility may be extended to several sectors grouped on a same CWP.

This document is based upon the common characteristics of the ERATO concept which is currently being developed by the DSNA.

It is expected this SPR will be updated at the end of the P04.03 project execution phase.

1 Introduction

1.1 Purpose of the document

This document is the Safety Performance Requirement (SPR) for an En-Route Air Traffic Organizer (ERATO) system.

The Safety performance Requirement Document (SPR) provides the operational, safety and performance requirements for operational services and concept elements defined in the OSED (Operational Service and Environment Description [7]).

1.2 Scope

This operational, safety and performance requirements (SPR) document supports the operational services and concept elements identified in the OSED.

This document is based upon the common characteristics of the ERATO concept which is currently being developed by the DSNA.

The traceability of the concept developed in this document to higher level documents such as the En-Route Operations DOD is not made in this initial version because the En-Route Operations DOD from the SWP 04.02 is not yet available.

1.3 Intended audience

1.4 Structure of the document

The structure of this SPR is as follows:

- **Chapter 1** (the present section) provides general information about the document. It includes the reference and applicable documents;
- **Chapter 2** summarizes the operational concept;
- **Chapter 3** lists the operational, safety and performance requirements;
- **Chapter 4** <*To Be Completed*>;
- **Chapter 5** <*To Be Completed*>;

1.5 Background

This section provides information on previous activities in the same domain and thus defined the input to the project. If documents are available, please provide the References. Section may be omitted.

1.6 Glossary of terms

1.7 Acronyms and Terminology

Term	Definition
ATM	Air Traffic Management
E-ATMS	European Air Traffic Management System
IRS	Interface Requirements Specification
INTEROP	Interoperability Requirements

Term	Definition
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SJU Work Programme	The programme which addresses all activities of the SESAR Joint Undertaking Agency.
SESAR Programme	The programme which defines the Research and Development activities and Projects for the SJU.
TS	Technical Specification
TAD	Technical Architecture Description
ADD	Architecture Definition Document
DOD	Detailed Operational Description
OSED	Operational Service and Environment Definition
SPR	Safety and Performance Requirements
CFL	Cleared Flight Level
CWP	Controller Working Position
DSNA	Direction des Services de la Navigation Aérienne
DTI	Direction de la Technique et de l'Innovation (DSNA Technical Services)
E-ATMS	European Air Traffic Management System
EOE	Extended Operational Experiments
ERATO	En-Route Air Traffic Organizer

Term	Explanation
Clearance	Generic term referring all or part of the instructions given by the controller to the flight crew. Clearances examples : ▪ Cleared Flight Level ▪ Direct to ▪ Heading ▪ Speed
Contextual view	For a given flight, the contextual view corresponds to the relevant flights for this flight analysis taking into account their trajectories.
Flight associated to the problem	Flight of the CWP involved in a problem the controller may handle to solve it. The updates on flights proposed in a materialized interaction are considered

Term	Explanation
	as flight associated to the problem.
Flight of the CWP	Flights of the CWP correspond to the planned flights on the CWP and additional flights on the CWP.
GEODE	Part of the CWP fed with flight plan and radar trajectory information…
Problem	A problem materializes a conflict or one or several interactions.
SJU Work Programme	The programme which addresses all activities of the SESAR Joint Undertaking Agency.
SESAR Programme	The programme which defines the Research and Development activities and Projects for the SJU.

2 Summary of Operational Concept (from OSED)

2.1 Description of the Concept Element

ERATO (En-Route Air Traffic Organizer) is a decision aid toolkit for EN-Route air traffic control in an electronic environment. It has as objectives:

- To provide an assistance to air traffic controllers for the detection ans resolution of conflicts
- To facilitate the cooperation on a controller working position (CWP)

ERATO is composed of four main features (functions) that make air traffic control and time management easier:

- Filtering: on controller request, this feature shades flights which are irrelevant to the analysis of the situation. Linked to this feature, a monitoring process continuously checks that the aircrafts are flying according to their flight plan. Based on the knowledge of controllers, this feature increases their ability to detect and solve conflicts but the choice of solutions and the responsibility for decisions are left to them.
- Task scheduler: this feature provides a visual aid to the controllers (with conflict problems displayed as timely tasks to be done). It allows them to schedule the tasks attributed to the CWP, and so to plan their workload and to monitor the situation through time. It is also a support for the cooperation between the planning controller and the executive controller in order to help them to build a common view of the traffic on the CWP.
- Extrapolation: on controller request, this feature extrapolates on the radar image the predicted trajectory known by ERATO for a set of filtered flights (highly interactive view of a filtering allowing a faster graphical analysis of the situation). It provides an aid to diagnose for the controller, to get him ahead of air traffic, and to speed up the building of his mental situation awareness.
- Geographic markers: this feature provides a way for the controller to record a task reminder for a flight at a specific location (point of the flight trajectory in the airspace of the CWP) and a monitoring aid to check for it to be overflown, raising then an alarm on the flight. It frees the controller from the stress related to forgetting something and eases to do the "right task at the right time" (without a substantial mental load consumed for this monitoring).

2.2 Description of Operational Services

- •Operational Processes:
  - Identification of groups of flights sorted according to operational criteria associated to flight trajectories
  - Materialization of conflicts
  - Updates of conflicts representation
  - Monitoring of the evolution of ongoing conflicts to act at the right time
  - Construction and maintenance of a mutual traffic representation on the CWP to ensure efficient cross-checks
  - Shared management of conflicts on the CWP
  - Collaborative management of workload on the CWP
  - Temporization or anticipation of tasks presentation
  - Synchronous and asynchronous communication on the CWP
  - Optimization of memory use
  - Check of the materialization of the detected conflicts
  - Organization of tasks in the frame of conflicts management
  - Differentiation between conflicts taken into account and conflicts not yet handled
  - Differentiation between conflicts taken into account and conflicts not yet handled
  - Decision making on a conflict resolution on the basis of information contained in the flights of the conflicts' contexts
  - Anticipation of clearance consequences on the traffic
  - Task execution control in order to check the actions efficiency or to correct them if needed

  - Understanding and prediction of the system behaviour

- Operational Services:
  - <To Be Completed>

- •Scenarios and Use Cases:
  - Identification of the contextual view for a flight with visualized radar track to detect associated conflicts based on the helping tool providing contextual view
  - Identification of the contextual view for a flight with a modified route and visualized radar track to detect associated conflicts
  - Identification of the best moment to make a flight climb because it can't climb as soon as possible to its cruise flight level due to traffic
  - Conflict materialization based on a flight analysis not resulting from a system proposition
  - Merging of two problems
  - Rescheduling of a problem to be handled taking into account its scheduling
  - Detection by the executive controller of a conflict already materialized by the planning controller
  - Transfer of a problem performed by the executive controller
  - Problem amendment on the basis of its analysis
  - Problem amendment on the basis of a flight analysis
  - Rescheduling of a new materialized interaction
  - Materialization of a reminder on an action to perform based on a flight analysis
  - Rescheduling of a reminder on an action to perform to be handled considering its scheduling
  - Identification of the contextual view for a flight based on the helping tool providing contextual view to anticipate a clearance issue
  - Identification of the contextual view of a flight cleared to a level, with discrepancies between effective aircraft performances and theoretical performances
  - Identification of the contextual view of a flight cleared to a level, with discrepancies between effective speed and theoretical speed (flight with strong tailwind)
  - Management of an incoming flight with a direct to clearance issued by a CWP A towards a waypoint of the CWP B without any preliminary coordination nor direct transmission to CWP B
  - Management of a flight following a heading clearance during several minutes

2.3 Description of Operational Environment

ERATO is the French implementation in the legacy platform (CAUTRA) of Medium Term Conflict Detection (MTCD), of monitoring aid and a first step to CORA (Conflict Resolution Assistant) which have been described at European level.

In order to provide the expected services, the ERATO toolkit must have knowledge of flight plan information, radar trajectory information, and clearances issued by air traffic controllers towards pilots. It must therefore be integrated in an electronic control environment that allows airs traffic controllers to fill the system with changes made to flight plans or clearances given to pilots.

The primary actors impacted by the introduction of the ERATO concept are the Planning and Executive Controllers on En-Route CWP in Air Traffic Services Operations. The airspace users (through the Flight Crew) are receivers of the Operational Service delivered through ERATO.

It is important to highlight that neither their role nor their responsibility nor organisation should be modififed with the introduction of this new concept.

In the operational environment planned for the introduction of the ERATO concept, there is currently no role for MSP (Multi-Sector Planner) as defined in the document [5], and the Planning Controller responsibility may be extended to several sectors grouped on a same CWP.

During 2011 Extended Operational Experiments (EOE)°will be done in both South/West french ACC. The EOE has as one of its targets validate the benefits of ERATO concept.

As part of this development, operational needs and requirements for ERATO have been described by DTI in a specific document (see Ref. [6]).

It is expected that this document will be updated taking into account the results of EOE.

3 Requirements

3.1 Operational Requirements

3.2 Performance Requirements

Id	**EOPS_001**
Requirement	The helping tool providing the contextual view for a given flight shall provide the result in less than 1 second
Title	
Status	
Importance	
Rationale	
Category	
V&V	

[REQ Trace]

Links	Target	Id	C	Link Type
	Requirement	DOD Requirement Identifier	F	SATISFIES
	Project	SESAR Project Number		ALLOCATED TO

Id	**EOPS_002**
Requirement	The helping tool providing the contextual view for a given problem shall provide the result: - in less than 1 second in 95% of cases - in less than 3 seconds in 99% of cases
Title	
Status	
Importance	
Rationale	
Category	
V&V	

[REQ Trace]

Links	Target	Id	C	Link Type
	Requirement	DOD Requirement Identifier	F	SATISFIES
	Project	SESAR Project Number		ALLOCATED TO

Id	**EOPS_003**
Requirement	The visualisation of the trajectories evolution of flights of the contextual view associated to a flight of the CWP or to a problem shall be provided within the order of one second
Title	
Status	
Importance	
Rationale	
Category	
V&V	

[REQ Trace]

Links	Target	Id	C	Link Type
	Requirement	DOD Requirement Identifier	F	SATISFIES
	Project	SESAR Project Number		ALLOCATED TO

Id	**EOPS_004**
Requirement	The helping tool providing the contextual view simulating at this time the issue of a clearance (direct to or CFL) shall provide a result in less than 2 seconds
Title	
Status	
Importance	
Rationale	
Category	
V&V	

[REQ Trace]

Links	Target	Id	C	Link Type
	Requirement	DOD Requirement Identifier	F	SATISFIES
	Project	SESAR Project Number		ALLOCATED TO

3.2.1 Safety

Id	**EOPS_005**
Requirement	The incoherence of the result provided by the helping tool providing the contextual view for a flight of the *CWP* on both GEODE of the CWP, shall last less than: - 1 second in 80% of cases - 3 seconds in 99% of cases
Title	
Status	
Importance	
Rationale	
Category	
V&V	

[REQ Trace]

Links	Target	Id	C	Link Type
	Requirement	DOD Requirement Identifier	F	SATISFIES
	Project	SESAR Project Number		ALLOCATED TO

3.2.2 Security

3.2.3 Environment Sustainability

3.2.4 Cost effectiveness

3.2.5 Capacity

Note that the requirements included in this chapter are applicated to ERATO enviromment. They are extracted from the "legacy platform operational needs". An additional study shall be led to ensure that these requirements comply with SESAR.

Id	**EOPS_006**
Requirement	The system shall be able to process at a given time at least 25 to 30 flights on each CWP.
Title	
Status	
Importance	
Rationale	
Category	
V&V	

[REQ Trace]

Links	Target	Id	C	Link Type
	Requirement	DOD Requirement Identifier	F	SATISFIES
	Project	SESAR Project Number		ALLOCATED TO

Id	**EOPS_007**
Requirement	The system shall be able to process at a given time a number of duplicated flights equal to at least 20% of the CWP traffic.
Title	
Status	
Importance	
Rationale	
Category	
V&V	

[REQ Trace]

Links	Target	Id	C	Link Type
	Requirement	DOD Requirement Identifier	F	SATISFIES
	Project	SESAR Project Number		ALLOCATED TO

Id	**EOPS_008**
Requirement	The system shall be able to process at a given time at least 10 assumed flights on the CWP.
Title	
Status	
Importance	
Rationale	
Category	
V&V	

[REQ Trace]

Links	Target	Id	C	Link Type
	Requirement	DOD Requirement Identifier	F	SATISFIES
	Project	SESAR Project Number		ALLOCATED TO

3.2.6 Efficiency

3.2.7 Flexibility

3.2.8 Predictability

3.2.9 Access and Equity

3.2.10Participation

3.2.11Interoperability

3.3 Non-functional Requirements

3.3.1 Reliability

3.3.2 Availability

3.3.3 Maintenance

3.3.4 Human Acceptability

Id	**EOPS_009**
Requirement	The controller shall be able to follow his other control tasks during the determination of the contextual view of a given flight
Title	
Status	
Importance	
Rationale	The determination of the contextual view of a given flight is a task performed in parallel with other control tasks (as frequency management, coordination, …). In consequence, it should not prevent the controller from performing his tasks
Category	
V&V	

[REQ Trace]

Links	Target	Id	C	Link Type
	Requirement	DOD Requirement Identifier	F	SATISFIES
	Project	SESAR Project Number		ALLOCATED TO

Id	**EOPS_010**
Requirement	The controller shall keep control over all control tasks, even when using helping tools, through the use of a set of relevant information.
Title	
Status	
Importance	
Rationale	Human has to be always in the decision loop. It is the responsibility of air traffic controllers to identify possible solutions and to implement the chosen solution to resolve a given conflict. Relevant information corresponds to the one fullfilling controller analysis and action logics. It also provides useful information regarding system behaviour.
Category	
V&V	

[REQ Trace]

Links	Target	Id	C	Link Type
	Requirement	DOD Requirement Identifier	F	SATISFIES
	Project	SESAR Project Number		ALLOCATED TO

4 Traceability matrix

TBC in the next version.

5 References and Applicable Documents

5.1 Applicable Documents

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

[1] SESAR SEMP 2.0
[2] Template Toolbox 02.00.00
[3] Requirements and V&V Guidelines 02.00.00
[4] Toolbox User Manual 02.00.00

5.2 Reference Documents

The following documents were used to provide input / guidance / further information / other:

[5] SESAR B4.2 Actors - Roles and Responsibilities, Ed. 00.01.02, dated 12/09/2010
[6] ERATO Consolidation des besoins ERATO, version V0R6, dated 07/01/2011
[7] SESAR OSED_ERATO V1R0, dated 21/02/2011

Appendix A Assessment / Justifications

A.1Safety and Performance Assessments

The experimentation that are lead on ERATO are followed and agreed by the DSAC (the French National Safety Authority). The live trial experimentation are conducted under their authorization.

A.1.1 Safety assessment

Summary of the OSA

A document called : Etude DEL-Prise en compte des OSDC (Document OSIC) V2R1 was published the 15th of October 2010.

It dispatched the security objectives between the three main components of the system.

Summary of the OHA

A preliminary document was issued the 24th of December 2008 “Liste des événements redouté et des objectifs de sécurité” the work done during the experimentation will contribute to validate this document

This information should contribute to justify the definition and allocation of Safety related requirements.

Summary of the ASOR

The Allocation of Safety Objectives and Requirements (ASOR) will be finalised after the experimentation.

A.1.2Security risk assessment

Not relevant.

A.1.3 Environment impact assessment

Not relevant.

A.1.4 OPA

Some operational Performance assessment has been made. It figures in the document : “Exigences opérationelles sur les performances systèmes » V1R0 issued the 2nd of december 2008.

- **END OF DOCUMENT -**