Step 1 final Technical Specification

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Abstract

This document is the Technical Specification for a sub-system inside the Local Traffic Complexity Management Functional Block. It addresses the sub-system required to ensure the support at local/sub-regional level of complexity assessment processes. The sub-system will provide basic assessment features through what-if functionalities and sector optimization to support the user on the resolution of imbalance air traffic situations.
This technical specification is under the OFA05.03.04 Enhanced ATFCM processes.
It is based upon operational requirements and contains technical requirements specifying this system. The operational requirements are derived from P04.07.01 Step1 V3 Interim Complexity Management OSED, deliverable D62.
This is the first "Final TS" document for the generic "Complexity Assessment and Resolution Sub-System" and the requirements will be consolidated in the Final TS document with the information obtained during the validation process (EXE 10.08.01-VP-005).

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8 Intellectual Property Rights (foreground)

9 This deliverable consists of SJU foreground.

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Executive summary

This document establishes the Technical Specification (TS) describing the requirements related to the implementation of the “Complexity Assessment and Resolution” system in Step 1 V3 associated with Local Traffic Complexity Management Functional Block. It is defined in the context of Step 1 V3 of the SESAR Validation and Verification (V&V) Storyboard.

The prototype requirements defined in this document are compliant with the operational requirements related with Complexity Prediction, What-if Trajectory and What-if Sectorization defined in the P04.07.01 OSED [8], SPR [9] and INTEROP [10] documents. These requirements will be consolidated with the information provided by the P04.07.01 after the validation process (EXE 10.08.01 VP-005).

The main function provided by the Complexity Assessment and Resolution system is to support assessment of air traffic complexity and to support user decision making about what-if trajectory functionalities and operational sectorization proposing an optimal sector configuration in a local/ sub-regional scope.

The assessment support is achieved by complexity analysis performed by using three different approaches and the proposal of optimal sector configuration. The functionality is realized by the sub-system as an element of the whole functional block.

The complexity analysis functionality is performed by means of different approaches. Complexity calculation approaches are defined in the section 2.2.10 of the P4.7.1 OSED document [8].

Concerning the management of the trajectory prediction data, two approaches are addressed.

- FTS approach: Based on the trajectory prediction processed by Fast Time Simulation.
- Approach based directly on the trajectory prediction.

Regarding workload computation two approaches are implemented:

- Cognitive approach
- Algorithmic approach (Lyapunov and/or deterministic algorithms)

Other main goal of the project is the comparison and validation of the different approaches for the complexity analysis.

The support to the user decision making in overloaded air traffic situations is provided by means of what-if trajectory, what-if sectorization functionalities and optimal sectorization proposals.

1 Introduction

1.1 Purpose of the document

This document describes the technical requirements of the sub-system to be developed for the Complexity Assessment and Resolution system.

This information will serve for the design and development of a prototype to be verified by P10.08.01 and validated by P04.07.01 (Complexity Management in En Route) in the context of Step 1 SESAR V&V Roadmap (Data Set (DS) 14) [14].

These requirements describe functional and capabilities specifications covering performance, safe/security and reliability characteristics under which the prototype has to perform.

The relations between this technical specification documents with regards to the other SESAR deliverables are illustrated in *Figure 1*.

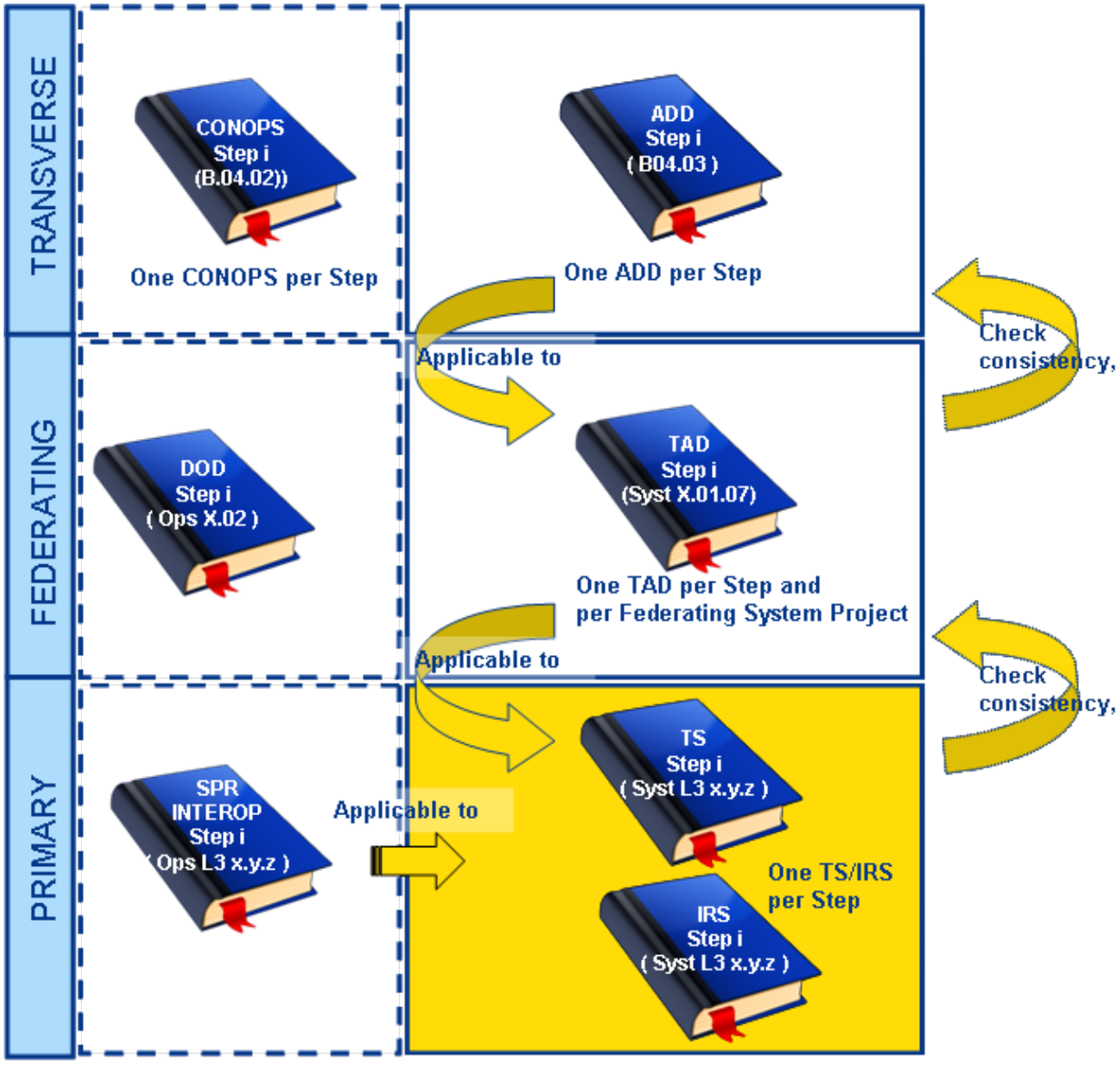

Figure 1: TS document with regards to the other SESAR deliverables

1.2 Intended readership

This document is intended for the following audience:

- Operational project P04.07.01 (Complexity Management in En Route) as the source of the operational requirements.
- Project 13.02.03 for using air traffic complexity information during the DCB process.
- WPB4.3 as the SESAR Technical Architect.
- OFA 05.03.04 as activity coordinator.
- P10.01.07 (ATC System specification) for maintaining the functional block and to contribute to the definition of the architecture.

1.3 Inputs from other projects

Project 04.07.01 is identified as the source of operational requirements related to Complexity Assessment and Resolution in which the technical requirements are based.

Project 10.01.07 D115 TAD Technical Architecture Description [7] will be the input to allocate prototype requirements in the corresponding functional Block (Local Traffic Complexity Management (LTCM).

1.4 Structure of the document

This document has the following structure based in the SJU TS template [11]:

Chapter 1: Introduction.

Chapter 2: General Functional Block Description

Chapter 3: Functional Block Functional and non-Functional Requirements

Chapter 4: Assumptions

Chapter 5: Referenced documents

1.5 Requirements Definitions – General Guidance

Requirements have been developed according to the SESAR Requirements and V&V Guidelines [2].

In order to facilitate importing of the requirements in a DOORS data base it has been used the toolbox delivered by the IS that provides the following layout described in [3].

The layout is illustrated below:

[REQ]

Identifier	
Requirement	
Title	
Status	
Rationale	
Category	
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<Enabler>	Enabler code	<Full>
<SATISFIES>	<ATMS Requirement>	INTEROP or SPR Requirement Identifier	<Full>
<ALLOCATED_TO>	<Functional block>	Functional block Identifier	N/A
<APPLIES_TO>	<Operational Focus Area>	Operational Focus Area Identifier	N/A
<CHANGED_BECAUSE_OF>	<Change Order>	Change reference	N/A
<ALLOCATED_TO>	<Project>	Project Identifier	N/A

Table 1: Requirements layout

The requirement Identifier follows the structure proposed by the SJU Guidelines, therefore having the following structure:

<Object type>-<Project code>-<Document code>-<Reference number 1>.<Reference number 2>

The four digits (abcd) of the <Reference number 1> field are structured inside this project as follows:

a (first digit) represents the Step.

b (second digit) represents the requirement type – according to the SJU TS template sections - (1 for functional/capability requirement, 2 for adaptability requirements, 3 for performance requirements, 4 for safety & security requirements, 5 for maintainability requirements, 6 for reliability requirements, 7 for component internal data requirements, 8 for design and construction requirements and 9 for component interface requirements).

c (third digit) represents the subtype requirement when needed. If there are no subtypes requirements it will be set to 0.

d (fourth digit) is to be used freely. In this case of Complexity assessment this digit will be always set to 0 or it would be used to complement the <Reference number 2> field.

This structure will prevent having duplicated identifiers in the different P10.08.01 project Steps.

1.6 Functional block Purpose

Local Traffic Complexity Management Functional Block purpose is to support the user in the assessment of air traffic complexity.
FB provides the user a foreseen view of the air traffic situation, using workload and complexity indicators values along the specified time horizon.
This FB enables the user to know beforehand imbalanced and overloaded air traffic situations, and helps on selecting needed measures to adapt the ATC capacity and the foreseen demand. It supports the user on assessing the impact of the selected measures by means of what-if functionalities.
Moreover it provides the user with a sectorization optimizer to propose optimal airspace sector configurations based on defined constraints and criteria to balance the ATC capacity with the foreseen traffic demand.

1.7 Functional block Overview

The Local Traffic Complexity Management Functional Block (LTCM) is described in “10.01.07 Technical Architecture Description” [7] as a part of the global ER/APP ATC System.
The following picture provides a context for LTCM in the whole ER/APP System functional breakdown:

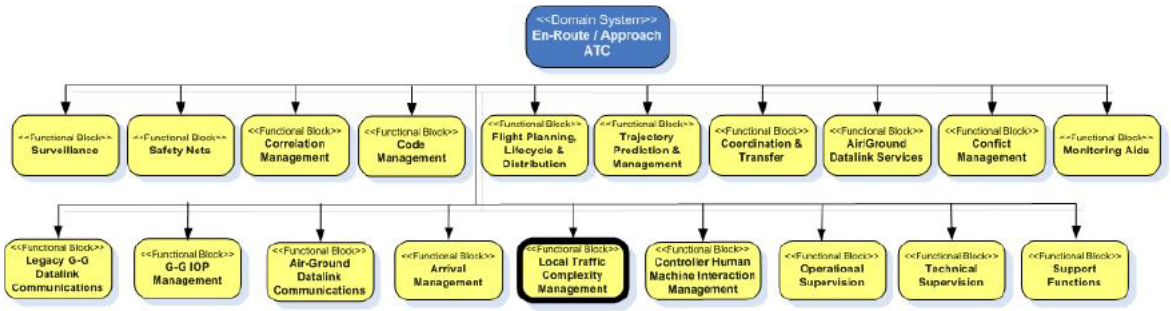

Figure 2: ER/APP ATC System Functional Breakdown

Local Traffic Complexity Management Functional Block calculates traffic complexity within predefined airspace volumes and derives the constituent factors contributing to complexity to facilitate the identification of measures that could be taken to adjust either traffic flows or the airspace sectorization to optimise the efficiency of the ATC/ATM services of En-route/Approach ATC Centres in high traffic density airspace.

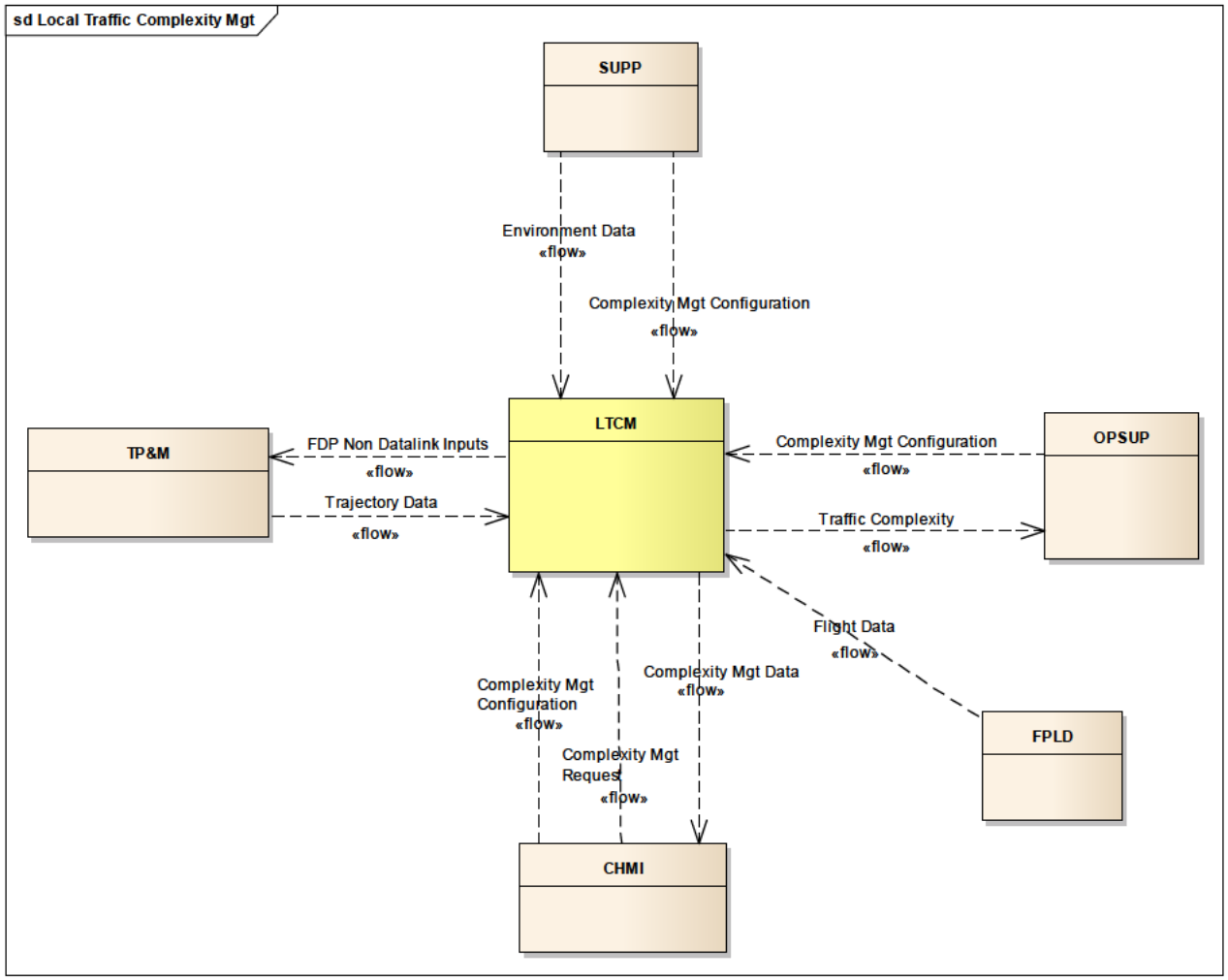

Figure 3: Local Traffic Complexity Management Functional Block

For further information about related functional blocks and their respective relations with technical blocks and connectivity capabilities, see “10.01.07 Technical Architecture Description” [7].

1.8 Glossary of terms

The terms described below will be used along the document:

- Additional complexity indicators:
  - Entry Rate – Number of flights entering the sector during a certain time period (calculation window)
  - Occupancy – Number of flights simultaneous within the sector in a certain time period (calculation window)
- Aircraft workload contribution: amount of workload that is subtracted from the total workload estimation/calculation when an aircraft is removed from the estimation/calculation. It is used to identify and understand the individual contribution of each aircraft to the overall workload.
- Calculation Window: Time interval considered for the calculation of figures per each complexity indicator.
- Cognitive Channels: are considered within the multiple resources model as the perceptual, cognitive or motor resources available to develop the actions.
- Control event: Actuation that an ATCO performs on traffic in the sector under his control.

- Estimation quality: it determines the reliability of the workload estimated according to a time horizon. It depends on two factors: Information quality and the quality of the Workload calculation method.
- Granularity: Sliding window size of the complexity figures calculations, i. e. Time interval between two complexity figures in the WL, Occupancy or Entry Rate Matrixes.
- Information quality: it determines the reliability of the information; that is, the probability that the trajectories of flights do not change.
- Time Horizon: Time interval considered for prediction per complexity indicator. The time frame envisaged is between 5 minutes and 3 hours.
- What-if: functionality that allows testing different options to resolve potential overload situations with the purpose of exploring their impact.
- Workload factors: parameters that have a sizable impact on the system like other additional complexity indicators as well as other complementary information related to the number of aircrafts, trajectories, volumes, sector configuration, distribution of the traffic and conflicts.
- INAP: This process plans and organises air traffic within an area of operation (sector family) such that situations of excessive complexity and air traffic controller workload can be avoided.
- Sector family: represents a group of adjoining airspace blocks that are treated as a single ATM airspace entity for the purposes of the INAP process.
- Workload matrixes: Set of WL estimations calculated on a specific time horizon for every Sector that composes the part of the airspace being assessed.

1.9 Acronyms and Terminology

Term	Definition
ADD	Architecture Definition Document
ATM	Air Traffic Management

Term	Definition
CAR	Complexity Assessment and Resolution
CHMI	Controller Human Machine Interface Management (Functional Block)
DB	Data Base
DOD	Detailed Operational Description
E-ATMS	European Air Traffic Management System
EAP	Extended ATC Planner
EFD	ETFMS Flight Data
ETFMS	Enhanced Tactical Flow Management System
HMI	Human Machine Interface
INAP	Integrated Network management function / Atc planning Process
FD	Flight Data
FDP	Flight Data Processor
FPLD	Flight Plan- Life Management – Data Distribution (Functional Block)
FTS	Fast Time Simulator
IRS	Interface Requirements Specification
INTEROP	Interoperability Requirements
LTCM	Local Traffic Complexity Management
LTM	Local Traffic Manager
MSA	Multi Sector Area
MSP	Multi Sector Planner
NMF	Network Management Function
OPSUP	Operational Supervision (Functional Block)
OSED	Operational Service and Environment Definition
PC	Planning Controller
RLI	Recording and Logging Infrastructure
SESAR	Single European Sky ATM Research Programme

Term	Definition
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.
SPR	Safety and Performance Requirements
SUPP	Support Functions (Functional Block)
TAD	Technical Architecture Description
TP&M	Trajectory Prediction & Management (Functional Block)
TS	Technical Specification
TSA	Temporary Segregated Area
WL	Workload

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237 Table 2: Acronyms table

2 General Functional block Description

2.1 Context

This document is the Technical Specification (TS) for SESAR Step1 LTCM defined in 10.01.07 Step 1 TAD [7].

The sub-system aims to support ATCOs in identification of complex air traffic situations and the evaluation of measures to de-conflict and reduce the complexity. It supports the user in keeping the declared ATC capacity and foreseen traffic demand balanced during the defined time horizon.

Main objectives of the sub-system described in this TS are the following:

- Traffic complexity assessment.
- To support the user in solving imbalanced situation by means of:
    - What-if sectorization (alternatives generation).
    - Sector configuration optimization.
    - What-if Trajectories assessment.

Although it is not an explicit function in the functional block, the sub-system defined in this TS adds the following functionality that will be described in the corresponding sections:

- Traffic complexity measurement:

  Complexity calculation based on real data.
- Predicted and measured complexity comparison:

  This function allows the user to adjust the complexity calculation algorithms and to increase the user confidence on the prediction tool.

Functionally speaking, the system described in this Technical Specification introduces the following functionalities in relation to the baseline systems:

- New complexity prediction calculation based on cognitive approach, augmented algorithmic and fast simulation former complexity calculators.
- Prediction time horizon increased to 180 minutes.
- Added information about flights of each sector in the flight list window.
- New information about contribution of each flight to the traffic complexity in each sector during a specified time interval.
- Complexity assessment for real situation based on recorded data during the operation.
- Comparison between the predicted and measured complexity.
- Sectorization optimization based on the new prediction calculations.
- What-if functionalities based on flight trajectories.
- Predefined sets of trajectory what-if actions.

2.2 Functional block Modes and States

In order to tackle the complexity assessment of traffic situation and to support the user to solve imbalance traffic situations the sub-system can be used in different modes depending on the functionality provided to the user. The system aims just to support the user decision making process therefore the system proposal will not be implemented in the real operational traffic situation.

The sub-system can work in three main modes depending on the information used for the computations and the results displayed on the HMI to the user:

The following diagram shows the basic modes of the sub-system defined in this TS:

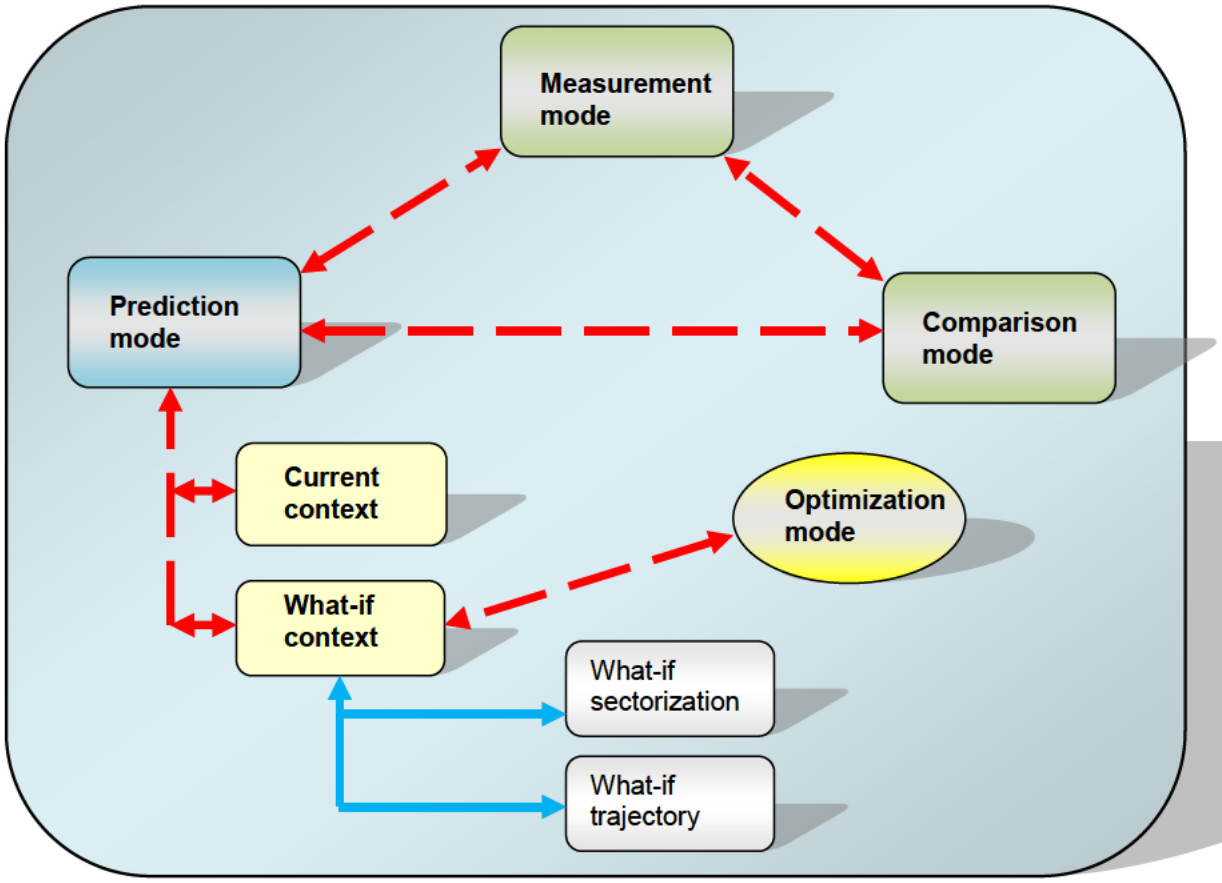

Figure 4: Functional block modes

Prediction mode (Complexity Assessment)

The sub-system predicts air traffic complexity within a look-ahead time horizon. It shows to the user the workload matrixes and additional complexity indicators (i.e. occupancy and entry rate) in the current sectorization plan and it provides several what-if functionalities.

The sub-system can be used in two main sub-modes:

- Current context sub-mode.
- What-if context sub-mode.

Current context sub-mode:

- The sub-system in current context sub-mode displays the traffic complexity prediction based on the current operational sector configuration and the real flights. The information is displayed in a dedicated window and it represents the sector configuration plan to be followed.
- This mode provides the real picture of the air traffic to the user and it is synchronized with the following information from the operational environment:
  - flight plan updates for real flights.
  - sectorization changes.
- This mode is always active and cannot be cancelled so the user is always aware of the real traffic situation.

What-if context sub-mode:

- The sub-system allows the user to generate alternate strategies like different airspace configurations or sectorizations and evaluate the calculated traffic complexity.
- The sub-system creates specific windows for each what-if situation where the user can propose sector configurations. The sub-system calculates the traffic complexity of each what-if situation and the results can be evaluated by the user.
- What-if windows can be closed when the user considers that the what-if situation is not needed anymore.
- Sector configuration proposal on this mode should be limited to the standard sectorizations available in the sub-system that have been validated by the operational expert for the specific ATC environment.
- Trajectory proposals on this mode has been agreed to be limited to the most used in real situations i.e level capping, rerouting and ground delay.
- The system will provide predefined what-if actions on trajectory to solve imbalance air traffic situations based on well known solutions validated in the past.

Measurement complexity mode

The objective of this mode is post operational computation of the traffic complexity based of real flight data recorded during real operations.

To compute the traffic complexity is based in the same type of approach of the prediction mode (i,e. algorithmic and cognitive approaches) so that the results can be compared with the predicted traffic complexity.

Input data in this mode are the recorded real trajectories flown, flight plans and actions implemented by controllers on them, therefore the calculated traffic complexity is a measurement of the real situation of air traffic flown.

Traffic complexity measure is displayed in a similar way to predicted traffic complexity so that they can be easily be evaluated by operational experts.

Assessment and Measurement Complexity Comparison mode

The goal of the sub-system is to provide a clear way to compare the results of the Predicted and Measurement complexity calculations.

The sub-system recovers the stored predicted and measured complexity values calculated for a specific time period and sectorization plan and it displays the comparison of those values so that the user can evaluate the prediction tool accuracy.

The comparison mode results address two main objectives:

- To adjust the algorithms and configuration parameters used during the prediction phase in order to improve the accuracy of the prediction methods.

- The user will increase the confidence on the prediction tool as it produces more realistic values for the traffic complexity predictions.

Sectorization optimization mode

The sub-system in this mode supports the user on solving imbalanced traffic situations.

The sector optimizer provides a set of solutions, i.e. the scheduling of sector configurations from the current time up to a time horizon, according to a set of constraints that best fit predefined criteria (cost functions).

2.3 Major Functional block Capabilities

The sub-system relies on a set of functionalities (capabilities) to achieve the objectives of the functional block, e.g. Traffic complexity assessment and to support the user to solve imbalanced situation between air traffic demand and capability on ATC environment.
The following diagram illustrates the functionalities of the sub-system to perform the objectives of the functional block:

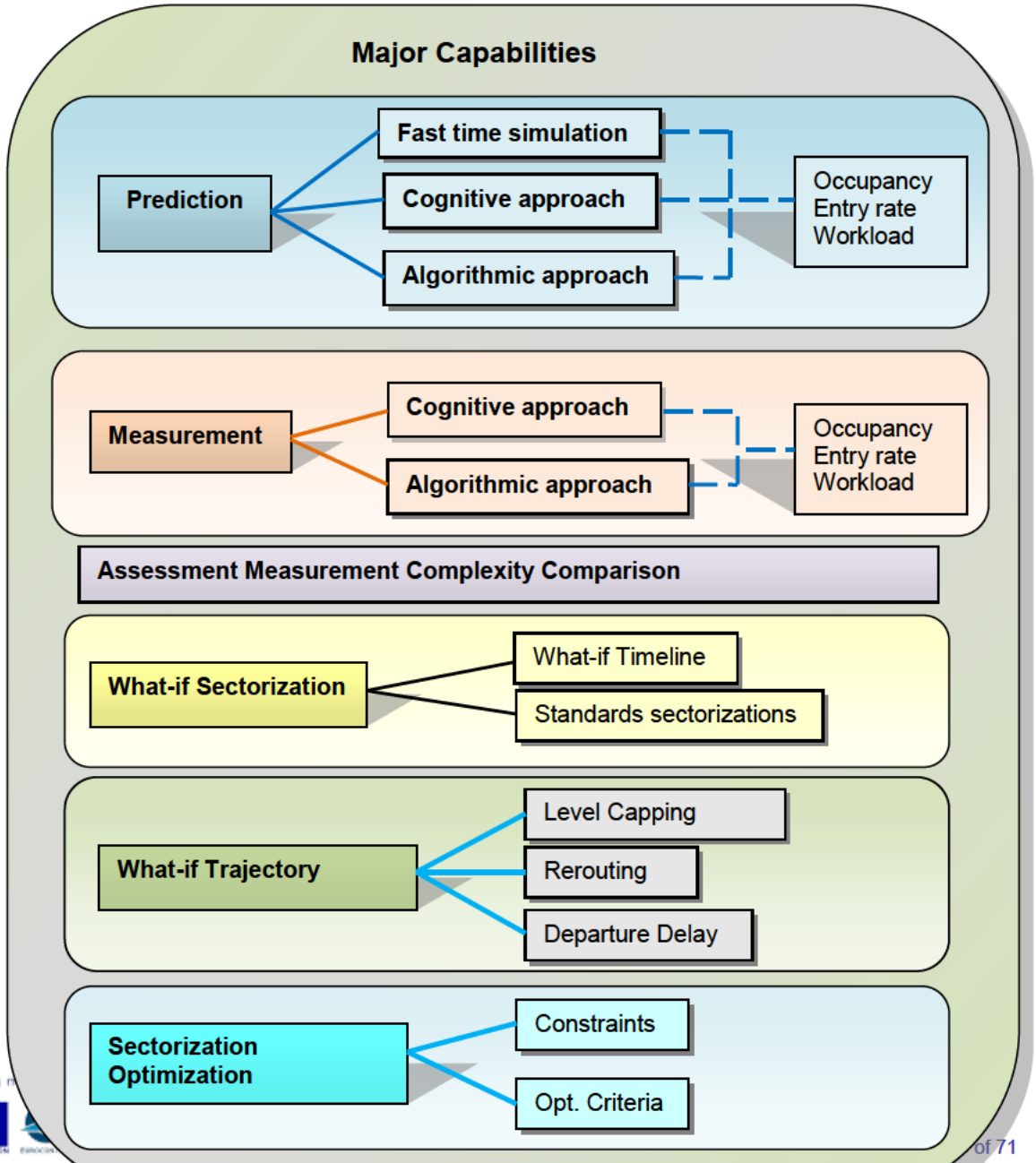

Figure 5: Major Functional Block Capabilities

A brief description of the functionalities of the figure is following:

1.- Prediction:

The sub-system predicts traffic complexity based on the following capabilities:

- The sub-system calculates air traffic complexity based on the flight plans information.
- The sub-system calculates the contribution of each flight to the traffic complexity and shows it to the user.
- Three approaches could be used to calculate the complexity:
    - Based on trajectory prediction processed by Fast time simulation.
    - Based directly on the trajectory prediction using two approaches:
        - Algorithmic approach (Deterministic and/or Lyapunov algorithms).
        - Cognitive channels approach.
- Three types on complexity indicator can be used to compute the traffic complexity:
    - Occupancy: This is the number of aircraft in the sector.
    - Entry rate: This is the number of aircraft predicted to enter the sector within the next hour.
    - Workload: This is the workload for an operational sector.

2.- Measurement of traffic complexity:

The sub-system uses the same complexity calculation methods as in the prediction functionality but the input data are the real flight flown, flight plans and commands performed by the controller during the operation.
This functionality provides a measurement of the real traffic complexity produced during time interval defined by the user.

3.- Assessment and measurement complexity comparison:

Based on the predicted complexity values and the measured complexity values recorded during the specific time interval defined by the user, the sub-system calculates differences between the traffic complexity using predicted data and real data.

This function is provided as a “post-analysis data” functionality.

4.- What-if sectorization:

This function allows the user to modify/propose the sector configuration (what-if sectorization) and the sub-system will compute the traffic complexity related to the new air traffic situation.

5.- What-if trajectory:

This function allows the user to modify/propose the trajectory of any what-if flight and the sub-system will compute the traffic complexity related to the new what-if air traffic situation.

The three different aspects of the what-if flight trajectory that will be proposed by the user by means of this functionality are the following:

- Level capping.
- Rerouting.
- Departure delay.

5.- Sectorization optimization:

This functionality supports the user on finding the optimal sectorization to solve imbalanced traffic situations.

It uses an optimization algorithm to propose a set of ranged solutions to the user to evaluate and decide the implementation of the selected solution.

2.4 User Characteristics

The user of the prototype is involved on the complexity assessment as part of the INAP global process.
INAP is performed within a sector family and links the Network Management Function with ATC planning.

The INAP process includes the following sub-processes/activities:

- Monitor and manage workload distribution within a sector family.
    - Implement DCB measures taken within the scope of sector family.
    - Monitor the execution of the measures and the situation at the sector family level.
- Perform early conflict detection and resolution (the implementation of the resolution might be shared with the control sector).
- Integrate NMF measures, traffic synchronisation and strategic conflict management measures.

The primary concern of INAP is to make sure that the planned ATC centre and sector resource arrangements match the expected air traffic load and complexity. The intention of INAP is to ensure that the complexity of the future air traffic situations in any sector within the Sector Family allows resolution of aircraft conflicts to be found at an acceptable level of controller workload and within acceptable limits of individual RBT modifications.

To achieve this, clear and beneficial procedures to cover the integration of Network Management Function and ATC planning in INAP have to be established.

These sub-processes/activities are shared by roles known today as: Local Traffic Management role, Complexity Management, eExtended ATC Planner role… Nevertheless, further coordinated work between WPB 04.02 / SWP 07.02 and SWP 04.02 is needed on role(s) related to INAP, which could result in a new role distribution, or a new task sharing between the existing roles.

- Planning Controller (PC) will assume the role of pre-tactical de-confliction of trajectories by utilising automated support planning tools to review Reference Business Trajectories.
- Local Traffic Manager (LTM) will be responsible for keeping the complexity of the traffic within a large area with multiple ATC sectors (ATC Centre) to a level which is manageable by Air Traffic Controllers. His principal tasks are to monitor the level of traffic complexity, forecast

traffic patterns, assure the provision of information on upcoming congestion, initiate CDM processes to find solutions to reduce traffic complexity when needed and verify the applicability of proposed solutions of airspace users etc.

- Extended ATC Planner (EAP) is responsible for ATC planning task within his area of operation Multi Sector Area (MSA) comprising of two or more of the present control sectors. His principal task is, with automated support, to check the planned trajectory of aircraft within his area of responsibility for potential separation risk, and co-ordinate entry/exit conditions with adjacent MSPs/PCs leading to conflict free trajectories.
- ACC Supervisor is responsible for planning ATCO resources in cooperation with LTM.

2.5 Operational Scenarios

The sub-system described in this TS document will perform the Complexity Assessment and Resolution (CAR) as part of the operational scenario “OS-4-02 Complexity Management in En Route” defined in [12] and specifically described in the Operational Scenario 1 defined in [8].

This scenario describes actions taken within an ACC to manage complexity through the deployment of pre-determined ATC Sector Configurations and specific measures to modify trajectories. It takes place in a busy ATC environment during a period of high traffic demand. The Complexity is assessed through a complexity management tool between 15 to 180 minutes before sector entry. Depending upon the prevailing circumstances (ACC specific or local requirements, staffing, traffic situation, time etc) the individual or team managing the complexity could differ. The Scenario indicates, in broad terms, a sequence of actions taken to reduce a predicted period of high complexity within a sector.

2.6 Functional

2.6.1 Functional decomposition

The main functionalities of the sub-system as it was described in the section 2.3 are to perform the calculation of complexity air traffic situation and to support the user to balance the traffic demand and the ATC available capacity.

Different approaches are used to calculate the air traffic complexity and, as an additional functionality, the sub-system tackles with the post-analysis and comparison of the predicted traffic and the real traffic in order to assess the accuracy of the complexity calculation approaches.

The sub-system functions are directly related with the modes described in the section 2.2 in such a way that the functional decomposition will show the same structure as the modes the sub-system works.

The sub-system functional decomposition is shown in the following picture:

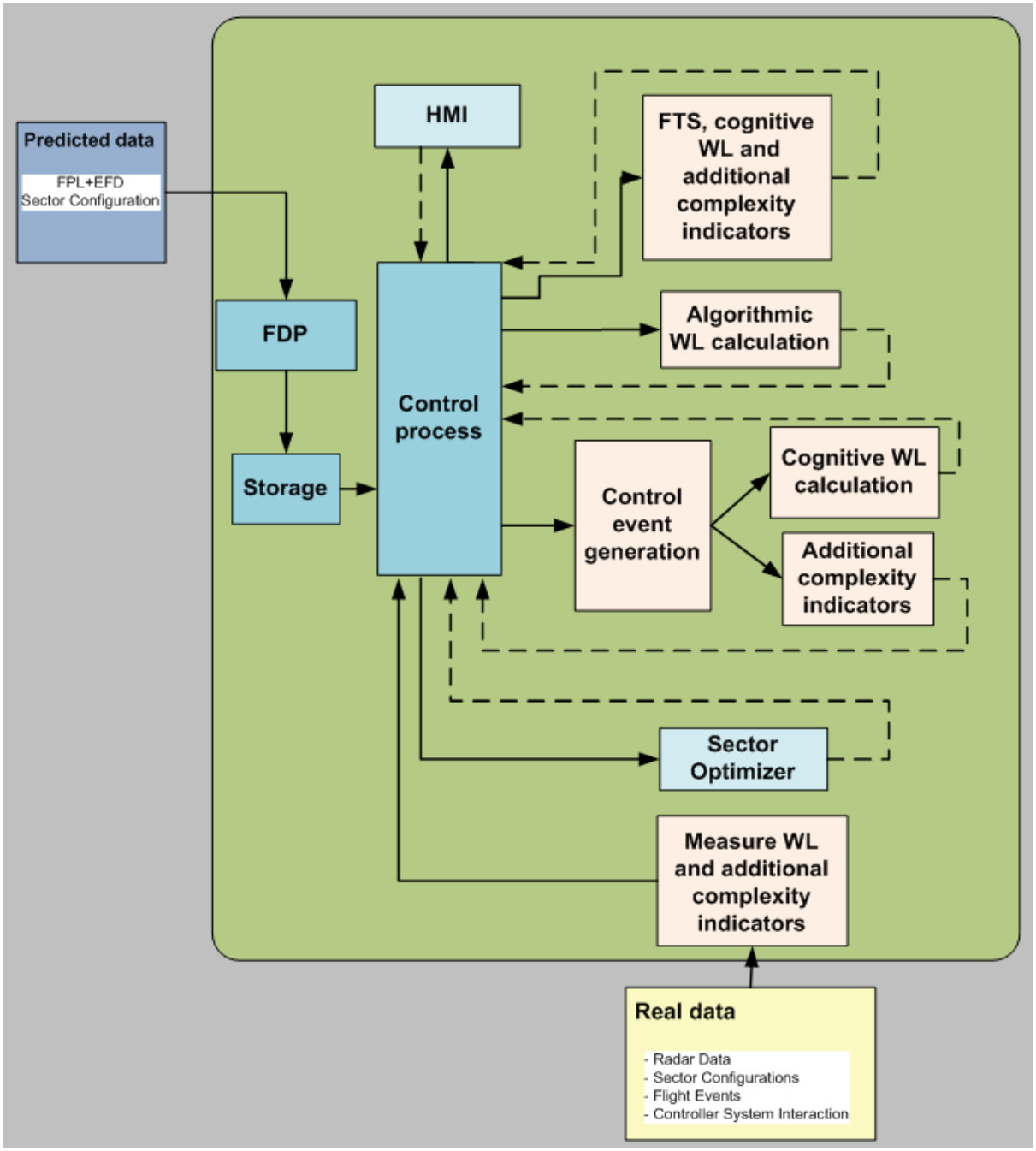

Figure 6: Functional decomposition.

Those functions can be grouped depending on the main functionalities as it is described below:

Prediction functionality (Complexity Assessment):

The sub-system calculates the traffic complexity based on prediction traffic information by means of the following functions:

- Control process: To control the global process and the data interchange between modules.
- FDP: To process and filter the information of flight plans and EFDs received from the external system.

- Storage: To store all the relevant information, e.g. flight plans, predicted workload matrixes, real flight data, etc.
- Control event generation: Based on flight data generates the control events for the Cognitive and WL factor calculations.
- Additional complexity indicators calculation: To compute the traffic complexity based on the occupancy and entry rate complexity indicators.
- Cognitive WL calculation: To compute the traffic complexity based the cognitive channels approach.
- Algorithmic WL calculation: To compute the traffic complexity based the algorithmic approach.
- FTS, cognitive WL calculation and additional complexity indicators: To compute the traffic complexity based on fast time simulation and cognitive approach.
- HMI: To display the results of the prediction processes and manage the user inputs.

What-if sectorization functionality:

As part of the prediction mode the sub-system allows the user to generate what-if sectorization proposals and to assess the traffic complexity of those proposals.

The functions involved specifically in the what-if sectorization are:

- Control process: To control the global process and the data interchange between modules.
- FDP: To process the information of the flight plans and the what-if sectorizations generated by the user.
- Storage: To deliver the predefined standard sector configurations and the flight plans information.
- HMI: It allows the user to generate proposals of what-if sector configuration by changing the sectorization time line or by selecting any available standard sector configuration. Moreover the HMI displays the traffic complexity calculated for those what-if proposals.

This calculation of the traffic complexity is performed by the same functions used in the prediction functionality.

What-if trajectory functionality:

As part of the prediction mode the sub-system allows the user to assess the modification of flight trajectories generating different proposals and calculating the traffic complexity of those proposals. A warning will be provided if the what-if proposal overload external sectors.

The functions involved specifically in the what-if trajectory functionality are:

- Control process: To control the generation of the user what-if and the data interchanged with the FDP.
- FDP: To process the information of flight plans and what-if trajectories generated by the user.
- Storage: To storage and deliver the flight plans information and the what-if flight calculated by the FDP function.
- HMI: It allows the user to input the information related with the trajectory what-if he/she wants to evaluate and it displays the traffic complexity calculated for the what-if proposals. It also provides access to the set of predefined what-if trajectory actions.

Measurement complexity functionality:

The sub-system calculates the traffic complexity based on real traffic information by means of the following functions:

- Control process: To control the global process and the data interchange between modules.
- Storage: To store all the relevant information, e.g. flight plans, predicted workload matrixes, real flight data and the controller commands.
- Algorithmic WL calculation: To compute the traffic complexity based on real traffic data and the algorithmic approach.
- Measure WL calculation: To compute the traffic complexity based on real traffic data and the cognitive channels approach.
- HMI: To display the results of the measurement processes and manage the user inputs.

Assessment and measurement complexity Comparison functionality:

The sub-system recovers prediction and measurement complexity data from a user specified time interval and compares them showing the differences to the user in a dedicated HMI window. This functionality is performed offline using the following functions:

- Control process: To control the global process and the data interchange between modules.
- Storage: To recover the predicted and measured traffic information of the time interval selected by the user.
- HMI: To display the results of the comparison processes on a specific window and manage the user inputs.

Sectorization optimization functionality:

The sub-system provides a set of sector configuration proposals using an optimization algorithm according to a set of constraints selected by the user and predefined criteria.

The sub-system uses a specific function “sector optimizer” to generate those optimal sector configuration proposals and the results are shown on the HMI.

2.6.2 Functional analysis

More detailed information of the functions is described in the following sub-sections.

2.6.2.1 Control process

This function controls the global process and the interaction between functions to provided the functionalities (capabilities) described in the section 2.3.

2.6.2.2 FDP

FDP generates the “4D Trajectories” from the input data, either flight plans received from operational system or EFDs from CFMU. At the same time this module calculates the predicted conflicts for flight trajectories and provides the sub-system with the list of flight in conflict and time and sector related information.

This function receives the following input data:

- Flight plan information.
- Sectorization plan.
- What-if trajectory.

This function provides the following output data:

- 4D trajectories.
- Conflicts information.

2.6.2.3 Storage

This function records the calculated workload matrixes, additional complexity indicators (i.e. occupancy and entry rate) and the used sectorization plan on a suitable media. The module will recover the information for processing on prediction and measurement processes and presentation on the HMI.

2.6.2.4 HMI

HMI tackles with the presentation of all the relevant information to the user on the different sub-system modes and processes. Moreover it is the sub-system input source receiving the user reactions and commands.

HMI presents the user the following data:

- Workload matrixes predicted/measured/what-if.
- Additional complexity indicators predicted/measured/what-if.
- Flight information.
- Load warning.
- Ranked Sector configuration list (Optimization list).

User provides the system the following input data through the HMI:

- User commands.
- Sector configuration what-if.
- Optimization process parameters.
- Trajectory what-if.
- Configuration parameters.

2.6.2.5 Sector - Optimizer

The sector optimizer uses an optimization algorithm to search the optimal solution for an imbalance situation by proposing a list of sector configurations. In order to rank the list of predefined sector configurations approved by the local authority, the sub-system takes into account the following parameters:

- Indicators:
  - Complexity Indicators: executive controller workload, entry rate and occupancy.
- Constraints:
  - Maximum number of Operational sector.
  - Major/Minor transitions (limit of number of sector changed in a new sectorization).
  - Minimum sectorization time: to avoid continuous changes of sectorization.
- Criteria to range the solution proposals:
  - To obtain the minimum overload peak.
  - To obtain a balanced load over all the sectors.
  - To minimize the global overload.
  - Minimum number of operational sector activated.

Complexity indicators, constrains and criteria to be used by the optimization algorithm can be selected/deselected to obtain different types of solution proposals.

672

673 2.6.2.6 Control events generation

674 This function generates the control events required for the Cognitive and additional complexity
675 indicators calculations. Those control events are calculated based on flight plan information.
676 This function receives the following input data:
677 • Flight plan information.
678 • Sectorization plan.
679
680 This function provides the following output data:
681 • Control events.
682 • Flight numbers in sector.
683

684 2.6.2.7 Algorithmic WL calculation

685 This function computes the executive controller workload base on the algorithmic approach.

686 This function receives the following input data:
687 • Flight plan information.
688 This module provides the following output data:
689 • Workload matrix.
690

691 2.6.2.8 Cognitive WL calculation

692 The Cognitive WL calculation functionality is performed by the Workload (WL) calculator module
693 which calculates the WL required per sector from a set of gathered control events that would have to
694 be done by a controller to ensure minimal separations.
695
696 This function is oriented to perform workload calculations based on the control events generated by
697 FTS or directly by the sub-system from predicted or real trajectories and on mental models that
698 estimates the impact of the cognitive channels demanded in each controlling action.
699
700 The function receives the following input data:
701 • Control events per ATC Controller and Sector.

702 The function provides the following output data:
703 • WL Matrix per ATC Controller and Sector.

704 In order to configure the function behaviour several parameters can be set, they can be classified in
705 two types:
706 • Configuration Parameters.

707 • Operational Concept: Parameters that are set off-line through some configuration files
708 oriented to the modelling of the controller activity.

709 The figure below summarizes the inputs required by the function as well as the outputs provided:
710

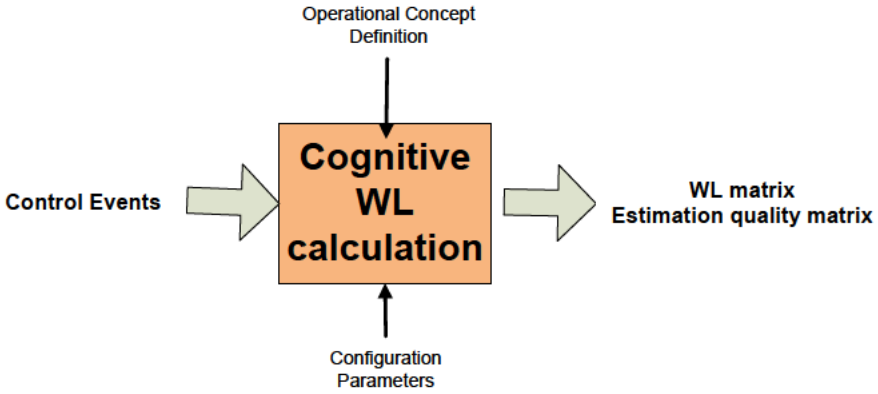

Figure 7: Cognitive approach main data flows

2.6.2.9 Additional complexity indicators calculation

This function receives as input the Control events associated to a sector during a certain period as well as the number of flights already in the sector at the beginning of the period.
The function provides occupancy and entry rate based on the occurrence of the Control Events associated to the flight assumption and release.

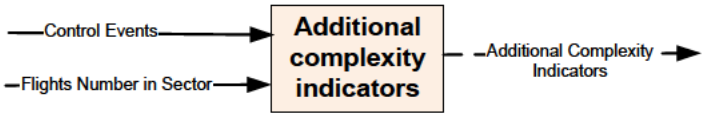

Figure 8: Additional complexity indicators function

2.6.2.10 FTS, Cognitive WL calculation and additional complexity indicators

This function calculates the Workload matrixes and additional complexity indicators (i.e. occupancy and entry rate) per sector for all the predefined sector configurations, improving the trajectory prediction through the pre-simulation of the predicted flight plans taking into account a very detailed description of aircraft performances and the resolution of potential conflicts.

The function is performed by a module that integrates:

- A fast time simulator (FTS) integrated within the module in such a way that from the predicted traffic demand and the set of predefined sector configurations, it generates a set of Control Events that will demand resources from the airspace controller.
- A WL Calculator that delivers the WL Matrix (with the estimation quality associated) per sector to all the predefined sector configurations based on the control events generated by the FTS and on mental models that consider two types of workload sources: temporal and cognitive.
- A WL Factors module that provides additional complexity indicators (i.e. occupancy and entry rate).

The function requires the following inputs:

- 4D Predicted Trajectories.
- List with all the predefined Sector Configurations.

The function provides the following outputs:

- Workload Matrix per sector for all the predefined sector configurations.
- WL Matrix quality estimator.
- Additional complexity indicators: Occupancy and entry rate.
- Specific information related to the flights in this sector including "aircraft workload contribution".

The figure below summarizes the inputs required by the function as well as the outputs provided:

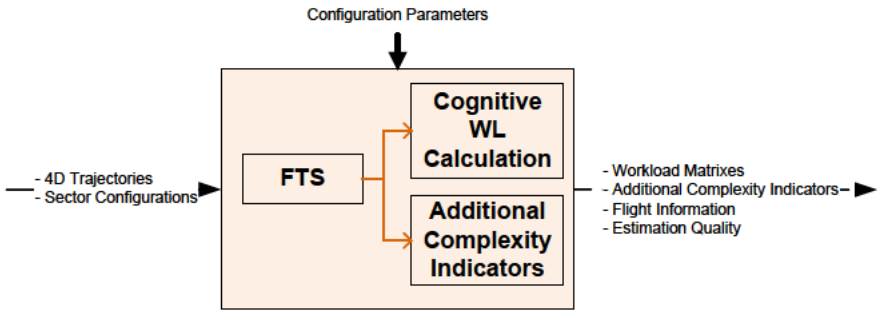

Figure 9: FTS, cognitive WL calculation and additional complexity indicators

2.6.2.11 Measure WL and additional complexity indicators

This function gathers the real control actions performed by the controller to ensure the minimal separation provision between aircrafts based on the recorded real data.

The following figure represents main internal functions modules and data flows.

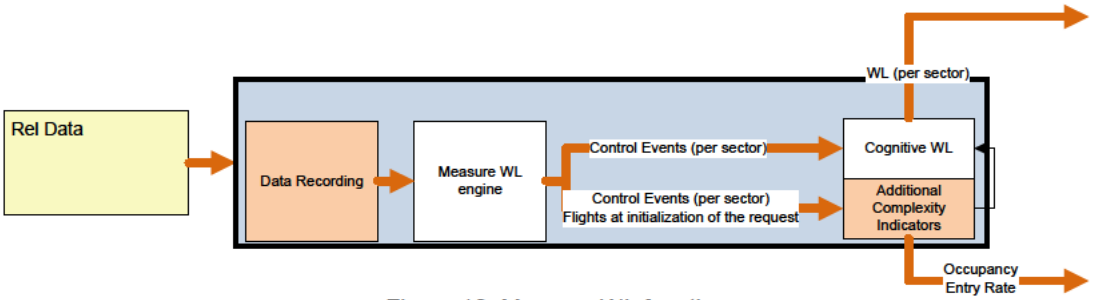

Figure 10: Measure WL function

This function detects and processes ATCO actions from the sub-system data recording and voice communications and translates them into control events which are provided to the modules that will calculate de complexity indicators.

2.7 Service View

N/A

3 Functional block Functional and non-Functional Requirements

The following subsection will described the functional and non functional requirements of the whole complexity assessment and resolution sub-system related with the functionalities described in the previous sections.

3.1 Capabilities

3.1.1 Traffic Complexity Assessment Requirements

This sub-section describes the requirements related with the “prediction” functionality.

[REQ]

Identifier	REQ-10.08.01-TS-1110.0010
Requirement	The system shall compute the complexity of the air traffic situation related to a sector configuration plan based on flight plan data received from the operational environment.
Title	Traffic complexity assessment.
Status	<Validated>
Rationale	The main functionality of the system is the prediction of traffic complexity.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0003	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0017	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0003.0001	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0002	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0015	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0050	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CAP1.0010	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CEFF.0010	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0020
Requirement	The system shall calculate the complexity prediction based on the actual sector configuration or what-if sector configuration.
Title	Actual and what-if sectorization.
Status	<Validated>
Rationale	The complexity prediction can be calculated for the actual sector configuration updated by the online system or for a what-if sector configuration proposed by the user.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A

<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0015	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0050	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CAP1.0010	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CEFF.0010	< Partial>

793
794
795 [REQ]

Identifier	REQ-10.08.01-TS-1110.0030
Requirement	The system shall handle the capacity thresholds of the ATC sectors.
Title	ATC sector capacity.
Status	<Validated>
Rationale	ATC sector capacity threshold can be modified to reflect the maximum, normal o minimum values of the capacity that each sector can assume.
Category	<Functional>
Validation Method	
Verification Method	<Test>

796
797 [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0008	<Full>

798
799
800 [REQ]

Identifier	REQ-10.08.01-TS-1110.0040
Requirement	The system shall take into account the military areas to calculate the traffic complexity.
Title	Military areas
Status	<Validated>
Rationale	The complexity prediction has to use the military areas.availability to perform the traffic complexity estimations.
Category	<Functional>
Validation Method	
Verification Method	<Test>

801
802 [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0004	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-INTEROP-0001.0001	<Partial>

803
804
805 [REQ]

Identifier	REQ-10.08.01-TS-1110.0050
Requirement	The system shall calculate the complexity of the air traffic within a look-ahead time horizon from 15 to 180 minutes (configurable) based on predicted data coming from external source.
Title	Look ahead time horizon.
Status	<Validated>
Rationale	Air traffic complexity will be calculate during the time interval defined by the time horizon.

Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0012	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0016	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0005	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0050	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CAP1.0010	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CEFF.0010	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0060
Requirement	The system shall calculate the complexity of the air traffic taking into account the time granularity specified by the user.
Title	Time granularity.
Status	<Validated>
Rationale	The complexity calculation can be performed with different accuracy depending on the time granularity defined by the user.
Category	< Validated >
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0015	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0070
Requirement	The system shall compute traffic complexity according to different approaches: 1.- Calculation based on Fast simulation and Cognitive Channels. 2.- Calculation based on trajectory prediction and Algorithmic formula. 3.- Calculation based on trajectory prediction and Cognitive channels.
Title	Approaches for complexity calculation.
Status	<Validated>
Rationale	The different approaches are used to compare the results of different methods to estimate the workload.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0014	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0018	<Full>

<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0060	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CAP1.0010	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CEFF.0010	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0075
Requirement	The system shall calculate individual flight contribution to the global complexity figure.
Title	Flight contribution to Complexity.
Status	<Validated>
Rationale	The system calculates the individual contribution to the complexity to ease the identification of the flights that contribute more to the traffic complexity.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0001	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0080
Requirement	The system shall perform the complexity prediction based on the flight trajectory information and the sectorization plan.
Title	Complexity prediction based on trajectories and sectorization plan.
Status	<Validated>
Rationale	Flight trajectories and sectorization plan are the main input information to predict the traffic complexity.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0003	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0003.0001	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0030	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0040	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0090
Requirement	The system shall use flight trajectory conflict information to perform the complexity prediction.
Title	Conflict information to calculate traffic complexity.
Status	<Validated>
Rationale	Information about conflicts on flight trajectories is used to improve the accuracy of the traffic complexity calculation.
Category	<Functional>
Validation Method	

Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0018	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0003.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0015	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0100
Requirement	The system shall calculate the prediction of the traffic complexity based on controller workload and complexity indicators.
Title	Prediction complexity indicators.
Status	<Validated>
Rationale	The complexity indicators used for the complexity prediction will be Occupancy and Entry rate, moreover the controller workload will be calculated as well to improve the accuracy of the traffic complexity prediction.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0006	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0002	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0060	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0110
Requirement	The system shall store the complexity prediction in a suitable media to perform further analysis.
Title	Prediction complexity storage.
Status	<Validated>
Rationale	The complexity prediction will be stored so that the user can analyse them in further phases.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0007	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2020.0020	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0120
Requirement	The system shall provide the same input data for all complexity calculation approaches.
Title	Identical traffic data for the complexity calculation modules.
Status	<Validated>
Rationale	The different complexity approaches will be able to be compared since they compute traffic complexity based in the same input data.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0014	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0006	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0130
Requirement	The system shall start the complexity calculation triggered by a calculation request produced each certain time interval (configurable).
Title	Calculation request trigger time.
Status	<Validated>
Rationale	The system requests the complexity calculation to the complexity calculator modules each defined time interval in order to provide them the same input data.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-0001.0050	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0140
Requirement	The system shall provide with the quality of the prediction for the complexity calculation.
Title	Information quality.
Status	<Validated>
Rationale	The system calculates the information quality used in the complexity calculation.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>

<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0003	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1110.0150
Requirement	The system shall generate alerts when the complexity indicator values exceed specified thresholds.
Title	Alerts of overload.
Status	<Validated>
Rationale	The system will warn the user when the complexity of the air traffic surpasses the thresholds specified for the ATC area.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0009	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0070	<Full>

3.1.2 Traffic Complexity Measurement Requirements

This sub-section describes the requirements related with the “measurement” functionality.

[REQ]

Identifier	REQ-10.08.01-TS-1120.0010
Requirement	The system shall measure the air traffic complexity based on the recorded real traffic data and sectorization plan.
Title	Measurement of air traffic complexity.
Status	<Validated>
Rationale	The data recorded during the real operation are used to measure the traffic complexity.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0050	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-INTEROP-0001.0001	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1120.0020
Requirement	The system shall measure the traffic complexity using the workload and suitable complexity indicators.
Title	Measurement complexity indicators.

Status	<Validated>
Rationale	The complexity indicators used for the complexity measurement are the same as the used in the prediction functionality: • Occupancy. • Entry rate. This approach provides a straight way to compare the prediction and the measurement calculations.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0006	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CAP1.0010	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CEFF.0010	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1120.0030
Requirement	The system shall use the actual sector configuration used in the operational environment to calculate the complexity measurement.
Title	Measurement complexity on actual sectorization.
Status	<Validated>
Rationale	The complexity measurement is calculate on the actual sectorization used in the operational environment.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0019	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0015	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-INTEROP-0001.0001	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1120.0040
Requirement	The system shall calculate the measured traffic complexity by means of different calculation approaches (cognitive and algorithmic).
Title	Different measurement approaches.
Status	<Validated>
Rationale	The complexity of the real situation is calculated by using different calculation approaches (cognitive and algorithmic). This method provides a way to compare different algorithms for complexity calculation.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0014	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0060	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1120.0050
Requirement	The system shall recover the recorded real air traffic data and calculates the workload and complexity indicators.
Title	Calculation of workload and complexity indicator using real traffic data.
Status	<Validated>
Rationale	The system can calculate and provide the user with the real traffic complexity based on the real recorded data.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0007	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2020.0020	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-INTEROP-0001.0001	<Partial>

3.1.3 Assessment and Measurement Complexity Comparison Requirements

This sub-section describes the requirements related with the “assessment and measurement complexity comparison” functionality.

[REQ]

Identifier	REQ-10.08.01-TS-1130.0010
Requirement	The system shall provide the user a means to compare the prediction vs the measured traffic complexity.
Title	Prediction/measurement assessment.
Status	<Validated>
Rationale	The traffic prediction complexity of the tool shall be compared with the measured traffic complexity.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0003	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1130.0020
Requirement	The system shall recover the prediction workload matrixes stored in the “prediction” phase from the suitable media for post analysis purposes.
Title	Recover prediction matrixes for analysis.
Status	<Validated>
Rationale	Predicted workload matrix are recovered so the user can analyse the prediction results.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0013	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2020.0020	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1130.0030
Requirement	The system shall recover the real data stored during the “prediction” phase from the suitable media, to calculate the workload and complexity indicators to be analysed by the user.
Title	Recover measured matrixes for analysis.
Status	<Validated>
Rationale	The real data recorded during the “prediction” phase are used to calculate the real traffic complexity.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0006	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2020.0020	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1130.0040
Requirement	The system shall provide a comparison of predicted and measured air traffic complexity.
Title	Comparison of predicted and measured data.
Status	<Validated>
Rationale	The differences between the predicted and measured air traffic complexity should be assessed by the user to gain confidence on the prediction tools.
Category	<Functional>
Validation Method	
Verification Method	<Test>

914 [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0003	<Partial>

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917 3.1.4 What-if Sectorization Requirements

918 This sub-section describes the requirements related with the “what-if sectorization” functionality.
919
920 [REQ]

Identifier	REQ-10.08.01-TS-1140.0010
Requirement	The system shall provide to the user a means to perform what-if sectorization functionality.
Title	What-if sectorization functionality.
Status	<Validated>
Rationale	The what-if sectorization functionality helps the user to assess the impact of different sector configurations on the traffic complexity.
Category	<Functional>
Validation Method	
Verification Method	<Test>

921
922 [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0001	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0017	<Full>

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925 [REQ]

Identifier	REQ-10.08.01-TS-1140.0020
Requirement	The system shall allow the user to select a specific sector configuration among a list of predefined sector configuration.
Title	Predefined sectorization selection.
Status	<Validated>
Rationale	The what-if sectorization functionality helps the user to assess different sector configurations.
Category	<Functional>
Validation Method	
Verification Method	<Test>

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927 [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0001	<Full>

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929
930 [REQ]

Identifier	REQ-10.08.01-TS-1140.0030
Requirement	The system shall allow the user to modify the start and end time of a specific sectorization along a sectorization plan.

Title	What-if sectorization start end time.
Status	<Validated>
Rationale	The user can change the start and end time of a sectorization to assess the impact on the situation complexity in order to solve imbalance situations.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0017	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0019	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1140.0040
Requirement	The system shall allow the user to modify off-line the standard sectorization to be used in the sectorization plans.
Title	Standard sectorization changes.
Status	<Validated>
Rationale	The user can change off-line the standard sectorization. This should be done by operational experts so that the result is a feasible sectorization on the specific ATC.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0019	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1140.0050
Requirement	The system shall calculate the workload and complexity indicators of the what-if sectorization selected by the user.
Title	What-if sectorization complexity calculation.
Status	<Validated>
Rationale	The system can calculate, under user request, the new workload and complexity indicators (occupancy, entry rate) of any what-if sectorization the user has implemented.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0003	<Full>

<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0017	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0050	<Partial>

3.1.5 What-if Trajectory Requirements

This sub-section describes the requirements related with the “What-if Trajectory” functionality.

[REQ]

Identifier	REQ-10.08.01-TS-1150.0010
Requirement	The system shall allow the user to use what-if trajectories (aka trajectory proposals) to assess the complexity air traffic reduction on implementing the proposed trajectories.
Title	Situation assessment using what-if trajectory.
Status	<In Progress>
Rationale	The user can propose different trajectories for selected flights to assess the change on the complexity if those trajectories are applied in the real air traffic situation.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0003.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0015	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0006	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0030	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0040	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CAP1.0030	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CEFF.0030	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-APUN.0010	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-FEFF.0020	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1150.0020
Requirement	The system shall compute the complexity of the proposed trajectories using the complexity calculator selected by the user.
Title	Selected complexity calculator.
Status	<In Progress>
Rationale	The user should select the specific complexity calculator to be used by the system to compute the workload and complexity indicators.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0006	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0030	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0060	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1150.0030
Requirement	The system shall perform a preliminary test of the what-if trajectory defined by the user in order to ensure the feasibility of the proposal.
Title	What-if trajectory.preliminary test.
Status	<In Progress>
Rationale	The system guarantees that the what-if trajectory defined by the user is feasible.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0011	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1150.0040
Requirement	The system shall allow the user to define the following what-if trajectory commands: level capping, rerouting and ground delay.
Title	Types of what-if trajectory.
Status	<In Progress>
Rationale	The user can select the following what-if trajectories commands: • Level capping: the flight can't flight over a defined level. • Rerouting: the waypoints of the flight route can be changed. • Ground delay: the departure time of the flight 4D trajectory can be changed.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0006	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0009	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0030	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0040	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1150.0050
Requirement	The system shall perform one what-if trajectory per flight in the same what-if context.
Title	What-if trajectory per flight.
Status	<In Progress>
Rationale	Each flight should have applied only one what-if in order to avoid overload one flight with two or more modifications in its flight plan.
Category	<Functional>

Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0006	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1150.0060
Requirement	The system shall calculate the complexity of the situation resulting of applying the what-if trajectories of all the flight in the same what-if context.
Title	Complexity of all what-if flights.
Status	<In Progress>
Rationale	The user needs to assess the complexity of the global situation resulting on applying all the proposal he/she has defined for all the flight in the what-if context.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0006	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0008	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0030	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0050	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CAP1.0030	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CEFF.0030	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-APUN.0010	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-FEFF.0020	< Partial>

3.1.6 Predefined What-if Trajectory Based Actions Requirements

This sub-section describes the requirements related with the “predefined actions” system feature.

[REQ]

Identifier	REQ-10.08.01-TS-1160.0010
Requirement	The system shall allow the user to define a set of predefined actions of what-if trajectories to be applied in known air traffic situations.
Title	Predefined what-if trajectory action.
Status	<In Progress>
Rationale	Solutions already tested to solve well known air traffic imbalance could be defined by the user to be used in similar future situations.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0030	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0040	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1160.0020
Requirement	The system shall allow the user to define a set of predefined what-if trajectory action offline.
Title	Offline definition of predefined what-if trajectory actions.
Status	<In Progress>
Rationale	The predefined what-if actions should be offline analysed by the corresponding experts to assess its feasibility and then stored in the system for future usage.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0010	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1160.0030
Requirement	The possible predefined what-if trajectory actions shall be the following: level capping, rerouting and ground delay.
Title	Type of predefined what-if trajectory actions.
Status	<In Progress>
Rationale	The type of predefined what-if action are limited to which are defined in the what-if requirements.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0009	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0030	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0040	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1160.0040
Requirement	The predefined what-if trajectory actions shall be single actions, i.e. only one what-if trajectory proposal for each predefined action.
Title	Single predefined what-if trajectory action.
Status	<In Progress>

Rationale	The predefined actions should be composed by only one what-if trajectory per action to keep simple its implementation and to improve the number of scenarios where its application is feasible.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0009	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0011	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1160.0050
Requirement	Each predefined what-if trajectory action shall define a predefined air traffic pattern on which its application is feasible.
Title	Predefined air traffic patterns.
Status	<In Progress>
Rationale	The predefined actions are associated to a predefined air traffic pattern defining the flights on which makes sense the implementation of the action.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0030	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1160.0060
Requirement	A traffic pattern shall be defined as a set of filters to apply to the flight list in order to select flights with common characteristics.
Title	Predefined air traffic patterns definition.
Status	<In Progress>
Rationale	Common flight characteristics, i.e. ADEP, ADES, shall be used to select from the flight list a traffic pattern. This pattern will be use to select the set of flights which the action is applied on.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0030	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1160.0070
Requirement	The system shall store the predefined what-if actions with its corresponding traffic patterns defined by the user in a suitable media.
Title	Storage of predefined actions and traffic patterns.
Status	<In Progress>
Rationale	The predefined action and patterns are stored in the system for further usage.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0010	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1160.0080
Requirement	The system shall allow the user to restore the predefined actions with its corresponding traffic patterns to be implemented when necessary.
Title	Restore of predefined actions and traffic patterns.
Status	<In Progress>
Rationale	The predefined actions and patterns should be restored from the system storage media for further usage.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0020	<Partial>

3.1.7 Sectorization Optimization Requirements

This sub-section describes the requirements related to the optimization functionality for the sector configurations.

[REQ]

Identifier	REQ-10.08.01-TS-1170.0010
Requirement	The system shall provide sector optimization functionality to propose a ranked list of optimal sector configurations.
Title	Sector configuration optimization.
Status	<Validated>
Rationale	Optimal sector configurations are proposed to the user to solve imbalanced demand capacity situations.
Category	<Functional>
Validation Method	

Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0020	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CAP1.0020	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CEFF.0020	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-DPUN.0010	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-FEFF.0010	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1170.0020
Requirement	The system shall use predefined constraints to find the optimal solution of all the possible sector configurations available.
Title	Use of constraints in the optimization process.
Status	<Validated>
Rationale	The optimization algorithm will use operational constraints to prune the search tree in the optimization process.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0003	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0004	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1170.0030
Requirement	The system shall use the following operational predefined constraints during the optimization process: • Maximum operational sector number. • Only minor transactions. • Minimum time between two consecutive sector configuration changes.
Title	Constraints for the optimization process.
Status	<Validated>
Rationale	The operational constraints are defined by the operational experts and should be validated in the validation process.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0003	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1170.0040
Requirement	The optimization module shall use predefined search criteria to create the cost function that shall be used by the optimization module.
Title	Use of criteria in the optimization process.
Status	<Validated>
Rationale	The optimization algorithm will use operational predefined search criteria to range the solutions proposed by the optimization module.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0003	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1170.0050
Requirement	The optimization module shall use the following operational predefined search criteria during the optimization process: • Minimised work overload. • Balanced workload. • Minimised sector transition time.
Title	Ranged criteria for the optimization process.
Status	<Validated>
Rationale	The search criteria are predefined by the operational experts and should be validated in the validation process.
Category	<Functional>
Validation Method	
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0003	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1170.0060
Requirement	The system shall use the selected complexity indicator or workload to calculate the optimal sector configuration.
Title	Selected indicator for the optimization.
Status	<Validated>
Rationale	The optimization process will use the complexity indicator selected by the user to propose the optimal solution.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0020	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1170.0070
Requirement	The system shall allow the user to copy the optimal proposed solution to the what-if context or implement that solution on the current context.
Title	Context for the proposed solution.
Status	<Validated>
Rationale	The optimal solution can be used to be validate in a what-if context or be implemented in the current context if the user decide to do it.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0020	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0060	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CAP1.0020	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CEFF.0020	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-DPUN.0010	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-FEFF.0010	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1170.0080
Requirement	The system shall be able to cancel the optimization process under user request.
Title	Optimization cancelation.
Status	<Validated>
Rationale	If the optimization process takes for too long the user can cancel the optimization process.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0002	<Partial>

3.1.8 HMI Requirements

This sub-section describes the requirements related to the “HMI” functionality.

[REQ]

Identifier	REQ-10.08.01-TS-1180.0010

Requirement	The system HMI shall display the complexity prediction, complexity measurement and prediction/measurement comparison in a suitable HMI.
Title	System HMI.
Status	<Validated>
Rationale	Complexity predictions, measurements and comparison will be shown to the user in the system HMI.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0004.0002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0004.0004	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0020
Requirement	The system HMI shall allow the user to select the complexity indicator which values will be displayed on the HMI.
Title	Selection of complexity indicator.
Status	<Validated>
Rationale	The user can select which complexity indicator will be used to display the complexity situation on the HMI.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0006	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0007	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0060	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0030
Requirement	The system HMI shall display the current context and the what-if contexts in suitable windows.
Title	Context windows.
Status	<Validated>
Rationale	The user can work in different windows depending on the context selected.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0004.0003	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0040
Requirement	The system HMI shall provide to the user a way to select the time horizon for the prediction complexity calculation.
Title	Time horizon selection.
Status	<Validated>
Rationale	The user can select the time horizon for the prediction calculations.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0016	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0050
Requirement	The system HMI shall allow the user to select the time of the sliding window time for the complexity indicator calculations.
Title	Selection of sliding window time.
Status	<Validated>
Rationale	The user can select the sliding window time depending on the traffic situation.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0015	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0060
Requirement	The system HMI shall allow the user to select the time granularity for the complexity indicator calculations.
Title	Selection of time granularity.
Status	<Validated>
Rationale	The user can select the time granularity depending on the traffic situation.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0015	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0004.0004	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0070
Requirement	The system HMI shall allow the user to set thresholds for the workload and complexity indicator values.
Title	Complexity indicator value thresholds.
Status	<Validated>
Rationale	The user can set thresholds.for the complexity indicators so that the system will warn the user when the complexity exceed the defined values.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0008	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0080
Requirement	The system HMI shall warn the user when the complexity values exceed the predefined threshold.
Title	Warning on exceeding the threshold.
Status	<Validated>
Rationale	The user will be warning when the workload or complexity indicator displayed exceeds the defined threshold.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0009	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0004.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0070	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0090
Requirement	The system HMI shall display the workload or complexity indicator of all sectors for the specified time horizon in predefined colours depending on the values of the defined thresholds.
Title	Complexity indicator coloured visualization.
Status	<Validated>
Rationale	The complexity values are displayed for each sector and time interval in different colours depending on the predefined thresholds.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0002	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0004.0004	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0050	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CAP1.0010	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CEFF.0010	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0100
Requirement	The system HMI shall display the workload or complexity indicator of a specific sector along the time horizon in a bar diagram under user request.
Title	Bar diagram display.
Status	<Validated>
Rationale	.The traffic complexity of a specific sector can be displayed in a bar diagram on the HMI.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0002	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0004.0004	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0050	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0110
Requirement	The system HMI shall display the flight information list of a sector and a time interval when it is selected by the user.
Title	Display the flight information list.
Status	<Validated>
Rationale	The user can select a specific sector and time interval to get the information of the flights in that sector during that time interval.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0012	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0001	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0050	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0120

Requirement	The system HMI shall display in the flight information list the contribution of each flight to the traffic complexity.
Title	Traffic complexity flight contribution.
Status	<Validated>
Rationale	The user can utilize the contribution of each flight to the traffic complexity in order to select candidates for further flight plan changes to solve imbalanced situations.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0001	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0130
Requirement	The system HMI shall display the information quality as the percentage of flights with different flight status.
Title	Display information quality.
Status	<Validated>
Rationale	The percentages of flight in different status provide the controller an assessment of the available information quality.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0004	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0140
Requirement	The system HMI shall display the estimation quality provided by each complexity calculator modules.
Title	Display estimation quality.
Status	<Validated>
Rationale	The estimation quality of each complexity calculator method is shown to support the user on evaluating the reliability of the information.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>

<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0014	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0150
Requirement	The system HMI shall allow the user to filter the flight information using the ADEP and ADES values.
Title	Flight information filters.
Status	<Validated>
Rationale	Filters can be used by the controller to select flights on the flight information list. The main filters are ADEP and ADEP. More filters could be added as a result of the validation process.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	NIMS-37	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0004.0003	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0001	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-INTEROP-0001.0001	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0160
Requirement	The system HMI shall display the user the ranked list of optimal sectorizations.
Title	Ranked list of sectorizations.
Status	<Validated>
Rationale	A list of optimal sector configurations will be shown to support the user in decision making process.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0002	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0170
Requirement	The system HMI shall allow the user to select the constraints to be used in the optimization process.
Title	Constraints selection.
Status	<Validated>
Rationale	Some of the available constraints can be selected to perform the optimization process in different ways.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0003	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0180
Requirement	The system HMI shall allow the user to select the workload or complexity indicator to be used in the optimization process.
Title	Indicator selection for optimization process.
Status	<Validated>
Rationale	The user can select different indicators to be used in the optimization process.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0014	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0060	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0190
Requirement	The system HMI shall inform the user about the status of optimization process.
Title	Optimization process status.
Status	<Validated>
Rationale	The user needs to know if the optimization process is currently running or it is finished.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0002	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0200
Requirement	The system HMI shall allow the user to cancel the optimization process at any time.
Title	Optimization process cancelation.
Status	<Validated>
Rationale	The user can cancel the optimization process if it takes too long to propose an optimal solution.
Category	<Functional>

Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0002.0002	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0210
Requirement	The system HMI shall allow the user to select the more suitable flight/s to apply the what-if trajectory proposals.
Title	Selection of flight candidates.
Status	<Validated>
Rationale	The user can select from the flight list any flight as candidate for applying what-if trajectory actions, usually based on their contribution to the traffic complexity.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0020	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0008	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0030	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0220
Requirement	The system HMI shall display the trajectory of the flight on which the what-if trajectory is going to be applied.
Title	Graphical trajectory display.
Status	<In Progress>
Rationale	The user can see graphically the trajectory of the flight and easily assesses the changes to be applied.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0008	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0009	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0230
Requirement	The system HMI shall allow the user to set the what-if trajectory in a text mode.

Title	Trajectory input text mode.
Status	<In Progress>
Rationale	The user could set the what-if trajectory defining the waypoints of the new trajectory in text mode.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0008	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0009	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0240
Requirement	The system HMI shall display the workload or complexity indicators before and after applying the what-if trajectory on the same graphic.
Title	Complexity comparison.
Status	<In Progress>
Rationale	The complexity values are displayed before and after applying the what-if proposal so the user can assess easily the impact of the proposals.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0013	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0030	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2000.0040	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CAP1.0030	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-CEFF.0030	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-APUN.0010	< Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-FEFF.0020	< Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0250
Requirement	The system HMI shall allow the user to define a set of predefined what-if trajectory actions to be stored in the system.
Title	HMI predefined actions definition.
Status	<In Progress>
Rationale	Once the user has assessed the suitability of different what-if actions the user stores them in the system offline using a dedicated HMI interface.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A

<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2020.0020	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1180.0260
Requirement	The system HMI shall allow the user to restore the set of predefined what-if trajectory actions available in the system to implement them for solving air traffic imbalance situations.
Title	Restore predefined what-if actions.
Status	<In Progress>
Rationale	The user can restore in the system, through the system HMI, all the previously saved predefined what-if trajectory actions so that they can be implemented when needed.
Category	<HMI>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<Enabler>	ER ATC 92	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2020.0020	<Partial>

3.1.9 Configuration Requirements

This sub-section describes the requirements related to the system configuration

[REQ]

Identifier	REQ-10.08.01-TS-1190.0010
Requirement	The system shall read configuration files for defining default behaviour of its modules.
Title	Configuration files.
Status	<Validated>
Rationale	The default behaviour of the system and its modules will be defined in the configuration files
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0019	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2020.0030	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1190.0020
Requirement	Each system shall define the configuration parameters needed for its default behaviour.
Title	Module configuration files.
Status	<Validated>

Rationale	The modules default behaviour will be defined by means of its own configuration parameters.
Category	<Functional>
Validation Method	
Verification Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0019	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2020.0030	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1190.0030
Requirement	The system shall allow the user to modify the configuration parameters offline.
Title	Modification of configuration parameters.
Status	<Validated>
Rationale	The user can control the system default behaviour modifying the configuration parameters.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0019	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2020.0030	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1190.0040
Requirement	The system shall read the configuration parameters from the configuration files.
Title	configuration parameter files
Status	<Validated>
Rationale	Configuration parameters will be available off-line in specific files.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0019	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2020.0030	<Partial>

3.2 Adaptability

[REQ]

Identifier	REQ-10.08.01-TS-1200.0010
Requirement	The system shall be able to use different complexity calculation algorithms.
Title	Different complexity algorithms.
Status	<Validated>
Rationale	Different algorithms can be used to estimate the workload,and complexity indicators so the system allows the user to assess different methods of complexity calculation.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0004	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0014	<Full>

3.3 Performance Characteristics

[REQ]

Identifier	REQ-10.08.01-TS-1300.0020
Requirement	The system shall be able to calculate the traffic complexity in less than five seconds by means of the algorithmic approach complexity calculation.
Title	Algorithmic complexity calculation maximum time.
Status	<Validated>
Rationale	A complexity calculation maximum time is defined using the algorithmic approach.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-1000.0010	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1300.0050
Requirement	The system shall be able to propose an optimal sectorization in an average time of 40 seconds.
Title	Optimization process mean time.
Status	<Validated>
Rationale	A optimization average time is defined for the system to find an optimal sector configuration. As the optimization process depends on the number of flight and the scenario, this value is a statistical average time for the optimization process. The time limit will be defined in a further performance requirement.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-1000.0010	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1300.0060
Requirement	The system shall be able to propose an optimal sectorization in a maximum time of 2 minutes.
Title	Optimization process maximum time.
Status	<Validated>
Rationale	A optimization maximum time is defined for the system to find an optimal sector configuration. After this time the optimizer will propose the best solutions found so far.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-1000.0010	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1300.0070
Requirement	The system HMI shall be able to display the calculated traffic complexity in less than 500 msec.
Title	HMI display maximum time.
Status	<Validated>
Rationale	A maximum time is defined for the system to display the received traffic complexity on the HMI.
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-1000.0010	<Partial>

3.4 Safety & Security

This sub-section describes the requirements related to the system safety & security requirements

3.4.1 Safety Requirements

[REQ]

Identifier	REQ-10.08.01-TS-1400.0010
Requirement	The system shall be isolated from the design to avoid any disturbance on the operational environment due to system malfunction.
Title	Isolation from operational environment.

Status	<In Progress>
Rationale	The operational system shouldn't be affected by any failure of the traffic complexity management system.
Category	<Safety>
Validation Method	
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0040	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1400.0020
Requirement	The system shall be connected to the operational system through an RLI (Recording and Logging Infrastructure) module that provides isolation from operational environment and a recovery way after system failure.
Title	RLI Isolation and recovery module.
Status	<In Progress>
Rationale	RLI module provides isolation to the operational environment against any system failure and provide the needed information for recovery after a system failure.
Category	<Safety>
Validation Method	
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0040	<Full>

3.5 Maintainability

N/A

3.6 Reliability

This sub-section describes the requirements related to the system reliability requirements. Reliability encompasses robustness to abnormal operating conditions.

[REQ]

Identifier	REQ-10.08.01-TS-1600.0001
Requirement	The system shall be developed for continuous operational use (24 hours per day, 7 days per week).
Title	System Availability.
Status	<Validated>
Rationale	The system has to be operative continuously.
Category	<Reliability>
Validation Method	
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0040	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1600.0010
Requirement	The system shall detect format errors on the input data from the external system.
Title	Detection of input data errors from the external sources.
Status	<Validated>
Rationale	An error in input data shall be detected to avoid further processing with unreliable data.
Category	<Reliability>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0040	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1600.0020
Requirement	The system shall record the errors detected in order to facilitate later analysis.
Title	Store input data errors.
Status	<Validated>
Rationale	The user shall be able to perform off-line analysis of the detected errors.
Category	<Reliability>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0010	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1600.0030
Requirement	The system shall detect format errors on configuration data.
Title	Configuration data error detection.
Status	<Validated>
Rationale	Inconsistent configurations shall be detected.
Category	<Reliability>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A

<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0010	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1600.0040
Requirement	The system shall detect format errors on user input data.
Title	User input data error detection.
Status	<Validated>
Rationale	These error detections allow reliable use for intended users.
Category	<Reliability>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0010	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1600.0050
Requirement	The system shall provide a media to deliver the recorded error to the user or external sources.
Title	Deliver recorded error.
Status	<Validated>
Rationale	This information could be used by the user for further analysis.
Category	<Reliability>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0010	<Partial>

3.7 Functional block Internal Data Requirements

This sub-section describes the requirements related to the system internal data requirements.

[REQ]

Identifier	REQ-10.08.01-TS-1700.0010
Requirement	The system should facilitate the use of different complexity calculators by means of a common internal interface.
Title	Common internal interfaces.
Status	<Validated>
Rationale	Different complexity calculators are used through a common internal interface with the system.
Category	<Interface>
Validation Method	
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-INTEROP-0001.0001	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1700.0020
Requirement	The internal interface should be scalable to provide new information needed by future complexity calculator modules to be connected to the system.
Title	Scalable interfaces.
Status	<Validated>
Rationale	Different complexity calculators may need more information than the defined in the current interface, so the internal interface could be increased to provide that information.
Category	<Interface>
Validation Method	
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-REL5.0007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-INTEROP-0001.0002	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1700.0030
Requirement	Future complexity calculators shall comply with the internal interface to be connected to the system.
Title	Complexity calculator modules interface.
Status	<Validated>
Rationale	The integration of future complexity calculator modules will be straight forward if the module complies the internal common interface.
Category	<Interface>
Validation Method	
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-INTEROP-0001.0002	<Partial>

3.8 Design and Construction Constraints

This sub-section describes the requirements related to the system design constraints.

[REQ]

Identifier	REQ-10.08.01-TS-1800.0010
Requirement	The system shall be developed using an operating system compatible with the IBP infrastructure.
Title	Software Operating System.

Status	<Validated>
Rationale	The system must be compatible with the IBP infrastructure and easily maintainable using existing resources and procedures.
Category	<Interoperability>
Validation Method	
Verification Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0030	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1800.0020
Requirement	The programming languages used in the software development shall be industrial standard widely used and supported.
Title	Programming languages.
Status	<Validated>
Rationale	The system must be easily modified and maintainable using existing resources and procedures.
Category	<Interoperability>
Validation Method	
Verification Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0030	<Partial>

[REQ]

Identifier	REQ-10.08.01-TS-1800.0030
Requirement	The database and other standard functions (graphics display) used in the development shall be industry standard COTS.
Title	Use of COTS software.
Status	<Validated>
Rationale	The system must be easily modified and maintainable using existing resources and procedures.
Category	<Interoperability>
Validation Method	
Verification Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2010.0030	<Partial>

3.9 Functional block Interface Requirements

[REQ]

Identifier	REQ-10.08.01-TS-1900.0010

Requirement	The system shall receive for the complexity calculations the needed data from the ATC system to which it is connected.
Title	Data inputs.
Status	<Validated>
Rationale	The system must be received the air traffic data from the operational system to perform the complexity calculations.
Category	< Interface >
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0001	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0002	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-INTEROP-0001.0001	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1900.0020
Requirement	The system shall be able to filter the received information from the ATC system to which it is connected through configurable filters.
Title	Input data filter configuration.
Status	<Validated>
Rationale	The filters improve the performance of the system input data communication by removing unnecessary information.
Category	< Interface >
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0001	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0002	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-INTEROP-0001.0001	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1900.0030
Requirement	The system shall receive the needed configuration data from the ATC system to which it is connected.
Title	data input configuration.
Status	<Validated>
Rationale	This provides the needed flexibility to the system.
Category	< Interface >
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0019	<Full>

[REQ]

Identifier	REQ-10.08.01-TS-1900.0040
Requirement	The system shall be able to configure the communication parameters for the link of the ATC system to with it is connected.
Title	ATC system communication parameters configuration.
Status	<Validated>
Rationale	The system shall be able to be connecting to different ATC communication systems.
Category	< Interface >
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0001.0019	<Full>

[REQ

Identifier	REQ-10.08.01-TS-1900.0050
Requirement	The system shall be connected to a data base for recover historical information that allow prediction calculation and its storage for historical purposes.
Title	Data Acquisition Database connection.
Status	<Validated>
Rationale	Historical information mining and exploitation.
Category	< Interface >
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.04	N/A
<ALLOCATED_TO>	<Functional block>	Local Traffic Complexity Mgt(LTCM)	N/A
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-OSED-0005.0013	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.01-SPR-2020.0020	<Partial>

4 Assumptions

N/A

5 References

[1] Template Toolbox 03.01.03
https://extranet.sesarju.eu/Programme%20Library/SESAR%20Template%20Toolbox.dot

[2] Requirements and V&V Guidelines 03.01.00
https://extranet.sesarju.eu/Programme%20Library/Requirements%20and%20VV%20Guidelines.doc

[3] Templates and Toolbox User Manual 03.01.01
https://extranet.sesarju.eu/Programme%20Library/Templates%20and%20Toolbox%20User%20Manual.doc

[4] EUROCONTROL ATM Lexicon
https://extranet.eurocontrol.int/http://atmlexicon.eurocontrol.int/en/index.php/SESAR

[5] B04.03 ADD Step 1 (2014 edition) edition 00.02.02 30/04/2015

[6] IEEE / MIL Standards

[7] 10.1.7-D115 Technical Architecture Description (TAD) edition 00.01.00, 19/03/2014

[8] 04.07.01-D62 Step1 V3 Interim Complexity Management OSED edition 00.01.01 14/07/2015

[9] 04.07.01-D63 Step1 V3 Interim Complexity Management SPR edition 00.01.01 16/07/2015

[10] 04.07.01-D64 Step1 V3 Interim Complexity Management INTEROP edition 00.01.01 30/04/2015

[11] SESAR Technical Specification.dot edition 03.00.00 08/05/2012

[12] P04.07.01-D71 Step 1 V3 VALP edition 00.01.03 03/12/2015

[13]07.02-D42 Step 1 Network Sub-system Technical Architecture edition 00.02.00 15/05/2014

[14] ATM Master Plan website: https://www.atmmasterplan.eu/working

5.1 Use of copyright / patent material /classified material

N/A

5.1.1 Classified Material

N/A

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