



# SESAR 2020 TS IRS - PJ.05-35 V3

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# PJ.05-W2-DTT

## DIGITAL TECHNOLOGIES FOR TOWER

This TS IRS is part of a project that has received funding from the SESAR3 Joint Undertaking under grant agreement No 874470 under European Union's Horizon 2020 research and innovation programme.



### Abstract

The SESAR2020 PJ05.35 Technical Specification describes the functions of a remote tower solution, and provides a requirement specification for those functions. It is developed aiming for V3 maturity for Solution PJ05-35.

It is based on SESAR1 project 12.04.07 D09 Remote Tower Technical Specifications [43] and SESAR2020 project 05 D3.1.010 [43]. While the SESAR1 TS was written to separate operation of a single aerodrome from the one of a multiple aerodrome, this TS views operation of a single aerodrome to be included in a multiple aerodrome operation.

PJ05.35 TS considers the outcomes of five different SESAR2020 validation exercises:

In SESAR2020 the intention is to ensure consistency and coherency between the delivered documents using EATMA, and the architectural diagrams showed in this document are present in EATMA.

## Table of Contents

Abstract .....	3
<b>1 Executive summary .....</b>	<b>8</b>
<b>2 Introduction .....</b>	<b>9</b>
2.1 Purpose of the document.....	9
2.2 Scope .....	9
2.3 Intended readership .....	9
2.4 Background .....	10
2.5 Structure of the document.....	10
2.6 Glossary of terms.....	11
2.7 Acronyms and Terminology .....	13
<b>3 SESAR Solution Impacts on Architecture .....</b>	<b>15</b>
3.1 Target Solution Architecture .....	15
3.1.1 SESAR Solution(s) Overview .....	15
<b>Remote Tower Centre with Flexible Allocation of Aerodromes to Multiple Remote Tower Modules (Solution 35).....</b>	
3.1.1.1 Deviations with respect to the SESAR Solution(s) definition.....	17
3.1.1.2 Relevant Use Cases.....	17
3.1.1.2.1 Trace Relevant Use Cases and Technical Models.....	19
3.1.1.3 Applicable standards and regulations .....	21
3.1.2 Capability Configurations required for the SESAR Solution .....	22
3.2 Changes imposed by the SESAR Solution on the baseline Architecture .....	22
<b>4 Technical Specifications.....</b>	<b>24</b>
4.1 Functional architecture overview (general introduction for all solutions) .....	24
4.1.1 Resource Connectivity view (one section per NSV-1) .....	28
4.1.1.1 Resource Infrastructure view (of the NSV-2).....	30
4.1.1.2 Resource Orchestration view (all NSV-4s linked to the NSV-1) .....	30
4.1.2 Resource Composition .....	43
4.1.3 Service view.....	44
4.1.3.1 Service description .....	44
4.1.3.2 Service Provisioning.....	45
4.1.3.3 Service Realization.....	46
4.2 Functional and non-Functional Requirements.....	46
4.2.1 Multiple Remote Tower Module (MRTM).....	46
4.2.1.1 General Requirements .....	46
4.2.1.2 Communications.....	50
4.2.1.2.1 Voice Communication System (VCS) .....	50
4.2.1.3 Alarms and alerts.....	51
4.2.1.4 ATCO Planning Tools.....	51
4.2.1.5 Other ATS System/Functions.....	53
4.2.1.6 Technical Supervision .....	54

4.2.1.7	Automation Functionalities .....	55
4.2.2	Transfer/Merging .....	58
4.2.2.1	Split and Merge .....	58
4.2.2.2	Supervisor tools.....	63
4.2.3	RTC Supervisor .....	65
4.2.3.1	General .....	65
4.2.3.2	RTC SUP Monitoring Tools.....	66
4.2.4	Technical Supervision.....	67
4.2.4.1	RTC SUP Planning Tools .....	68
4.2.5	Approach.....	69
<b>5</b>	<b>Recommendation for Implementation.....</b>	<b>71</b>
<b>6</b>	<b>Assumptions .....</b>	<b>72</b>
<b>7</b>	<b>References and Applicable Documents .....</b>	<b>73</b>
7.1	Applicable Documents .....	73
7.2	Reference Documents.....	74
<b>Appendix A</b>	<b>Baseline Requirements for Single Remote Tower (from SESAR 1) .....</b>	<b>76</b>
<b>A.1</b>	<b>Baseline Concept Requirements.....</b>	<b>76</b>
<b>A.2</b>	<b>General Service / Functional requirements.....</b>	<b>76</b>
A.2.1	Communications .....	76
A.2.2	MET-functions .....	77
A.2.3	NAV functions.....	78
A.2.4	Other ATS Systems / Functions .....	79
A.2.5	Voice and Data Recording .....	80
<b>A.3</b>	<b>Remote Functional Requirements .....</b>	<b>81</b>
A.3.1	Concept Requirements Single aerodrome Applications .....	81
A.3.2	RTC level requirements .....	81
A.3.3	RTC Supervisor .....	83
A.3.4	Visualization .....	84
A.3.5	Airport sound reproduction .....	94
A.3.6	Other ATS System/Functions.....	95
A.3.7	Voice and Data Recording .....	97
A.3.8	Work Environment .....	97
A.3.9	Reliability and integrity .....	99
<b>A.4</b>	<b>Additional requirements for multiple aerodrome applications.....</b>	<b>99</b>
A.4.1	Concept requirements multiple aerodrome applications.....	99
A.4.2	Remote functional requirements.....	99
A.4.3	Visualization .....	102
A.4.4	Sound .....	102
A.4.5	Work environment .....	102
<b>A.5</b>	<b>Contingency requirements.....</b>	<b>103</b>
A.5.1	Concept requirements .....	103
A.5.2	Performance and functional requirements.....	103
<b>Appendix B</b>	<b>Reference Requirements for Multiple Remote Tower Module (from SESAR 2020 Wave 1 PJ.05-02-V3).....</b>	<b>105</b>
<b>B.1</b>	<b>Performance Requirements .....</b>	<b>105</b>

<b>B.2</b>	<b>Multiple Remote Tower Module (MRTM)</b> .....	<b>106</b>
B.2.1	General Requirements .....	106
B.2.2	Communications .....	109
B.2.3	MET-functions .....	116
B.2.4	Visualization .....	118
B.2.5	NAV-functions .....	137
B.2.6	Other ATS System/Functions.....	138
B.2.7	Voice and Data Recording .....	140
B.2.8	Airport sound reproduction .....	144
B.2.9	Technical Supervision.....	147
B.2.10	ATCO Planning Tool .....	148
<b>B.3</b>	<b>Transfer/Merging</b> .....	<b>149</b>
B.3.1	General.....	149
B.3.2	Static.....	150
<b>B.4</b>	<b>Remote Tower Centre (RTC)</b> .....	<b>153</b>
<b>B.5</b>	<b>Work Environment</b> .....	<b>154</b>

## List of Tables

Table 1: Solution 3 architecture of Capability Configuration, roles, technical systems and functional blocks.....	8
Table 2: Glossary .....	13
Table 3: Acronyms and terminology .....	14
Table 4: SESAR Solution XX Scope and related Functional Blocks/roles & Enablers.....	17
Table 5: Trace relevant Use Cases vs Technical Models .....	21
Table 6: List of Capability Configuration required for the SESAR Solution .....	22
Table 7: List of changes due to the SESAR Solution .....	23
Table 8: Solution 3 architecture of Capability Configuration, roles, technical systems and functional blocks.....	26
Table 9: Functional architecture overview.....	27
Table 10: Roles impacted by the Solution.....	28
Table 11: Services Description for Services created by PJ.05 .....	45
Table 12: Service Description for Services used by PJ.05.....	45
Table 13: Service Provisioning.....	46

## List of Figures

Figure 1. Flexible allocation of aerodromes to MRTMs .....	15
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Figure 2: Solution 35 Relations..... 16

Figure 3. Resource Connectivity Model NSV-1 for PJ.05-W2-35..... 29

Figure 4. Infrastructure Connectivity Model NSV-2 for PJ.05 Solution 35 ..... 30

Figure 5: Resource Orchestration Model [NSV-4] MRTM (General view)..... 33

Figure 6: Resource Orchestration Model [NSV-4] MRTM (number 1) ..... 34

Figure 7: Resource Orchestration Model [NSV-4] MRTM (number 2) ..... 35

Figure 8: Resource Orchestration Model [NSV-4] MRTM (number 3) ..... 36

Figure 9: Resource Orchestration Model [NSV-4] MRTM (number 4) ..... 37

Figure 10: [NSV-4] Emergency Situation – Transfer of an aerodrome/aerodromes to another MRTM within the RTC with RTC Supervisor support ..... 39

Figure 11: [NSV-4] Transfer of aerodromes to any MRTM within a RTC requested by RTC Supervisor40

Figure 12: [NSV-4] Coordination between MRTM for aerodrome transfer purposes ..... 41

Figure 13. Infrastructure Connectivity Model NSV-2 for PJ.05 Solutions 35 ..... 44

# 1 Executive summary

The SESAR2020 PJ05.35 Technical Specification describes the functions of a remote tower solution, and provides a requirement specification for those functions. It is developed aiming for V3 maturity for Solution PJ05-35.

It is based on SESAR1 project 12.04.07 D09 Remote Tower Technical Specifications [43] and SESAR2020 project 05 D3.1.010 [43]. While the SESAR1 TS was written to separate operation of a single aerodrome from the one of a multiple aerodrome, this TS views operation of a single aerodrome to be included in a multiple aerodrome operation.

Solution 35 can be considered an evolution of Solution 03. More than one MRTMs are located within a Remote Tower Centre (RTC), which is under charge of a RTC Supervisor. Every MRTM is technically enabled to display all the aerodromes under control and their respective relevant data. The RTC should allow the ATCO to transfer control of a remotely controlled aerodrome from a MRTM to another one.

In SESAR2020 the intention is to ensure consistency and coherency between the delivered documents using EATMA, and the architectural diagrams showed in this document are present in EATMA.

The architecture of the main Capability Configuration, roles, technical systems and functional blocks is summarized for solution 3 in the following table:

Capability Configuration	Role	Technical System	Functional Block
TWR (Step 2)	Tower Clearance Delivery Controller	Aerodrome ATC	Visual Panorama
			CHMIM Aerodrome ATC
			G/G Communication ATC
			Technical Supervision
			Aerodrome Flight Data Processing
			Support Functions Aerodrome ATC
			Aerodrome Weather Information Management
			Aerodrome Surveillance
			Multiple Remote Aerodromes Management
	Tower Ground Controller		
Tower Runway Controller			
RTC Supervisor			
		Voice	A/G Voice Communication

**Table 1: Solution 3 architecture of Capability Configuration, roles, technical systems and functional blocks**

The architecture is based on requirements, organized in 6 different categories and based on operational requirements listed in the OSED.



## 2 Introduction

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### 2.1 Purpose of the document

This document describes the functions of a solution with more than one MRTM located within a Remote Tower Centre (RTC), and provides a requirement specification for those functions.

The aim is not to answer *how* this kind of solution is implemented nor to describe a specific multiple remote tower solution, but to describe on a general level the functionality such a solution must provide in order to fulfil the operational methods and scenarios described in the PJ05 OSED for Remote Provision of ATS to Aerodromes. The purpose is also to provide a requirement description that can be used by stakeholders to procure such a technical solution.

### 2.2 Scope

This document is developed aiming for V3 maturity, and describes the TS related to a Remote Tower Centre with flexible allocation of aerodromes to a MRTM. Solution 35 can be considered an evolution of Solution 03. More than one MRTMs are located within a Remote Tower Centre (RTC), which is under charge of a RTC Supervisor. Every MRTM is technically enabled to display all the aerodromes under control and their respective relevant data. The RTC should allow the ATCO to transfer control of a remotely controlled aerodrome from a MRTM to another one.

The solution addressed in this TS is:

- **Solution PJ05-W2-35: Multiple Remote Tower and Remote Tower Centre**

### 2.3 Intended readership

The intended audience for this document is primarily all the partners involved in SESAR 2020 PJ.05-35.

External to the SESAR project, other stakeholders are to be found among:

- ANS providers;
- ATM infrastructure and equipment suppliers.
- Airspace users;
- Airport owners/providers;
- Affected NSA;
- Affected employee unions;

SESAR 2020 Projects/Solutions with dependencies to PJ

- PJ.14-W2 I-CNSS  
(Solution PJ.14-W2-84 — New use and evolution of Cooperative and Non-Cooperative Surveillance)

Other SESAR 2020 Projects/Solutions with dependencies to PJ05-W2-35:

- PJ.14-W2 I-CNSS  
(Solution PJ.14-W2-84 — New use and evolution of Cooperative and Non-Cooperative Surveillance)

SESAR 2020 Transversal Projects:

- PJ.19 W2 (CI) Content Integration
- PJ.20 W2 (AMPLE) Master Plan Maintenance

## 2.4 Background

This document considers the requirements done in SESAR 1 for project included in the deliverable 12.04.07 D09 Remote Tower Technical Specifications [43] and also the work done in SESAR 2020 PJ05 in Wave 1.

The work done for single remote tower, and remote contingency, is the baseline for the multiple remote tower concepts but is not addressed anymore in this document (for completeness the requirements can be found in the Appendix A at the end of this document). See chapter assumptions [1] for the detailed assumption.

While the SESAR1 TS was written to separate the operation of a single aerodrome from the operation of a multiple aerodrome, this TS views the operation of a single aerodrome to be included in a multiple aerodrome operation.

All pre-described solutions regarding Remote Tower concept developed and validated under SESAR programme projects (SESAR 1, SESAR 2020 wave1) have delivered results determining the solution PJ05-02-V3 as reference for Solution 35 regarding Multiple Remote Tower Modules. (Most requirements for this solution can be found in the Appendix B at the end of this document while some are included in the requirement set in this document as they are seen to be validated in PJ05-W2-35 under other conditions compared to in PJ05-02). Additionally, RTC and flexible allocation of the aerodromes between the different MRTMs in solution 35 can be considered as successor of solution PJ05-03-V2, and will be validated at V3 maturity level.

In this solution an MRT specific surveillance data source, being developed in sol 84 c, can optionally be used to enhance ground visibility.

PJ05 TS has been used as an input for the following SESAR2020 validation exercises:

- EXE-05.35-V3-2.1 – DLR
- EXE-05.35-V3-2.2 – COOPANS
- EXE-05.35-V3-2.3 – INDRA
- EXE-05.35-V3-2.4 – ENAV
- EXE-05.35-V3-2.5 – DFS

## 2.5 Structure of the document

This document is organized as follows:

- Chapter 1: Executive Summary
- Chapter 2: Introduction
- Chapter 3: SESAR Solution impacts on Architecture
- Chapter 4: Technical Specifications
  - Section 4.1.1: Resource Connectivity Model
  - Section 4.1.2: Resource Orchestration view
  - Section 4.1.3: Functional Block Descriptions
  - Section 4.1.4: Infrastructure Connectivity Model
  - Section 4.1.5: Service view
  - Section 4.2: Functional and non-Functional Requirements
- Chapter 5: Implementation Options, no content
- Chapter 6: Assumptions
- Chapter 7: References and applicable documents
- Appendix A: Baseline requirements from SESAR1
- Appendix B: Baseline requirements from SESAR2020 wave 1

In this document, there are no Service Description Document or Service Technical Design Document, added as there are no identified plans for SWIM taken in account in this version.

## 2.6 Glossary of terms

Term	Definition	Source of the definition
AIR-REPORT	A report from an aircraft in flight prepared in conformity with requirements for position, and operational and/or meteorological reporting.	ICAO, Annex 3
ATS (Air Traffic Service)	A generic term for the three services Flight Information Service (FIS), Alerting Service (ALRS) and Air Traffic Control Service (ATC). In this document, when the term ATS is used, it is usually referring to TWR or AFIS in the context	ICAO, Annex 11
Aerodrome Control Service (TWR)	The air traffic control (ATC) service provided by the Air Traffic Control Officer (ATCO) for an aerodrome.	ICAO, Annex 11

Multiple Remote Tower Module (MRTM)	Term for the complete module including both the CWP(s) and the Visual Presentation display screens. A <b>MRTM</b> is defined as a work station for one or two ATCOs able for providing ATS to more than one aerodrome. The <b>MRTM</b> will enable the ATCO to maintain a view over the aerodromes including the manoeuvring area and surfaces as stipulated in regulation.	SESAR2020 PJ05 Multiple Remote Tower Project
Remote Tower Module (RTM)	<b>Remote Tower Module</b> (RTM) is a combination of systems and constituents from where remote aerodrome ATS can be provided, including one or more ATCO/AFISO workstation(s) and the visual presentation. (It can be compared with the tower cabin of an aerodrome conventional tower.).	EASA
Technical Enablers	Technical Enablers refer to additional features and functions within a single or a multiple module that enable the provision of ATS using the concept. These technical features will assist in the areas of visualisation and operational performance. Further information on the requirement status of the Technical Enablers is given within this document.	SESAR
Remote Tower	Remote Tower is a geographically independent facility from which aerodrome ATS is provided principally through indirect observation of the aerodrome and its vicinity, by means of a visual surveillance system. (It is to be seen as a generic term, equivalent in level to a conventional tower).	EASA
Remote Tower Centre (RTC)	A Remote Tower Centre (RTC) is a facility housing one or more Remote Tower Modules.	EASA

Remote Tower Centre Supervisor (RTC SUP)	Remote Tower Centre Supervisor (RTC SUP) The role of an RTC supervisor may be established in order to provide an efficient set up at all times and guarantee a flexible system by means of; maintaining overall supervision of all aerodromes within the RTC; managing the allocation of staff and Modules (MRTMs/RTMs); performing planning, administration, allocation of tasks and supervision of technical systems.	SESAR2020 PJ05 Multiple Remote Tower Project
Visual Presentation	Visual Presentation is the term for the collected aerodrome sensor data (from cameras and/or other sensors) and presented to the ATCO/AFISO in order to provide situational awareness of the aerodrome and its vicinity. Note that other terms such as Visual Reproduction and Visual Representation have been applied throughout the lifetime of the projects. The definition of the terms should be taken as identical to the definition provided for visual presentation.	EASA

Table 2: Glossary

## 2.7 Acronyms and Terminology

Term	Definition
AFIS	Aerodrome Flight Information Service
AFISO	Aerodrome Flight Information Service Officer
A/G	Air/Ground
ANSP	Air Navigation Service Provider
ATCO	Air Traffic Control Officer
ATM	Air Traffic Management

<b>ATS</b>	Air Traffic Service
<b>CHMIM</b>	Controller Human Machine Interaction Management
<b>CTR</b>	Control Zone
<b>CWP</b>	Controller Working Position
<b>EATMA</b>	European ATM Architecture
<b>FB</b>	Functional Block
<b>FP</b>	Flight Plan
<b>G/G</b>	Ground/Ground
<b>ILS</b>	Instrument Landing System
<b>IRS</b>	Interface Requirements Specification
<b>ISRM</b>	Information Services Reference Model
<b>MET</b>	Meteorology, meteorological
<b>MRTM</b>	Multiple Remote Tower Module
<b>NAF</b>	NATO Architecture Framework
<b>NSV</b>	NAF System View
<b>OSED</b>	Operational Service and Environment Definition
<b>OTW</b>	Out-The-Window
<b>PTZ</b>	Pan-Tilt-Zoom
<b>RTC</b>	Remote Tower Centre
<b>RTM</b>	Remote Tower Module
<b>RVR</b>	Runway Visual Range
<b>SESAR</b>	Single European Sky ATM Research Programme
<b>SJU</b>	SESAR Joint Undertaking
<b>SLG</b>	Signal Light Gun
<b>SPR</b>	Safety and Performance Requirements
<b>SWIM</b>	System Wide Information Model

Table 3: Acronyms and terminology

## 3 SESAR Solution Impacts on Architecture

### 3.1 Target Solution Architecture

#### 3.1.1 SESAR Solution(s) Overview

##### Remote Tower Centre with Flexible Allocation of Aerodromes to Multiple Remote Tower Modules (Solution 35)

Solution 35 can be considered an evolution of Solution 03. More than one MRTMs are located within a Remote Tower Centre (RTC), which is under charge of a RTC Supervisor. Every MRTM is technically enabled to display all the aerodromes under control and their respective relevant data. The RTC should allow the ATCO to transfer control of a remotely controlled aerodrome from a MRTM to another one.

The Operational Improvement brought into operation that summarises the PJ.05-35 concept is:

- SDM-0210 – Highly Flexible Allocation of Aerodromes to Remote Tower Modules

The image below is a representation of the concept afore described.

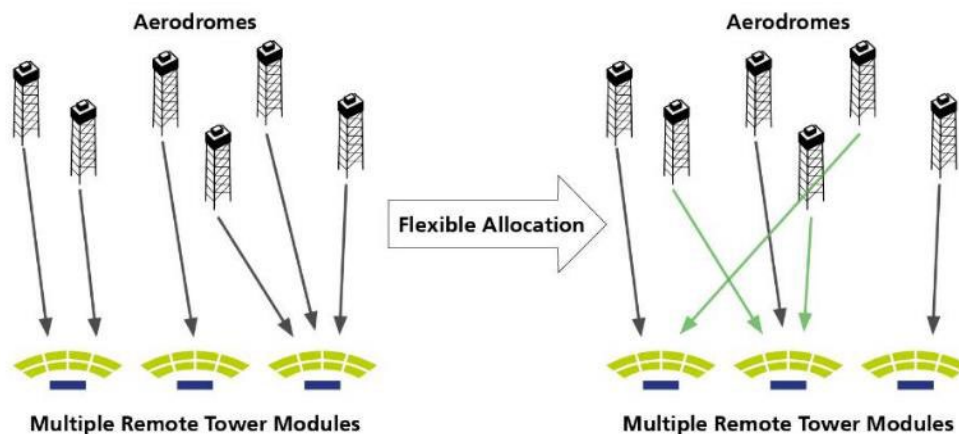


Figure 1. Flexible allocation of aerodromes to MRTMs

The RTC Supervisor, supported by a planning tool, is in charge of allocating the different aerodromes to the available MRTMs. The distribution is determined taking into account several parameters such as aerodrome information, nowcast and forecasted traffic, weather information and controllers' endorsements.

Solution 35 also covers the situation where Approach services are delivered combined with the Tower services from a common MRTM by the same ATCO.

Moreover, this Solution adds an optional automation support to controllers by alerting them in case of potential conflict.

For Solution 35 the following architecture is used. To be highlighted that these are the FBs impacted by the mandatory Enablers of this Solution; therefore, these FBs will be the main impacted ones and the core of this solution.

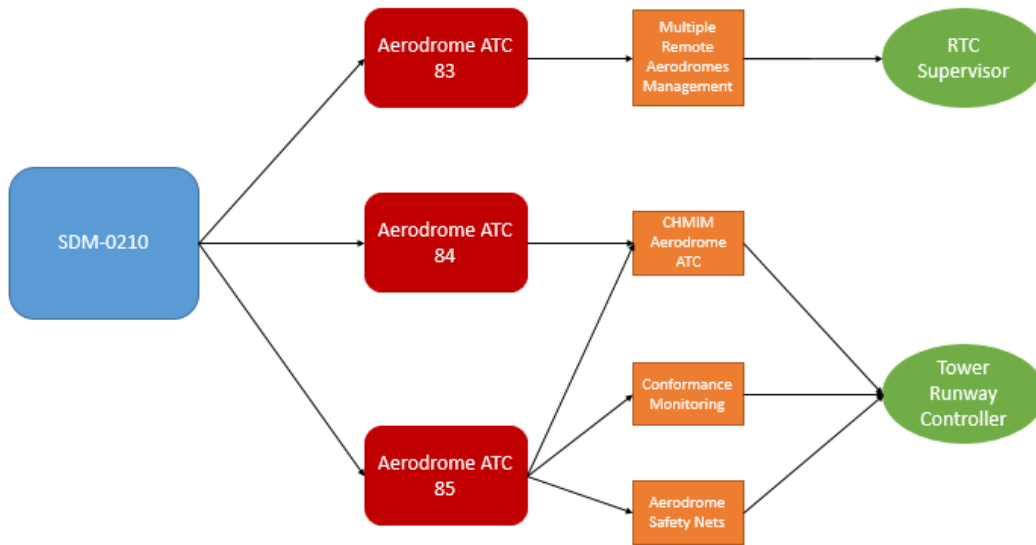


Figure 2: Solution 35 Relations

SESAR Solution ID and Title	Functional Blocks/Role impacted by the SESAR Solution (from EATMA)	Enabler ID (from EATMA)	Enabler Title (from EATMA)	Enabler coverage
PJ05-W2-35: Multiple Remote Tower and Remote Tower Centre	Multiple Remote Aerodromes Management / RTC Supervisor	AERODROME-ATC-83	Multiple Remote Tower planning tools for Supervisor	Fully
	CHMIM Aerodrome ATC	AERODROME-ATC-84	MRTM allowing dynamic allocation of aerodromes	Fully
	Conformance Monitoring / ATCO	AERODROME-ATC-85	Provide the MRTM with automation functionalities to reduce controller workload	Fully
	Aerodrome Safety Nets / ATCO		AERODROME-ATC-88 (optional)	Multiple Remote Tower Module provided with



	CHMIM Aerodrome ATC / ATCO		basic ground surveillance	
		CTE-S10 (optional)	Surveillance MRT Sensor	Fully

**Table 4: PJ.05-W2-35 Scope and related Functional Blocks/roles & Enablers**

The Roles directly impacted by this Solution are the Tower Ground Controller, Tower Runway Controller, Tower Clearance Delivery Controller and RTC Supervisor.

- Tower Ground Controller, Tower Runway Controller, Approach Controller and Tower Clearance Delivery: The three Roles perform the same activities that they would do in a conventional tower, but remotely in the MRTM. One single controller can be in charge of the three Roles for more than one aerodrome at the same time. One controller is in charge of each of the active MRTM. He or she can request to transfer an aerodrome to another controller in case it is required due to an overload of workload.
- RTC Supervisor: He or she is in charge of the correct operation of the RTC. PJ.05-35 sets as his/her responsibility to find the optimal distribution of aerodromes amongst available MRTMs in the RTC. A controller in a MRTM can request support from the RTC Supervisor, who decides whether an aerodrome transfer is needed or if support from his or her side is sufficient.
- Technical personnel: He or she is in charge of the system maintenance coordination to be carried out by a qualified engineer/technician Technical personnel need to be aware of the technical status.

### 3.1.1.1 Deviations with respect to the SESAR Solution(s) definition

No deviations are listed in this version.

### 3.1.1.2 Relevant Use Cases

A technical architecture has been developed in order to cover the following use cases mentioned in the OSED.

UC 1:1 / Provide ATS with simultaneous movements (ground and air) at different aerodromes from one MRTM
UC 1:2 / Provide ATS to co-operative RPAS and normal aircraft at a time to different aerodromes <i>NOTE: Regulations for RPAS at airports will be the same for local ATS and RTS. This is also applicable for Multiple Remote Tower (therefore this use case will not be tested specifically).</i>
UC 1:3 / Control of Vehicles in the Manoeuvring Area to different aerodromes
UC 1:4 / Provide ATS to simultaneous landings at different aerodromes
UC 1:5 / Provide ATS to simultaneous departures at different aerodromes
UC 1:6 / Provide ATS to a landing and a departing aircraft simultaneously at different aerodromes

UC 1:7 / VFR flight in the traffic circuit with an arriving IFR flight with simultaneous movements on another aerodrome
UC 1:8 / ATCO planning of movements and workload supported by short term planning tool
UC 1:9 / Failure of parts of the technical system building the Remote Tower Service, e.g. Camera view, screens, voice com
UC 3:1 / Transfer of aerodrome between MRTMs within an RTC, initiated by RTC supervisor role or ATCO
UC 3:2 / RTC Supervisor capacity and workload planning
UC 3:3 / Emergency Situation – Supported by Supervisor
UC 3:4 / Emergency Situation – Transfer of aerodrome(s) to another MRTM within the RTC
UC 4:1 / Provide ATS with simultaneous TWR and APP from one MRTM

The Technical Use Cases developed are summarised in the following technical views:

### MRTM

The overall working of the MRTM and the interactions between the different parts of the system are presented. It describes how the data (e.g. vehicle or aircraft requests) arrive to the MRTM, flowing through or making use of some systems proper of the Local TWR that is being represented remotely.

Information coming from more than one Local TWR can be managed by a single MRTM.

The Technical UC represents which Functional Block takes care of each part proper of the operation. Some of them are the following:

- The **Visual Panorama** displays the visual presentation of the remotely controlled aerodrome.
- Data from the remote active aerodromes (e.g. FPs, traffic situation) are collected and managed by the **Multiple Remote Aerodromes Management** and is presented in the **CHMI**.
- **Technical Supervision** checks MRTM and remote aerodrome system status.
- **Aerodrome Surveillance** and **Aerodrome Flight Data Processing** are also involved.

This in mind, Technical UC covers the Use Cases in relation with providing ATS from a MRTM to different remotely controlled aerodromes at the same time.

Request to transfer aerodromes from a fixed MRTM to a spare MRTM to meet requested capacity

This use case describes the flow of an aerodrome transfer when requested traffic levels are higher than ATCO capacity in multiple mode.

An ATCO in a MRTM detects a necessity of transferring an aerodrome due to an excess of workload. The aerodrome transfer procedure is initiated by requesting to another ATCO in a different MRTM to take over an aerodrome(s).

Aerodrome transfer procedure continues in the Technical UC “Coordination between MRTM for aerodrome transfer purposes”.

### **Emergency Situation – Transfer of an aerodrome/aerodromes to another MRTM within the RTC with RTC Supervisor support**

This use case describes an emergency situation where an ATCO requests the RTC Supervisor support. The RTC Supervisor assesses whether an aerodrome transfer is needed to resolve the situation.

The planning tool presents data from the active aerodromes in the RTC, as well as the picture for the different MRTM. This information supports the RTC Supervisor when assessing the possibility of transferring one of the aerodromes active in the MRTM where the emergency is happening.

In case the RTC Supervisor finds it required to transfer an aerodrome, he or she requests both ATCOs involved in the transfer to begin the transfer procedure. This triggers the coordination between them, which is described in the Technical UC: “Coordination between MRTM for aerodrome transfer purposes”.

### **Transfer of aerodromes to any MRTM within a RTC requested by RTC Supervisor**

This use case describes an aerodrome transfer requested by the RTC Supervisor.

The planning tool presents an overview of traffic requests to the different aerodromes connected to the RTC. Due to a higher request than feasible for an ATCO in one MRTM, the TRC Supervisor initiates a transfer of a suitable aerodrome to another ATCO in another MRTM in the RTC.

This triggers the coordination between them, which is described in the Technical UC: “Coordination between MRTM for aerodrome transfer purposes”.

### **Coordination between MRTM for aerodrome transfer purposes**

This use case represents the continuation of an aerodrome transfer procedure. It starts when an ATCO in a MRTM requests an aerodrome transfer to another MRTM.

The MRTM is prepared for the new module corresponding to the aerodrome transferred. The Visual Panorama displays the visual presentation, and CHMI is set up accordingly.

Coordination between the two ATCOs begins and the ATCO that is about to take over the aerodrome receives the information necessary to do it, e.g. aerodrome situation, traffic picture.

Once the transfer is accepted, the ATCO that is no longer in charge of the aerodrome transferred closes the module corresponding to it and keeps controlling the remaining aerodrome(s) in the MRTM, if any.

To be noted that the Technical UC “*MRTM*” from PJ.05 Solution 02 is also applicable for this Solution, since it describes the overall working of a MRTM.

#### **3.1.1.2.1 Trace Relevant Use Cases and Technical Models**

Table hereunder show the trace of the Technical Use cases developed in the validation against the Operational Use Cases from SESAR Solution 05-02 SPR-INTEROP/OSED for V3 – Part I [41].

Operational Use Case	Op. UC Description	Related Technical Model
UC 1.1 / Provide ATS with simultaneous movements (ground and air) at different aerodromes from one MRTM	This use case describes the baseline for how to provide ATS for both air and ground movements in multiple remote Towers.	<i>MRTM</i>
UC 1.2 / Provide ATS to co-operative RPAS and normal aircraft at a time to different aerodromes	This use case describes the provision of air traffic service to a manned aircraft and a remotely controlled aircraft at the same time at different aerodromes	<i>MRTM</i>
UC 1.3 / Control of Vehicles in the Manoeuvring Area to different aerodromes	This use case describes how to provide ATS for vehicles on ground in multiple remote Towers.	<i>MRTM</i>
UC 1.4 / Provide ATS to simultaneous landings at different aerodromes	This use case describes how to provide ATS to simultaneous landings to different Airports	<i>MRTM</i>
UC 1.5 / Provide ATS to simultaneous departures at different aerodromes	This use case describes how to provide ATS to simultaneous departures at different airports	<i>MRTM</i>
UC 1.6 / Provide ATS to a landing and a departing aircraft simultaneously at different aerodromes	This use case describes how to provide ATS to a landing and a departing aircraft simultaneously at different airports	<i>MRTM</i>
UC 1.7 / VFR flight in the traffic circuit with an arriving IFR flight with simultaneous movements on another aerodrome	This use case describes how to provide ATS to a VFR flight in the traffic circuit while there is an arriving IFR flight to another aerodrome with simultaneous movements in the MRTM	<i>MRTM</i>
UC 1.8 / ATCO planning of movements and workload supported by short term planning tool	This use case describes how the ATCO is supported by planning tools in order to plan movements and workload up to 6 hours ahead to avoid task overload.	<i>MRTM</i>
UC 1.9 / Failure of parts of the technical system building the Remote Tower Service, e.g. Camera view, screens, voice com	This use case describes a degraded mode where the technical system in the MRTM or at the airport malfunctions, e.g. of systems can be screens, voice com, input devices, cameras, ILS or similar.	
UC 3.1 / Transfer of aerodrome between MRTMs within an RTC, initiated by RTC supervisor	This use case describes how the role of a RTC supervisor initiates transfer of aerodromes between MRTMs in a flexible way within an RTC with several MRTMs.	<i>MRTM</i> <i>Transfer of aerodromes to any MRTM within a RTC requested by RTC Supervisor</i>

Operational Use Case	Op. UC Description	Related Technical Model
		<i>Coordination between MRTM for aerodrome transfer purposes</i>
UC 3.2 / RTC supervisor capacity and workload planning	This use case describes the daily flow in a RTC where aerodromes are allocated to MRTMs flexibly.	<i>Transfer of aerodromes to any MRTM within a RTC requested by RTC Supervisor</i>  <i>Coordination between MRTM for aerodrome transfer purposes</i>
UC 3.3 / Emergency Situation – Supported by Supervisor	This use case describes an emergency situation where the RTC supervisor is able to support the ATCO in control of the emergency situation by introducing and following up transfer of aerodrome/aerodromes to other MRTM/MRTMs	<i>Emergency Situation – Transfer of an aerodrome/aerodromes to another MRTM within the RTC with RTC Supervisor support</i>  <i>Coordination between MRTM for aerodrome transfer purposes</i>
UC 3.4 / Emergency Situation – Transfer of aerodrome(s) to another MRTM within the RTC	This use case describes the flow where there is an emergency situation at an aerodrome controlled from a MRTM where a transfer of any aerodrome/aerodromes is the mitigation.	<i>Emergency Situation – Transfer of an aerodrome/aerodromes to another MRTM within the RTC with RTC Supervisor support</i>  <i>Coordination between MRTM for aerodrome transfer purposes</i>
UC 4.1 / Provide ATS with simultaneous TWR and APP from one MRTM	This use case describes how to provide ATS for both air and ground movements as well as approach functions in multiple remote Towers.	<b>MRTM</b>

**Table 5: Trace relevant Use Cases vs Technical Models**

It has to be noted that the technical architecture is traced to the operational Use Cases modelled in detail in MEGA.

### 3.1.1.3 Applicable standards and regulations

Standards and regulations for multiple remote tower operations need to be developed by EASA and EUROCAE based on the ones provided for single remote tower.

- [EUROCAE ED-240A](#), [38]
- [EASA ED Decision 2019/004/R](#), [39]

### 3.1.2 Capability Configurations required for the SESAR Solution

SESAR Solution ID and Title	Capability Configurations (CCs) (from EATMA)	Sub-Operating Environment(s) where the CCs operate	Capabilities (from EATMA)	Nodes (from EATMA)	Stakeholders (from EATMA)
PJ05-W2-35: Multiple Remote Tower and Remote Tower Centre	TWR (Step 2)	Small and Other Airports	None	Aerodrome ATS	ANSPs

Table 6: List of Capability Configuration required for the SESAR Solution

The table above shows the relevant Capability Configurations of the Solution and their relation to the Sub-Operating Environments, Capabilities, Nodes and Stakeholders.

### 3.2 Changes imposed by the SESAR Solution on the baseline Architecture

Enabler ID (from EATMA)	Enabler Title (from EATMA)	Changes
AERODROME-ATC-83 – Multiple Remote Tower planning tools for Supervisor	Multiple Remote Aerodromes Management	<p>FB is created. This functional block provides functionalities to forecast and plan in a short and medium term the allocation of multiple remote aerodromes and staff to different Multiple Remote Tower Modules (MRTMs) within a Remote Tower Center. For this allocation, different features are taken into account, such as the aerodromes demand, forecasted weather...</p> <p>FB is updated to perform the following Functions: Display traffic and aerodrome situation within RTC</p>

AERODROME-ATC-84 – MRTM allowing dynamic allocation of aerodromes	Visual Panorama (PJ.05)	FB is updated to perform the following Functions: <ul style="list-style-type: none"> <li>- Display OTW from active aerodromes</li> </ul> Shut down OTW from aerodrome transferred
	Controller Human Machine Interaction Management Aerodrome ATC (PJ.05)	CHMIM is updated to perform the following Functions: <ul style="list-style-type: none"> <li>- Set Up New Aerodrome</li> </ul> Shut Down Aerodrome Transferred
AERODROME-ATC-85 – Provide the MRTM with automation functionalities to reduce controller workload	Conformance Monitoring	Conformance Monitoring is updated to perform the following Functions: Monitor Conformance to Clearance
CTE-S10	Surveillance MRT Sensor	optionally

**Table 7: List of changes due to the SESAR Solution**

## 4 Technical Specifications

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### 4.1 Functional architecture overview (general introduction for all solutions)

This section describes the Functions needed to perform the Solution concepts and provides a functional view of how the technical systems, functional block(s), system ports and roles achieve the operational needs.

Some Functional Blocks within the domains impacted by the *Remote Provision of ATS* concept are substantially impacted and will be addressed in detail in this document.

- **Controller Human Machine Interaction Management** provides the controllers with a graphical user interface and with the means to interact with the aerodrome ATC system. CHMIM will allow ATCO, with a graphical user interface, to provide ATS remotely to multiple aerodromes simultaneously from a single working position.
- **Visual Panorama** provides Tower Controllers with a clear view of the real traffic situation and with all the necessary traffic data concerning a Remote Tower of others aerodrome ATC systems, in order to assist them in their control tasks.

OTW can also help the Tower Controller to identify targets in Low Visibility with the support of the Aerodrome Surveillance Data. These data are the result of merging the surveillance information provided by the different surveillance sources providing a unique picture of the actual traffic situation.

The remote tower implementation will use these (with the possible addition of more camera sensors) and provide the ATCO with a visual presentation of the aerodrome to allow ATS to be provided remotely.

- **Operational Supervision** allows the supervisor to manage the most appropriate operational configuration, according to traffic demands and needs, and to react in case of system fault, re-assigning and distributing available resources in order to maintain adequate safety levels and quality of service. A high-level status information of all operations components and services is provided for checking operational availability of airport equipment and remote tower modules.
- **Multiple Remote Aerodromes Management** provides functionalities to forecast and plan in a short and medium term the allocation of multiple remote aerodromes and staff to different Multiple Remote Tower Modules (MRTMs) within a Remote Tower Center (RTC). For this allocation, different features are taken into account, such as the aerodromes demand, forecasted weather...
- **Technical Supervision:** is in charge of the technical supervision of an Aerodrome ATC system (e.g. monitoring the services provided by the system, starting, stopping or re-starting the system or part of it). Providing a high-level view of all relevant system components for all airports as an overview of the overall system status and a detail view enabling the technical supervisor to investigate problems in detail and to identify the failed component.



Some of the functional blocks will be impacted in a minor way only and will only be briefly addressed in this document. They include:

- **Support functions:** Recording of visual aerodrome data.
- **G-G / A-G Voice communication:** provides the A-G functions performed by a VCS, and the functions performed to handle ground ATS communication through various communication interfaces.
- **Aerodrome Flight Data Processing:** manages the creation, update and modification of system flight plans up to/from the moment the aircraft takes-off/lands from all the controlled aerodromes.
- **Aerodrome Surveillance:** It merges the surveillance information provided by the different surveillance sources providing a unique picture of the actual traffic situation for each aerodrome under control.
- **Aerodrome Weather Information Management:** This functional block provides to the ATCO the access to the meteorological information that he/she needs to understand the status of the weather in the remote airport.

Some of the functional blocks will be mentioned for reference in this document as being impacted in solution 03 only. They include:

- **Aerodrome Safety Nets:** Detects and triggers the potential safety hazards situations on the controlled aerodromes movement areas, which comprise runway incursion, intrusion in protected areas, aircraft/aircraft and aircraft/vehicle collisions.
- **Conformance Monitoring:** Allows the ATCO for detection of conflicting ATC clearances (CATC) and the detection of non-conformance to ATC instructions and/or procedures for all the aerodromes under control.

The architecture of the main Capability Configuration, roles, technical systems and functional blocks is summarized for Solution 3 in the following table:

Capability Configuration	Role	Technical System	Functional Block
TWR (Step 2)	Tower Clearance Delivery Controller	Aerodrome ATC	Visual Panorama
			CHMIM Aerodrome ATC
	Tower Ground Controller		G/G Communication ATC
			Technical Supervision ATC
	Tower Runway Controller		Aerodrome Flight Data Processing
			Support Functions Aerodrome ATC
	RTC Supervisor		Aerodrome Weather Information Management
			Aerodrome Surveillance
	Conformance Monitoring		

			Multiple Remote Aerodromes Management
			Operational Supervision
			Aerodrome Safety Nets
		Voice	G-G/A-G Voice Communication

**Table 8: PJ.05-W2-35 architecture of Capability Configuration, roles, technical systems and functional blocks**

\*Cells in green are FB added in solution 03 with respect to solution 02. Multiple Remote Aerodromes Management FB is in turquoise colour because it is used in solution 03 with additional functions (mid-term planning function).

The table below presents a functional breakdown proper of this Solution. This functional breakdown is consistent with the architecture modelled in MEGA and the latest applicable version of EATMA. It should be noted that only those Functions related to Functional Blocks impacted by PJ.05-W2-35 were modelled and created. The rest of the Functional Blocks were inserted into the model to make it understandable; nevertheless, these FBs are considered as black boxes and the functions modelled within them are Functions with the same name as the FBs

Capability Configuration	Technical System	Functional Block	Function
TWR (Step 2)	Aerodrome ATC	Controller Human Machine Interaction Management Aerodrome ATC (PJ.05)	Set up new aerodrome; Shut Down Aerodrome Transferred; Display system status; Present data from remote active aerodrome(s); Present upcoming traffic situation;
		Visual (PJ.05) Panorama	Display OTW from active aerodromes; Shut Down OTW from Aerodrome Transferred; Process data from local aerodromes; Collect relevant data from local aerodrome;

Capability Configuration	Technical System	Functional Block	Function
			Distribute data collected from local aerodrome;
		Multiple Remote Aerodromes Management	Display traffic and aerodrome situation within RTC;  Collect FPs from all the aerodromes under control;  Distribute upcoming traffic situation;
		Technical Supervision ATC (PJ.05)	Check MRTM system status;  Check remote aerodromes system status;

Table 9: Functional architecture overview

Capability Configuration	Role	Function
TWR (Step 2)	Tower Runway Controller (PJ.05)	Approve Aerodrome Transfer; Check Traffic Situation; Close Aerodrome Transferred; Control Aerodrome(s); Coordinate with Another MRTM; Prepare Module for New Aerodrome; Receive Aerodrome Transfer Confirmation; Receive Aerodrome Transfer Request; Request to Transfer Aerodrome;
	RTC Supervisor (PJ.05)	Assess Aerodrome Situation; Decide to Transfer an Aerodrome from one MRTM to Another;

Capability Configuration	Role	Function
		Decide whether an Aerodrome Transfer is Needed; Request to Transfer Aerodrome; Support ATS Unit; Terminate Support to ATS Unit;

Table 10: Roles impacted by the Solution

### 4.1.1 Resource Connectivity view (one section per NSV-1)

This project mainly focuses on the TWR (Step 2) Capability Configuration as it is the one that is adding features to the current architecture. Other CCs are presented in the models in order to understand the full operation of the system; nevertheless, they will not be focused since they are out of the scope of the Solution.

The following diagram represents the high-level interactions between the CCs involved. The Resource Connectivity for Solution PJ.05-35 is described.

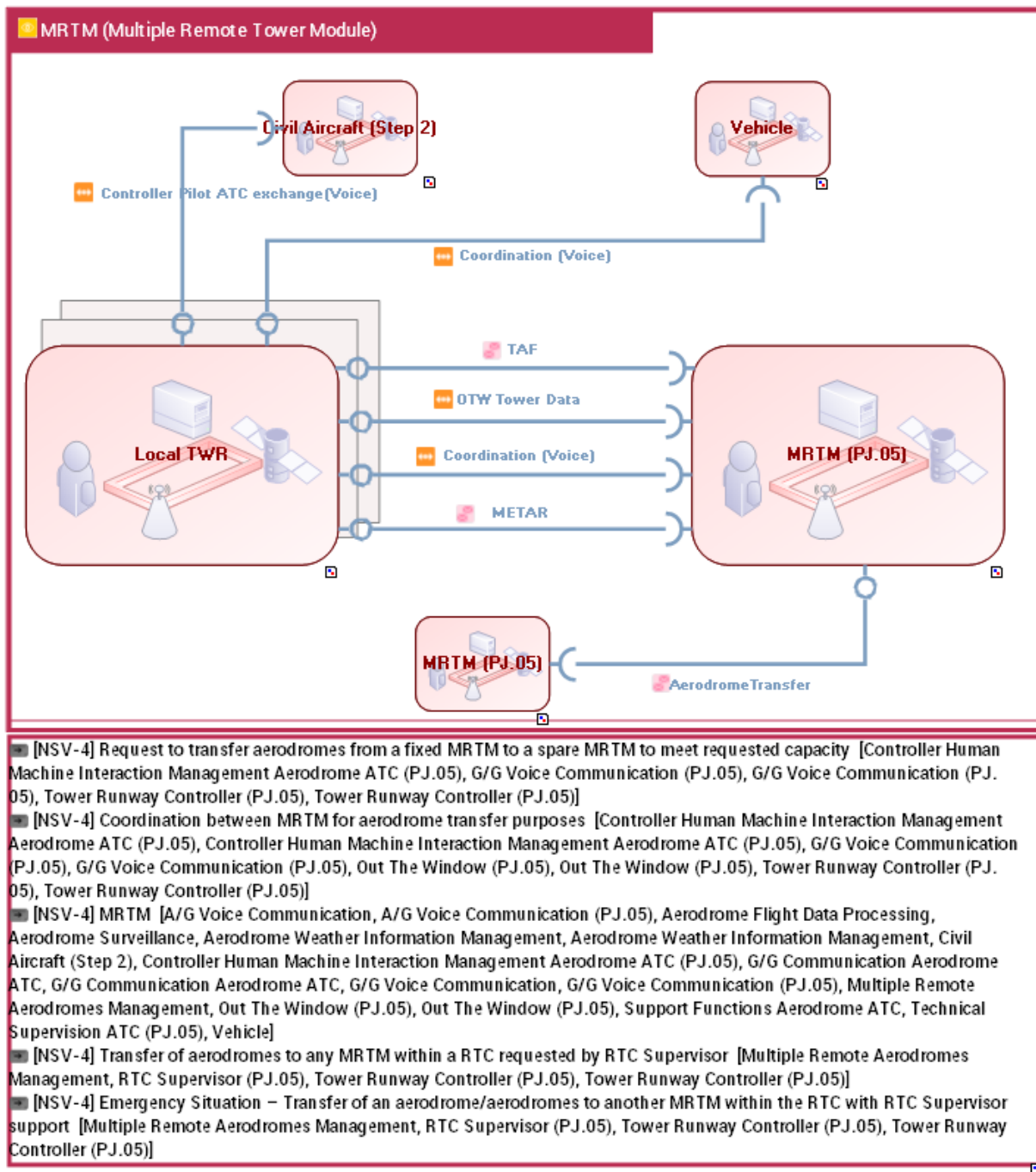


Figure 3. Resource Connectivity Model NSV-1 for PJ.05-W2-35

#### 4.1.1.1 Resource Infrastructure view (of the NSV-2)

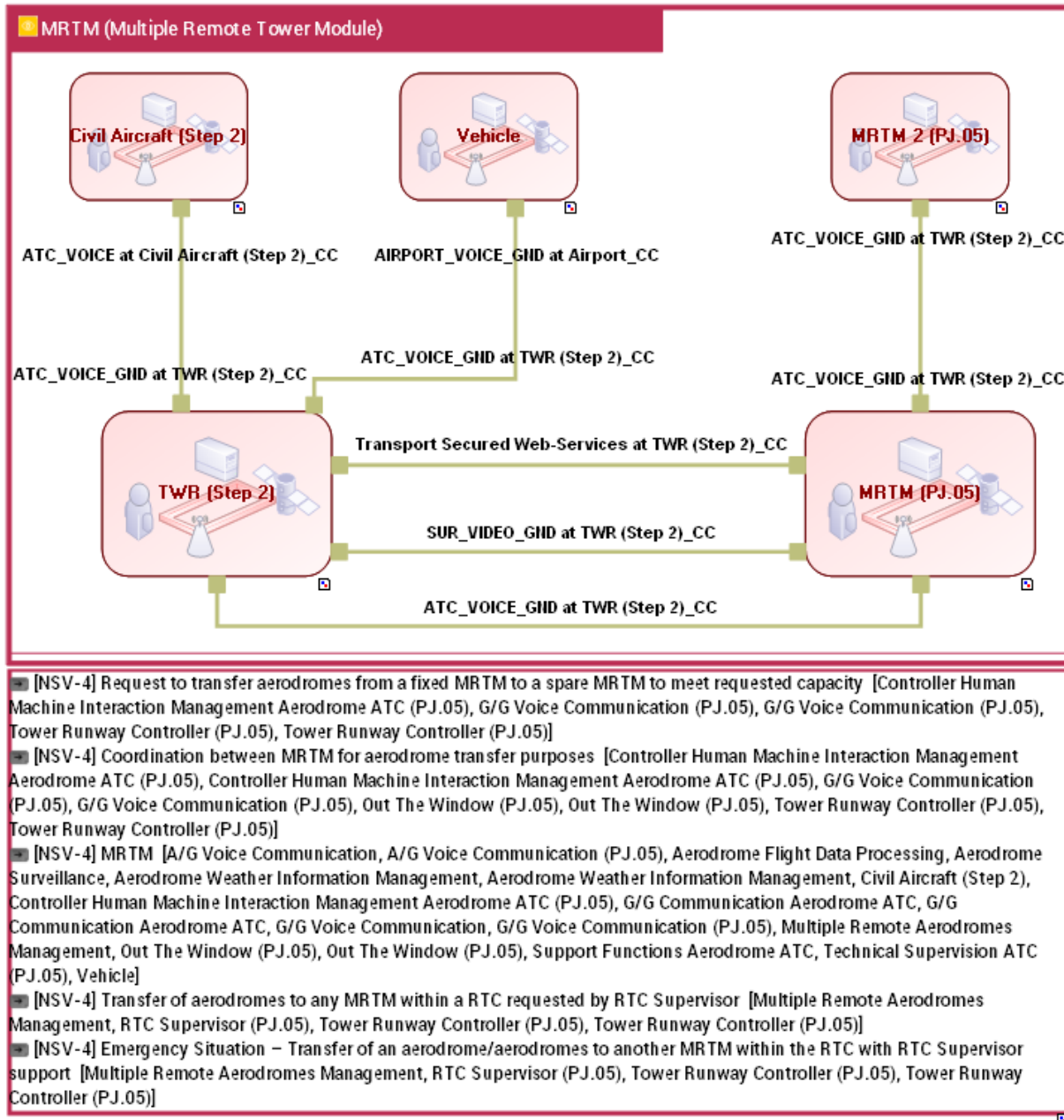


Figure 4. Infrastructure Connectivity Model NSV-2 for PJ.05 Solution 35

#### 4.1.1.2 Resource Orchestration view (all NSV-4s linked to the NSV-1)

The logical architecture is modelled in MEGA, and therefore compliant with EATMA, and lists all functional components of the remote tower solutions and their dependencies and relations.

Furthermore, external systems or sensors which are related to the remote tower systems are not shown in the NSV architecture as they are physical systems; however, they belong to the FB shown in this diagram. It is understood that they need to exist for the correct performance of the whole system. The logical information flow of flight data, support information and voice communication is the same

as for the conventional towers. Main difference is the remote connection to dedicated information sources at the local airport and the acquisition of this information via the WAN infrastructure.

The diagrams within this section represent the interactions of the main FBs involved. Due to the dimension of one of the models ([NSV-4] MRTM), the interactions and the different elements are barely appreciated in this document. In order to make the architecture understandable for the reader, the model has been divided in 4 sections and zoomed in 4 different pictures, one for each area defined. Nonetheless, this model, with a better resolution, is available in MEGA/EATMA.

[https://www.srvs.nm.eurocontrol.int/mega\\_prod/hopex/default.aspx#start](https://www.srvs.nm.eurocontrol.int/mega_prod/hopex/default.aspx#start)).

It should be noted that [NSV-4] MRTM has been produced within PJ.05 Solution 02 framework, but it is presented here since it is still of interest for PJ.05 Solution 35.

The description for each model follows:

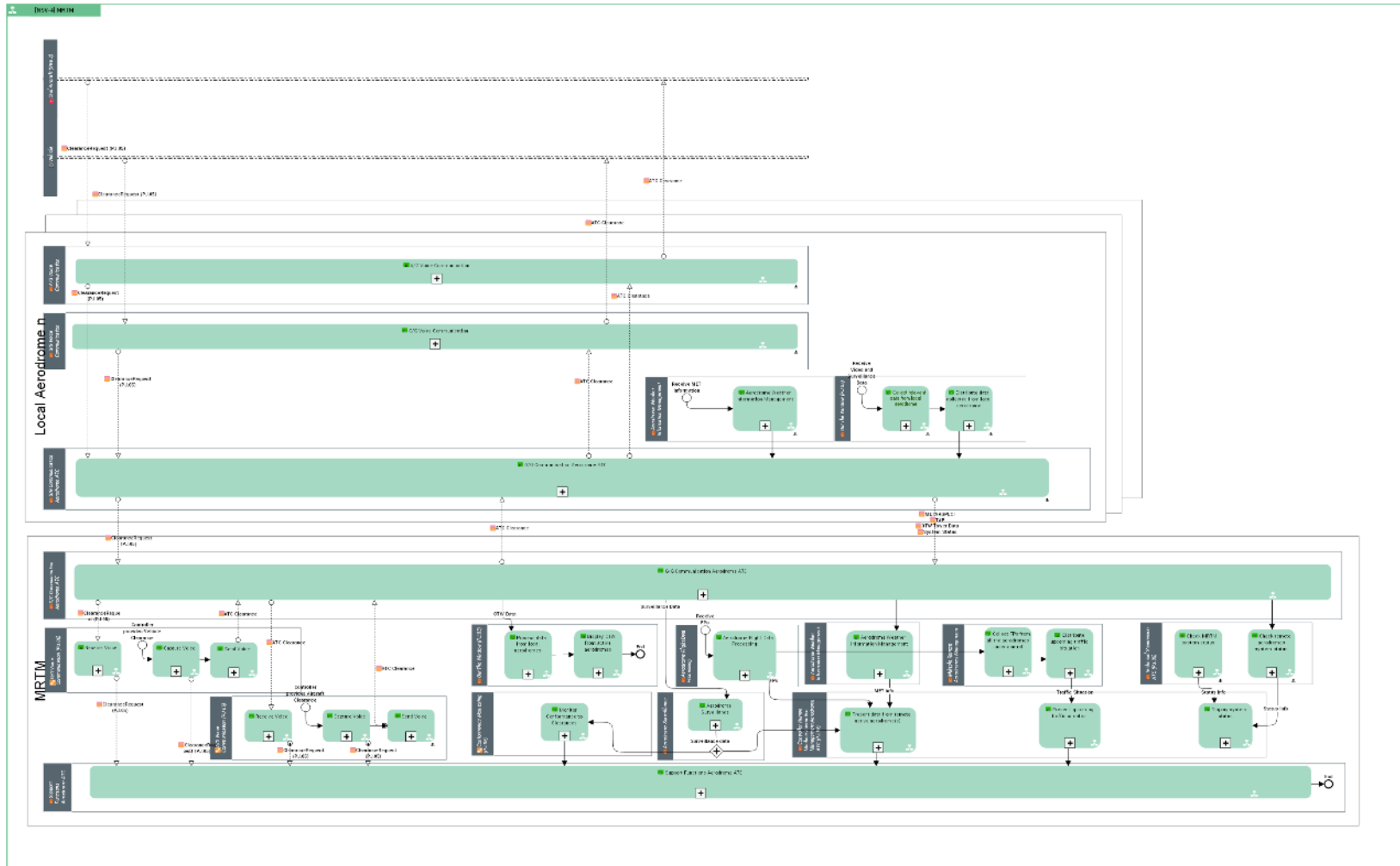






Figure 5: Resource Orchestration Model [NSV-4] MRTM (General view)

Founding Members



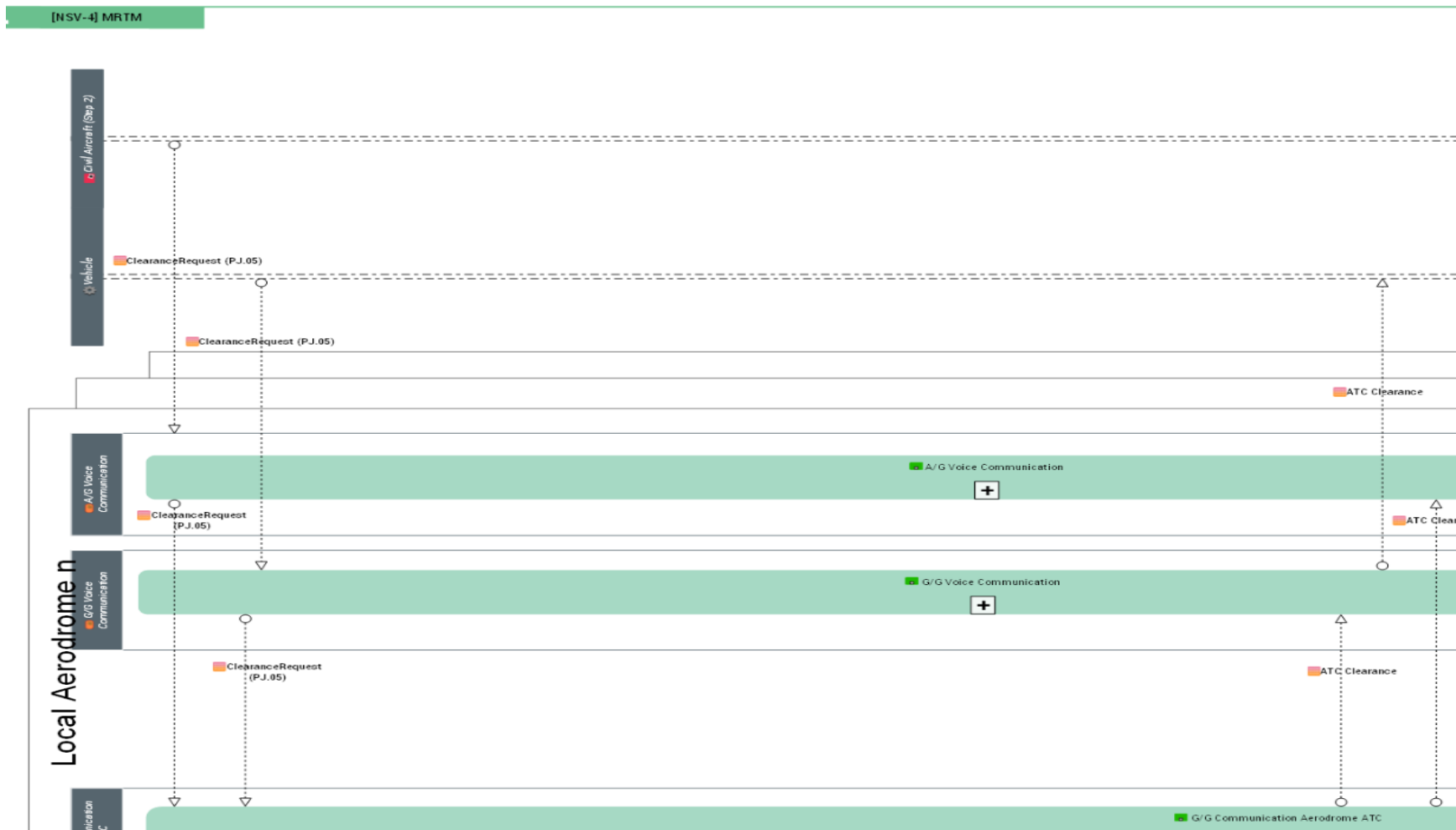


Figure 6: Resource Orchestration Model [NSV-4] MRTM (number 1)

Founding Members



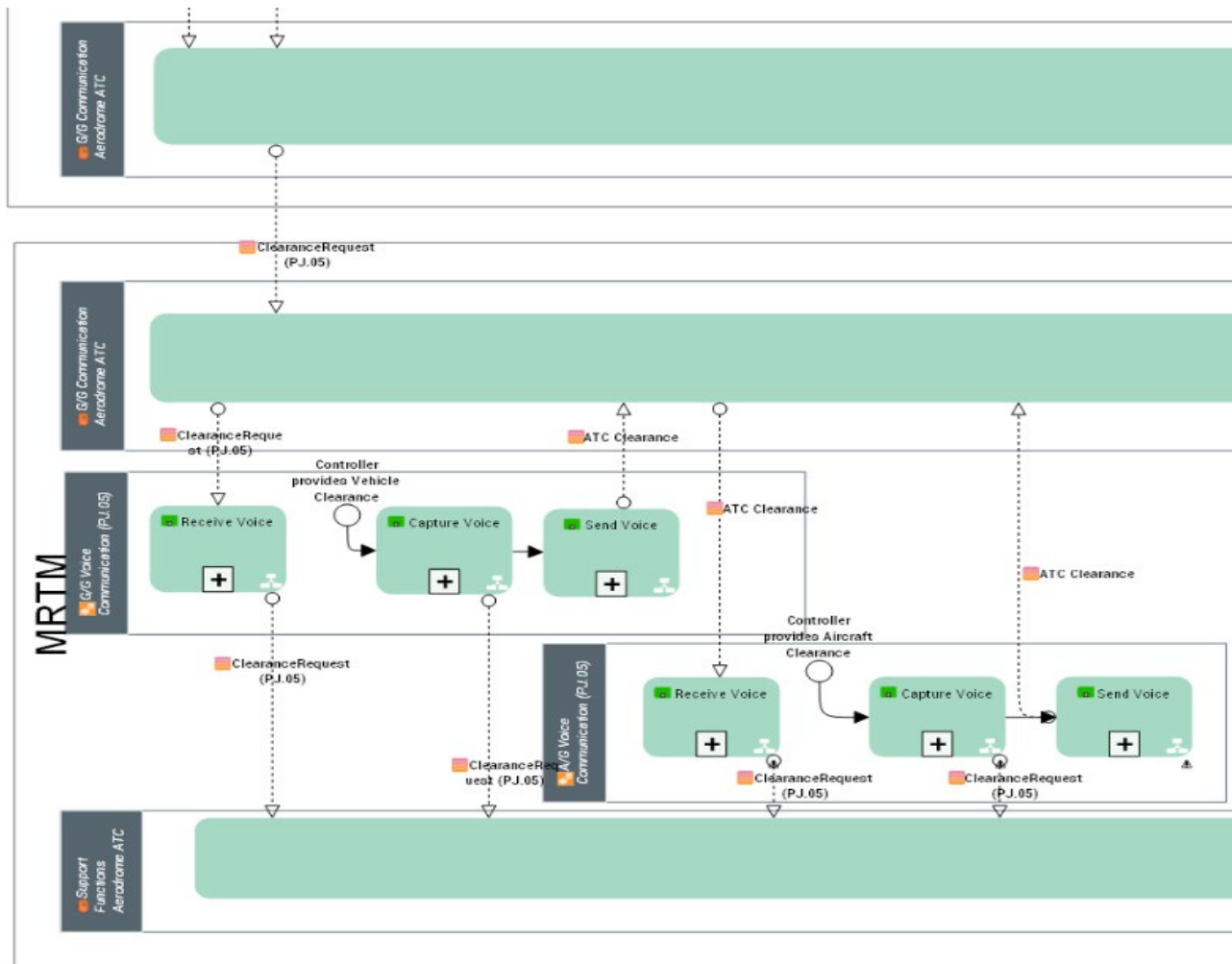


Figure 7: Resource Orchestration Model [NSV-4] MRTM (number 2)

Founding Members



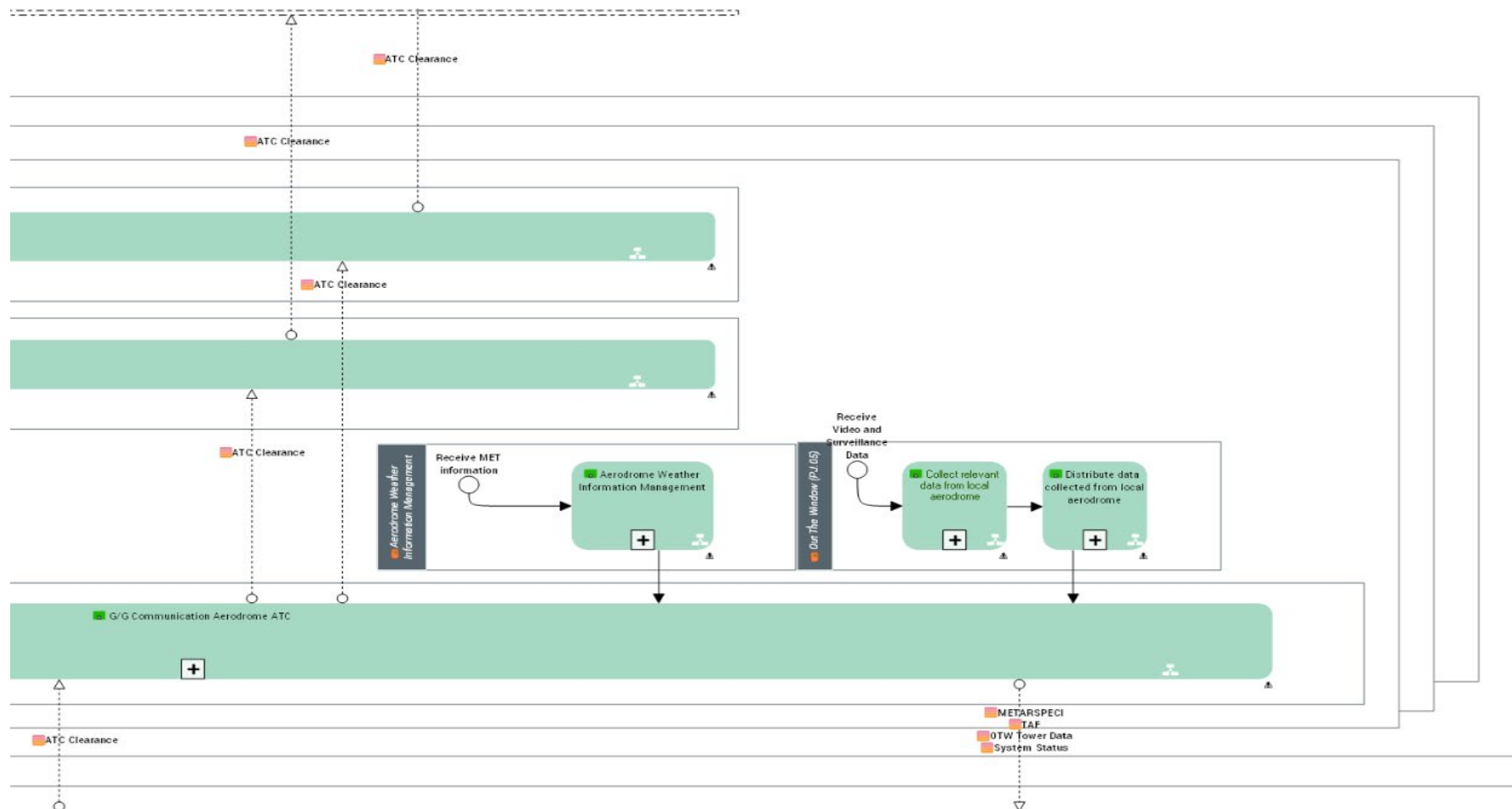


Figure 8: Resource Orchestration Model [NSV-4] MRTM (number 3)

Founding Members



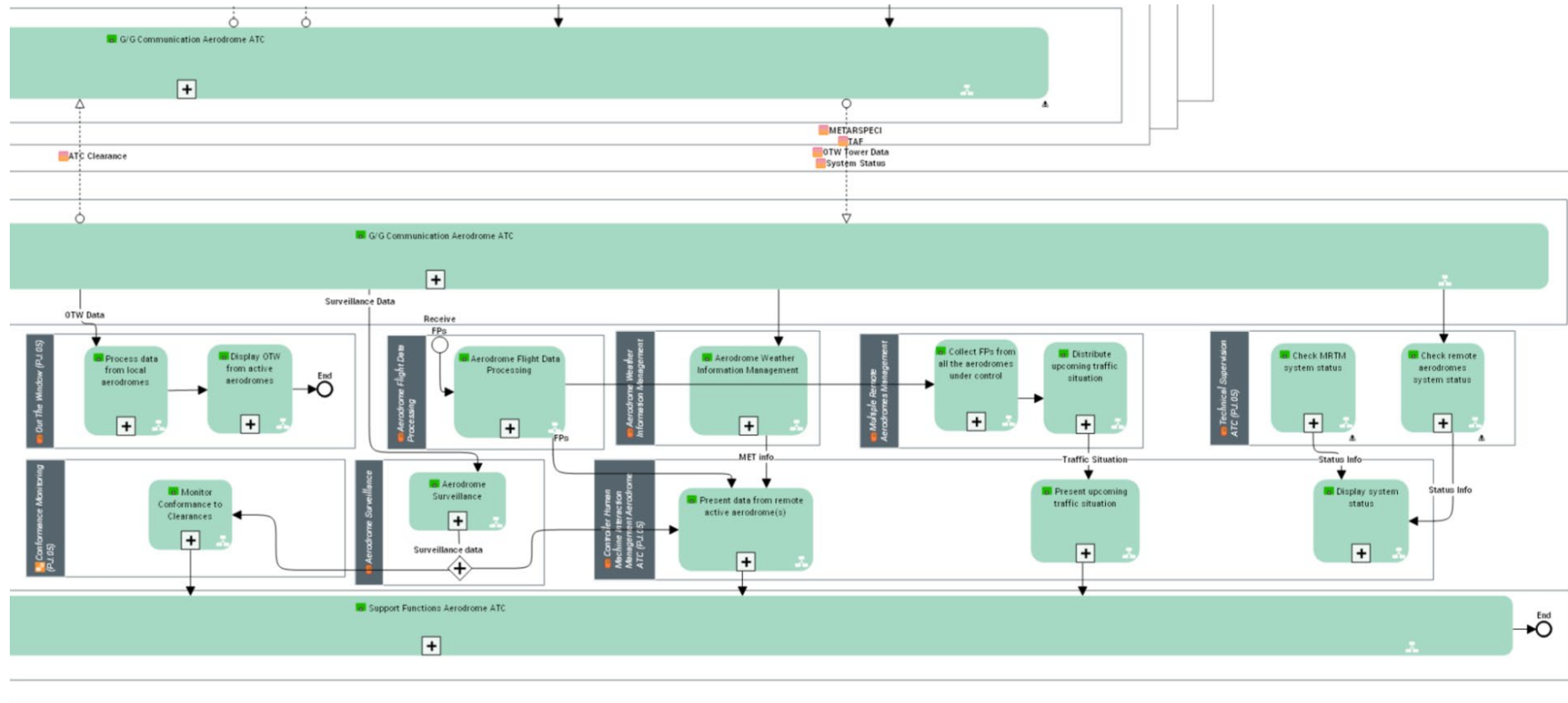


Figure 9: Resource Orchestration Model [NSV-4] MRTM (number 4)



Founding Members



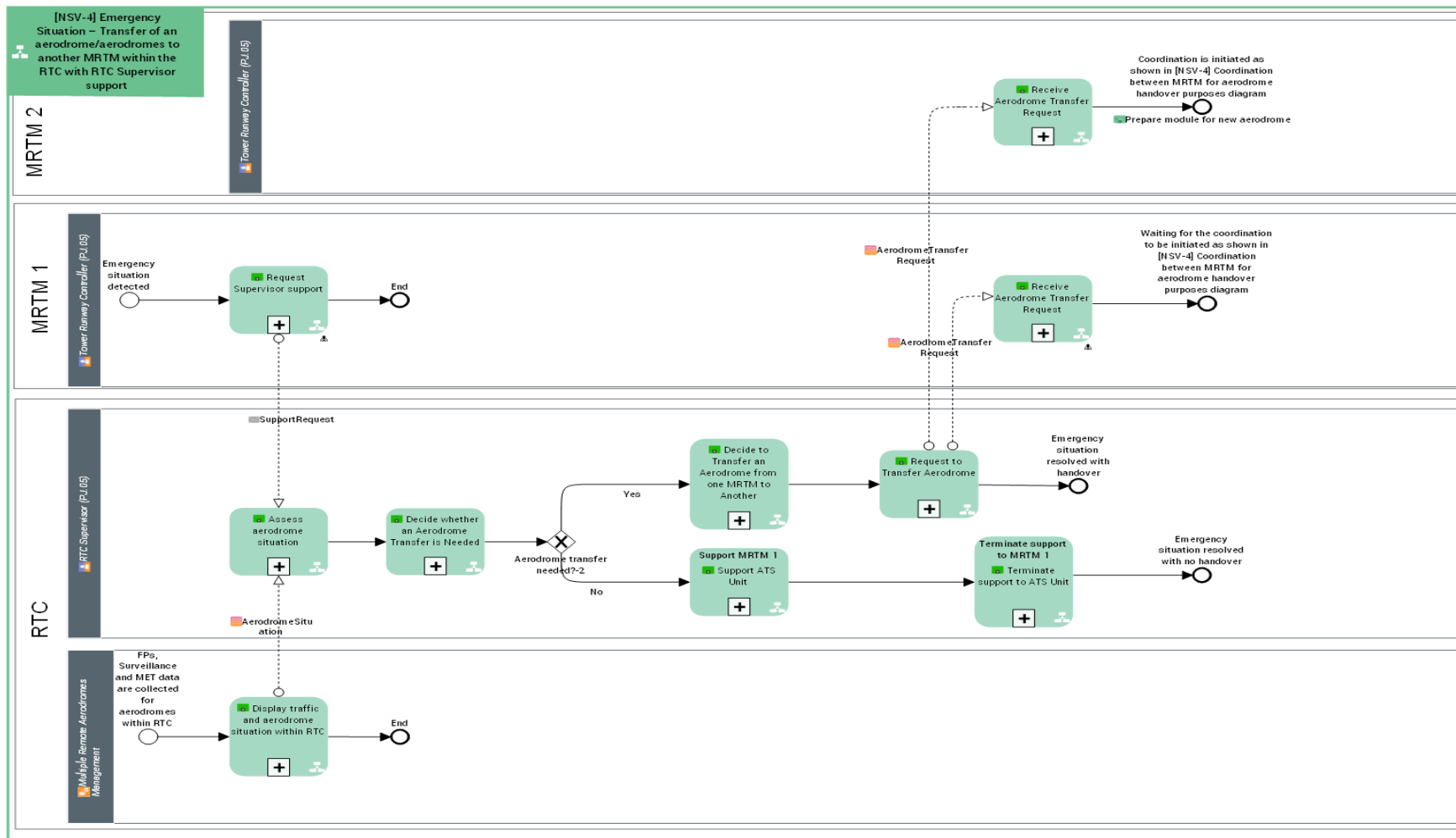


Figure 10: [NSV-4] Emergency Situation – Transfer of an aerodrome/aerodromes to another MRTM within the RTC with RTC Supervisor support

Founding Members



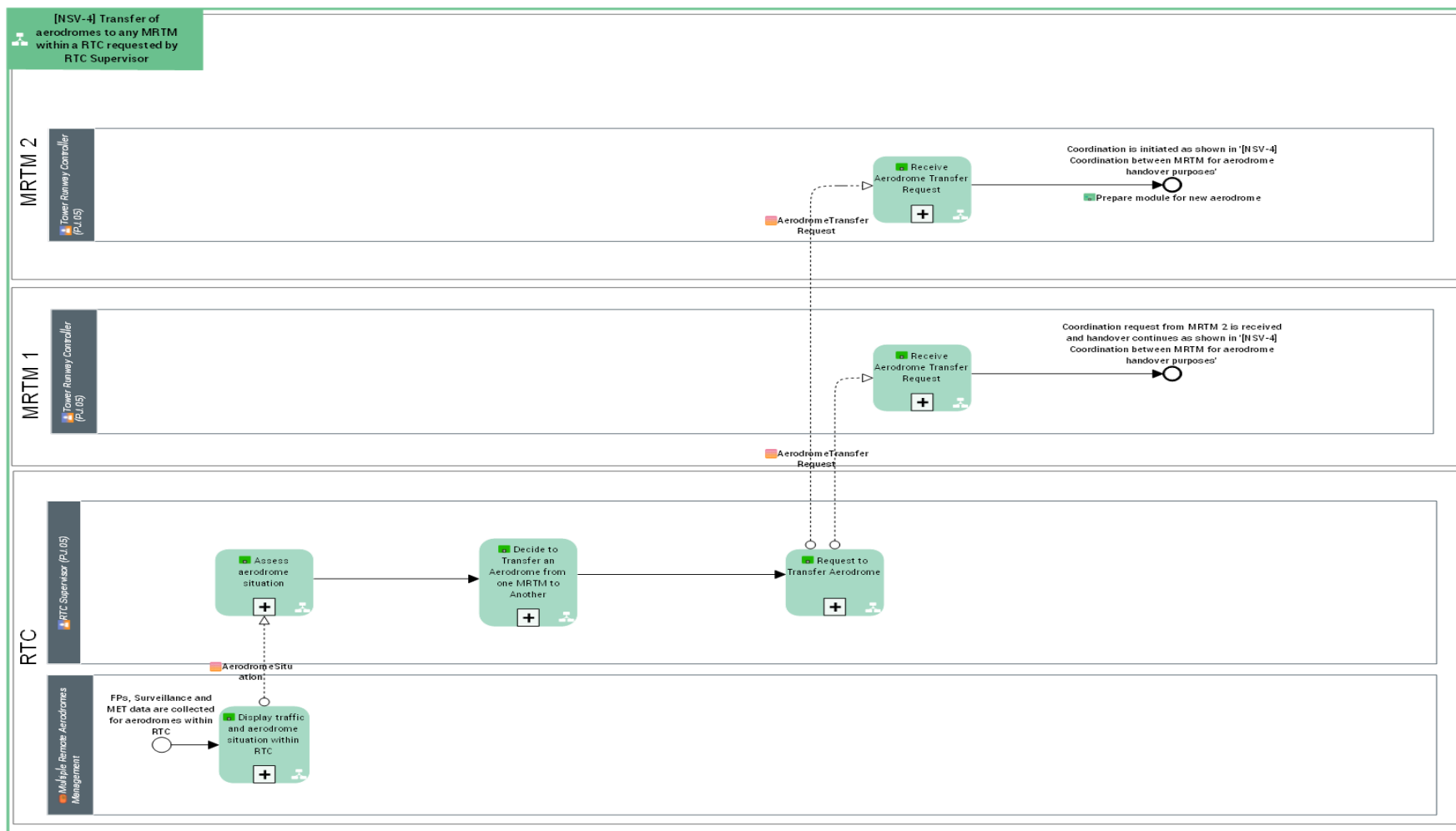


Figure 11: [NSV-4] Transfer of aerodromes to any MRTM within a RTC requested by RTC Supervisor

Founding Members





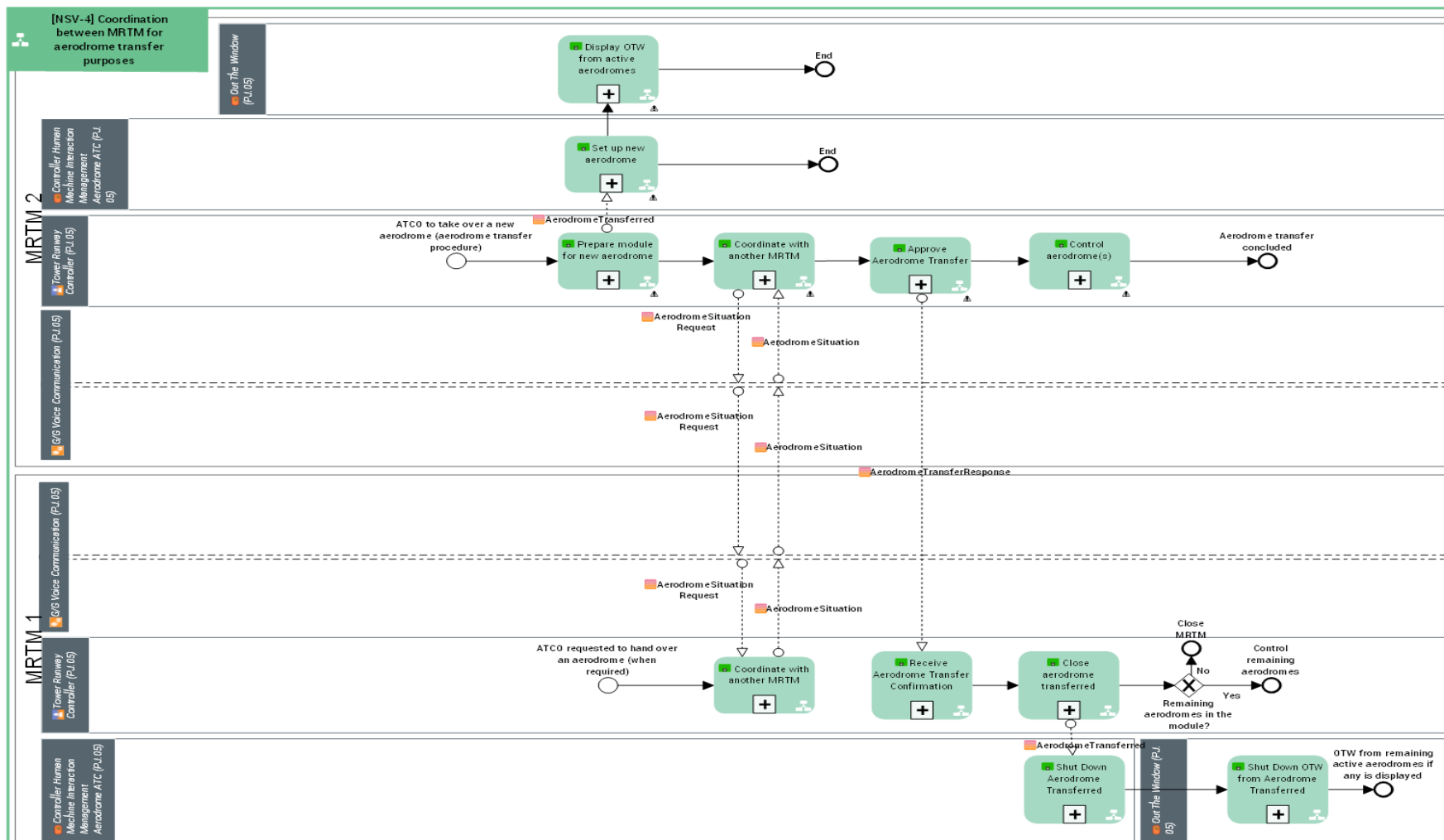


Figure 12: [NSV-4] Coordination between MRTM for aerodrome transfer purposes

Founding Members



Solution 35 of PJ.05 builds upon Solution 03. It is one more step based on what is developed in the latter. It is important to give some hints about PJ.05 Solution 02.

**PJ.05 Solution 02** focuses mainly on Multiple Remote Tower Modules (MRTM). The central elements are the CHMIM, the OTW, and Remote Aerodromes Management planning tool focused.

- A remote tower specific part is the *OTW View* component. It provides MRTMs controllers with a clear view of the real traffic situation and with all the necessary traffic data concerning a Remote Tower of another Aerodrome ATC system, in order to assist them in their control tasks. It can also help the controllers to identify targets in Low Visibility with the support of the Aerodrome Surveillance Data. These data are the result of merging the surveillance video and data information provided by the different surveillance sources providing a unique picture of the actual traffic situation. An optional Surveillance sensor specifically to support MRT operations is being developed in Pj14-4-3 as solution 84b. It is intended to be validated in the context of exercise EXE-05.35-V3-2.5 – DFS.

The *CHMIM* provides controllers with a graphical user interface and with the means to interact with the Aerodrome ATC systems. It receives necessary data for display, such as alerts from the detection systems, the Flight Plans, the short-term planning from the planning tool, the nowcast and forecast MET information and the systems status.

The *Technical Supervision* is in charge of the technical supervision of an Aerodrome ATC system and will receive heartbeats of every system from both the local tower and the MRTM. The Technical Supervision encompasses the following functions:

- Presenting technical and functional systems status: monitor system availability. Acquire, synthesize and display technical and functional status on all the system hardware/software resources.
- Providing failure detection and analysis assistance: generate alarm or warning on failure detection. Provide support for analysis supervision data (enable queries on historic of events).
- Providing supervision commands and actions.

*Support functions* will synchronize the CHMIM data and perform the recording of the system data, and, buffering those data on a persistent database. It also provides support for safety aspects.

The *Multiple Remote Aerodrome Management* will send to the CHMIM information about the upcoming traffic and weather situation at the aerodromes under control.

**PJ.05 Solution 35** has one main difference with the Solution 02 of PJ.05: the RTC Supervisor comes into play. This means that there are plenty MRTMs and a RTC Supervision position. The central elements will be the Operational Supervision and the Multi Remote Aerodromes Management. Thus, the architecture for the Remote Tower Centre still is the same with some FB in addition:

*Safety Nets* and *Conformance Monitoring* will calculate alerts based on the surveillance information coming from sensors. This information is directly sent to the CHMIM.

The *Operational Supervision* allows the Supervisor to manage the most appropriate operational configuration, according to traffic demand and aerodrome needs, and to react in case of system fault,

re-assigning and distributing available resources in order to maintain adequate safety levels and quality of service. It will receive both the nowcast and forecast weather and the mid-term planning for the different MRTMs from the Multiple Remote Aerodromes Management.

For this solution, *Technical Supervision* will feed both the Controller and the Supervisor via CHMIM and Operational supervision.

The *Multiple Remote Aerodrome Management* will send a short-term plan to the MRTMs according to what has been decided by the Supervisor based on the mid-term plan received for the distribution of the different aerodromes in the MRTMs.

#### 4.1.2 Resource Composition

Infrastructure elements show the physical realization of Resource Interactions and Services.

This Supporting Infrastructure is the set of:

- Capability Configurations:
  - TWR (Step 2)
  - Aircraft
  - Airport
- Main Technical Systems:
  - Aerodrome ATC
  - Voice
  - Vehicle
- System Ports:
  - ATC\_Voice
  - Transport Secured-Web Services
  - SUR\_VIDEO\_GND
  - VIDEO\_STATUS\_GND

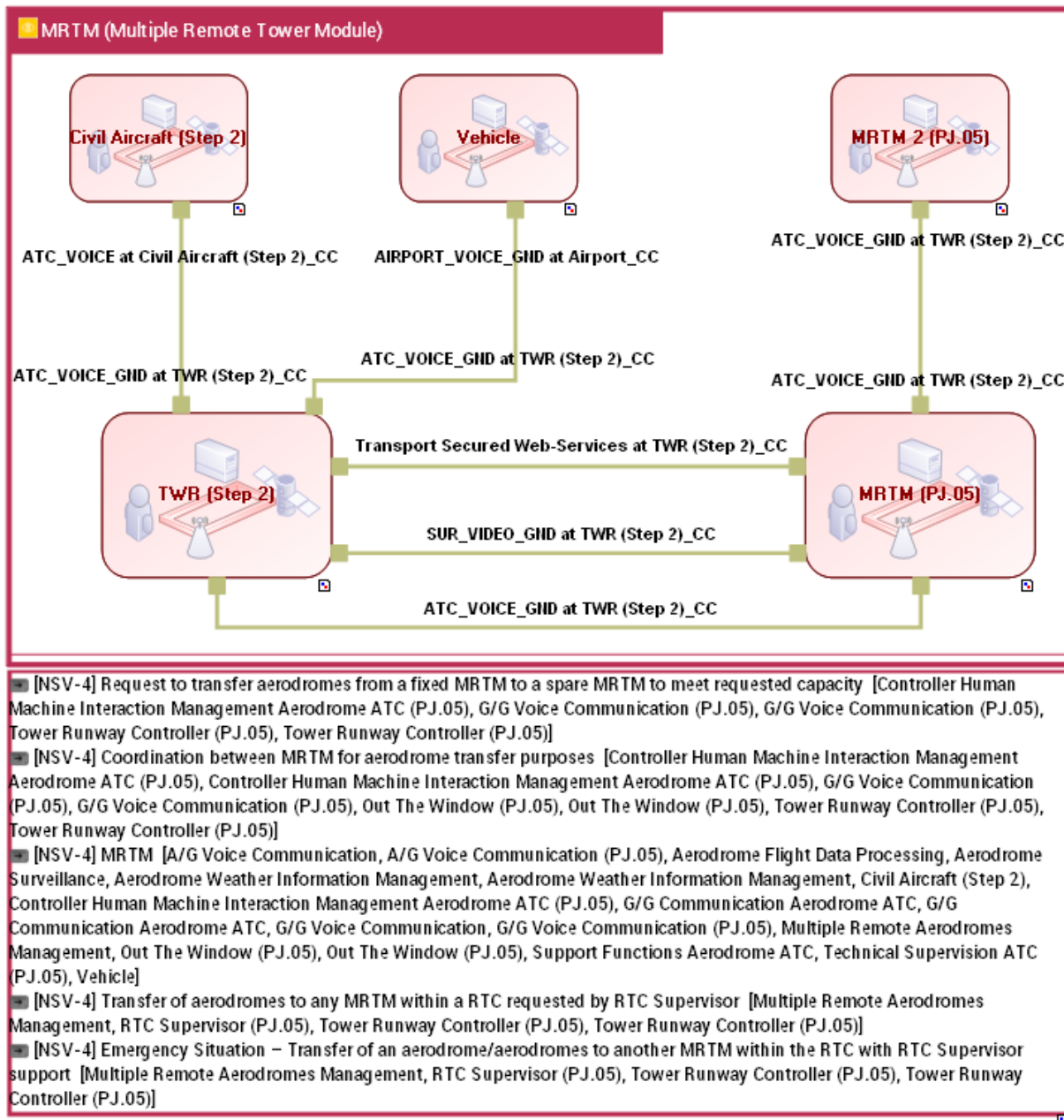


Figure 13. Infrastructure Connectivity Model NSV-2 for PJ.05 Solutions 35

### 4.1.3 Service view

A Service called AerodromeTransfer has been created within PJ.05 framework.

#### 4.1.3.1 Service description

##### AerodromeTransfer

This service allows the aerodrome transfer procedure between MRTMs within the same Remote Tower Centre.

When needed, an ATCO in a MRTM can make a request to transfer one of the active aerodromes in the MRTM to another ATCO in a different MRTM. ATCOs can as well receive an aerodrome transfer request from the RTC Supervisor if he or she deems it necessary.

The Service consists of the aerodrome transfer request and response, and the coordination that is done in the meantime between both the ATCO that is transferring the aerodrome and the one that is taking over it.

For the moment, these operations are planned to be done via Voice between controllers. This could be a reason for not creating a Service ad-hoc for this matter. It could not be required or perhaps a Resource Interaction could be sufficient for it.

However, at some time, the infrastructure and physical architecture for these data exchanges can change, as new communication channels can be used. That in mind, it has been decided to create the logical architecture for the Service.

Thus, the operations that are proper of this Service are:

- Aerodrome transfer request; ATCO that is intended to take over an aerodrome is provided with the aerodrome in question and the transfer request.
- Coordination for aerodrome transfer; Both ATCOs involved in the transfer procedure exchange data about the aerodrome situation, traffic picture, short-term events and any other information that could be needed for taking over an aerodrome with full awareness of the situation.
- Aerodrome transfer response; the ATCO that is intended to take over the aerodrome accepts the transfer once he or she is fully aware of the situation and confident to proceed.

Service	Service description
AerodromeTransfer	A service allowing the aerodrome transfer procedure between Multiple Remote Tower Modules within the same Remote Tower Centre

**Table 11: Services Description for Services created by PJ.05**

Besides, some Services are used as well by the Solution. To be noted that none of these Services have been validated in the Solution.

Service	Service description
METAR	A service providing the METAR bulletin according to ICAO Annex 3 requirements
TAF	A service providing the TAF bulletin according to ICAO Annex 3 requirements

**Table 12: Service Description for Services used by PJ.05**

#### 4.1.3.2 Service Provisioning

Interaction	Consumer CC	Consumer System	Provider CC	Provider System
AerodromeTransfer	MRTM	Aerodrome ATC;	Aerodrome ATC;	Aerodrome ATC;
TAF	MRTM	Aerodrome ATC;	Local TWR	Aerodrome ATC;
METAR	MRTM	Aerodrome ATC;	Local TWR	Aerodrome ATC;

Interaction	Consumer CC	Consumer System	Provider CC	Provider System
Controller Pilot ATC exchange (Voice)	Civil Aircraft (Step 2)	Aircraft;	Local TWR	Voice;
OTW Tower Data	MRTM	Aerodrome ATC;	Local TWR	Aerodrome ATC;
Coordination (Voice)	Vehicle	Airport Operations Centre;	Local TWR	Voice;
Pilot - Controller ATC Communication	MRTM	Voice;	Local TWR	Voice;

**Table 13: Service Provisioning**

### 4.1.3.3 Service Realization

This section describes the technology use to realise the Services.

- System Ports:
  - ATC\_Voice
  - Transport Secured-Web Services
  - SUR\_VIDEO\_GND
  - VIDEO\_STATUS\_GND

## 4.2 Functional and non-Functional Requirements

### 4.2.1 Multiple Remote Tower Module (MRTM)

#### 4.2.1.1 General Requirements

[REQ]

Identifier	REQ-05.35-TS- SD01.0106
Title	Clear distinctions of aerodrome borders
Requirement	The system should provide a border of each displayed aerodrome in the visual presentation and head-down displays. Consistent indication shall be used for the different aerodromes on visual presentation and head-down displays.
Status	<Validated>
Rationale	Borders between the displayed airports should be highlighted to easily distinguish the frame related to each aerodrome in the visual presentation and in the head down displays.
Category	<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-SD01.0106
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-SD01.0107
<SATISFIES>	<Enabler>	N/A
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## [REQ]

Identifier	REQ-05.35-TS- SD01.0108
Title	Flexible positioning of aerodromes within the same MRTM
Requirement	The system shall allow flexible positioning of aerodromes within the same MRTM by the ATCO.
Status	<Validated>
Rationale	Aerodromes assigned to a particular MRTM shall be flexibly positioned by the ATCO who operates that MRTM and is responsible for providing safe and efficient ATS, in accordance to their own preferences.
Category	<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-SD01.0108
<SATISFIES>	<Enabler>	N/A
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller

<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.35-TS- SD03.0110
Title	Alert in case of failure of the transfer function
Requirement	The system shall raise an alert in case of failure of the transfer function.
Status	<Validated>
Rationale	The ATCO shall be aware of the status of the transfer function.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-SD01.0110
<SATISFIES>	<Enabler>	N/A
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.35-TS-SD03.0111
Title	Alert in case of corrupted data by any critical system
Requirement	The Supervisor Planning Tool shall raise an alert in case of the tool receives corrupted data from any critical systems.
Status	<Validated>
Rationale	The Supervisor shall be aware of integrity of the Supervisor Planning tool data.



Category	<Safety>
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[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-SD03.0111
<SATISFIES>	<Enabler>	N/A
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	RTC Supervisor
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.00-TS-CO01.0005
Title	Spare MRTMs
Requirement	The system should support enough MRTMs to be able to split aerodromes.
Status	<Validated>
Rationale	<p>Splitting of aerodromes to separate MRTMs as a backup procedure allows safe provision of ATS in case that traffic or other factors increase workload to an amount that does not allow provision of ATS to multiple aerodromes.</p> <p>Assessments at local level, based on complexity/volumes of traffic, simultaneity of movements, etc. should be done to confirm the appropriate number of modules to be considered in a RTC.</p>
Category	<Functional>,<Adaptability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.00-SPRINTEROP-CO01.0005
<SATISFIES>	<Enabler>	N/A

<ALLOCATED_TO>	<Functional block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

#### 4.2.1.2 Communications

##### 4.2.1.2.1 Voice Communication System (VCS)

[REQ]

Identifier	REQ-05.35-TS-CO01.0002
Title	Overlapping of air-ground communication
Requirement	The system shall provide support for minimizing air-ground communication overlapping.
Status	<Validated>
Rationale	It should be avoided that ATCOs receive air-ground communication at the same time to not overload ATCOs and affect situation awareness. E.g. coupling of frequencies.
Category	<Operational>,<Safety>,<Human Performance>,<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-CO01.0002
<SATISFIES>	<Enabler>	N/A
<ALLOCATED_TO>	<Functional block>	G/G Voice Communication
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

#### 4.2.1.3 Alarms and alerts

[REQ]

Identifier	REQ-05.35-TS- AL01.0001
Title	Support for ATCO to monitor runway
Requirement	The system may support in monitoring the runway by ground surveillance system or other safety nets.
Status	<Validated>
Rationale	The ATCO may be supported in monitoring the runway. In case of support to monitor runway, how this support is provided, should be locally assessed. If available, a ground surveillance system is desirable.
Category	<Functional>,<Safety>,<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-AL01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Aerodrome Surveillance
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

#### 4.2.1.4 ATCO Planning Tools

[REQ]

Identifier	REQ-05.35-TS- AP01.0001
Title	ATCO Planning tool to provide accurate and reliable information

Requirement	The system shall provide an ATCO Planning tool with accurate and reliable traffic and planning information.
Status	<Validated>
Rationale	ATCO planning tool shall support ATCOs with reliable and accurate information to efficiently and safely manage flexible allocation
Category	<Functional>, <Safety>, <Human Performance>,

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-AP01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Aerodrome Surveillance
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.00-TS-AP01.0002
Title	ATCO Planning tool
Requirement	The ATCO Planning tool shall display information relevant for tactical short term prioritising tasks (e.g. providing landing clearance or taxi clearance)
Status	<Validated>
Rationale	This will help the ATCO in prioritising tasks, planning the work, and understanding the expected workload.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02

<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-AP01.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-81
<ALLOCATED_TO>	<Functional block>	Multiple Remote Aerodromes Management
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

#### 4.2.1.5 Other ATS System/Functions

[REQ]

Identifier	REQ-05.35-TS-FN01.0001
Title	MRTM ground surveillance
Requirement	<p>Ground surveillance for the MRTM may be integrated with air surveillance at an aerodrome.</p> <p>When ground surveillance is provided, the MRTM should</p> <ul style="list-style-type: none"> <li>• complement air surveillance</li> <li>• improve PTZ tracking based on surveillance data</li> <li>• provide alerts and warnings for non-conformances</li> </ul> <p>Note: Ground surveillance for the MRTM may be below the existing standards (ED87)</p>
Status	<Validated>
Rationale	<ul style="list-style-type: none"> <li>• Enhance ATCO situations awareness for ground movements through availability of ground surveillance</li> <li>• Facilitate the ATCO interaction with the System through improved PTZ tracking</li> <li>• Increase safety through conformance monitoring</li> </ul>
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.00-SPRINTEROP-FN01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79

<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Aerodrome Surveillance
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

#### 4.2.1.6 Technical Supervision

[REQ]

Identifier	REQ-05.00-TS-TS01.0002
Title	Alarms and alerts on potentially conflicting situations
Requirement	The system Alarms and Alerts presented by HMI and indicating potentially conflicting situations shall be developed in line with HF design principles.
Status	<Validated>
Rationale	Note: Ability to detect potentially conflicting situations depend on the surveillance coverage.
Category	<Functional>,<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<ATMS Requirement>	REQ-05.00-SPRINTEROP-TS01.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-82
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.00-TS-TS01.0003
Title	Alarms and alerts in Multiple mode of operation
Requirement	The HMI shall present overall status information as well as operationally relevant Alarms and alerts in the same way for all aerodromes available for multiple remote tower operations within the same MRTM.
Status	<Validated>
Rationale	The consistent presentation of information between the aerodromes would help the ATCO easily identify the relevant information.
Category	<Functional>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.00-SPRINTEROP-TS01.0003
<SATISFIES>	<Enabler>	AERODROME-ATC-82
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Technical Supervision ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## 4.2.1.7 Automation Functionalities

## [REQ]

Identifier	REQ-05.03-TS-AF01.0002
Title	Conformance Monitoring on the ground
Requirement	The MRTM may include functionality to detect non-conformance to clearances for ground movements provided by e.g. an MRT specific surveillance ground sensor.
Status	<Validated>

Rationale	Support in ground conformance monitoring can support that ground clearances are followed. A ground monitoring support tool is envisaged to be especially useful in a multiple environment and could be an enabler to support certain operational contexts in multiple mode of operation.
Category	<Functional>,<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-AF01.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-85
<ALLOCATED_TO>	<Functional block>	Conformance Monitoring
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

[REQ]

Identifier	REQ-05.03-TS-AF01.0004
Title	Conflict Detection
Requirement	The MRTM may include functionality to detect if contradictory clearances are given.
Status	<Validated>
Rationale	Support in conflict detection can support the ATCO to follow up if contradictory clearances are given. This could be implemented using alarms, visuals and/or audibles.
Category	<Functional>,<Safety>



[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-AF01.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-85
<ALLOCATED_TO>	<Functional block>	Aerodrome Safety Nets
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

[REQ]

Identifier	REQ-05.35-TS-AF01.0005
Title	Indication of Clearances to be given
Requirement	The system may provide an indication when clearances can be given.
Status	<Validated>
Rationale	Situation awareness may be increased and potential conflicting situations may be avoided if the system indicated when clearances can be given. This helps if the ATCO is focussing on one aerodrome while a clearance can be given at another aerodrome.
Category	<Functional>,<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-AF01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-85

<ALLOCATED_TO>	<Functional block>	Aerodrome Safety Nets
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

## 4.2.2 Transfer/Merging

### 4.2.2.1 Split and Merge

[REQ]

Identifier	REQ-05.35-TS- TM01.0001
Title	Transfer initiation by ATCO
Requirement	The system shall provide functionality to allow an ATCO to transfer even if he/she is not holding the RTC supervisor role.
Status	<Validated>
Rationale	If an ATCO need a transfer he/she needs to be allowed to do that regardless of support from supervisor role.
Category	<Functional>,<Safety>,<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-TM01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama

<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A

## [REQ]

Identifier	REQ-05.35-TS-TM01.0007
Title	Display layout to be presented in a predefined way
Requirement	During aerodrome transfer the system shall retain displays in the predefined ATCO Set-up.
Status	<Validated>
Rationale	If the ATCO has customised his/her displays (e.g. radar map, Visual Presentation etc.), this should be maintained also after the transfer for the aerodromes that are under control.
Category	<Operational>, <Safety>, <Human Performance>, <Performance>, <Interoperability>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-TM01.0007
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A

## [REQ]

Identifier	REQ-05.35-TS-TM01.0008
Title	Consistent display layout for all aerodrome configurations
Requirement	The system shall provide the same layout for all the possible aerodrome configurations for Visual Panorama and head down displays.
Status	<Validated>

Rationale	To avoid confusion the displayed layout shall be consistent among possible aerodrome configurations in the head up and head down displays
Category	<Operational>, <Safety>, <Human Performance>, <Performance>, <Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-TM01.0008
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A

[REQ]

Identifier	REQ-05.35-TS-TM01.0009
Title	Pre-set aerodrome radar maps
Requirement	The system should provide pre-defined pre-sets for the aerodrome radar maps.
Status	Validated
Rationale	Pre-sets should be defined for the aerodrome radar maps in order to support the ATCO to efficiently manage flexible allocation.
Category	<Operational>, <Safety>, <Human Performance>, <Performance>, <Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-TM01.0009
<SATISFIES>	<Enabler>	AERODROME-ATC-79

<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A

[REQ]

Identifier	REQ-05.35-TS- TM01.0010
Title	Time monitoring for active aerodromes with focus on endorsement
Requirement	The system should provide functionality to automatically monitor the time each ATCO works on each airport to ensure that the minimum required amount of hours (and therefore the endorsement) is maintained.
Status	<In progress>
Rationale	As the ATCOs have different endorsements in order to work in the RTC, there is a need to automatically check the number of hours worked on each aerodrome in order to ensure the endorsements are maintained
Category	<Functional>,<Safety>,<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-TM01.0009
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A

[REQ]

Identifier	REQ-05.35-TS-TM02.0004
Title	Presentation of Aerodromes on multiple MRTMs

Requirement	During the transfer of an aerodrome from one MRTM to another, aerodrome data for all relevant systems shall be available in both MRTMs until the transfer is completely done.
Status	<Validated>
Rationale	When a transfer is going to be done, the ATCO receiving the control of the aerodrome needs to monitor the situation to build situational awareness before accepting control of the aerodrome. For this purpose, both ATCOs need to have the aerodrome data until the transition is done.
Category	<Functional> <Safety> <Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-TM02.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.35-SPRINTEROP-TM02.0005
Title	Synchronization for transferring systems and information during split and merge
Requirement	When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.
Status	<Validated>
Rationale	The ATCOs HMI shall allow automatic transfer of all the displays and information during the split and merge
Category	<Operational>, <Safety>, <Human Performance>, <Performance>, <Interoperability>

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-TM02.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

#### 4.2.2.2 Supervisor tools

[REQ]

Identifier	REQ-05.35-TS-TM03.0002
Title	Overview on MRTM traffic and operational status
Requirement	The system should provide the RTC Supervisor role with functionality that gives a global view of each MRTM including actual traffic load, and gives the possibility to have flexible allocation of airports to each MRTM.
Status	<Validated>
Rationale	<p>The RTC Supervisor need to have a global picture of the connected aerodromes and MRTMs to support a balanced workload for the ATCOs. This will allow the supervisor to plan and manage resources and assist or initiate the transfer of aerodromes between the MRTMs.</p> <p>Relevant information could be MRTM status, traffic load, current allocation of aerodromes to MRTMs, etc.</p>
Category	<Functional>,<Safety>,<Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-TM03.0002

<SATISFIES>	<Enabler>	AERODROME-ATC-84
<ALLOCATED_TO>	<Functional block>	Operational Supervision Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	RTC Supervisor
<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

[REQ]

Identifier	REQ-05.03-TS-TM03.0003
Title	RTC Supervisor Planning tool
Requirement	The RTC Supervisor’s HMI shall provide display of information that support the Supervisor in understanding the traffic load and capacity for the connected aerodromes, in order to facilitate the allocation of aerodromes between the MRTMs.
Status	<Validated>
Rationale	The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine aerodromes in the MRTM. This information may be available to another role when a supervisor is not necessary.  Relevant information could be e.g. traffic levels, traffic complexity, airport layout , geographical difference, daylight conditions, weather conditions, work in progress on the airport, etc.
Category	<Functional>,<Data>,<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-TM03.0003
<SATISFIES>	<Enabler>	AERODROME-ATC-84
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	RTC Supervisor



<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

## 4.2.3 RTC Supervisor

### 4.2.3.1 General

[REQ]

Identifier	REQ-05.03-TS-SP01.0001
Title	RTC Supervisor Coordination Tools
Requirement	The system shall provide the RTC Supervisor role with access to functions for communicating the operational status of RTC and aerodromes and coordinating maintenance (to be carried out by a qualified engineer/technician).
Status	<Validated>
Rationale	The role of the RTC Supervisor is defined in the SPRINTEROP.  Operational status includes e.g. what aerodromes are connected to each MRTM.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-SP01.0001
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-SP01.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-84
<ALLOCATED_TO>	<Functional block>	Operational Supervision Aerodrome ATC
<ALLOCATED_TO>	<Role>	RTC Supervisor

<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

#### 4.2.3.2 RTC SUP Monitoring Tools

[REQ]

Identifier	REQ-05.35-TS-SP02.0003
Title	RTC Supervisor Airport Weather Monitoring Tools
Requirement	The system shall provide the RTC Supervisor or similar with access to functions for the monitoring of weather conditions for all aerodromes.
Status	<Validated>
Rationale	The RTC Supervisor need to be aware of the weather conditions at the aerodromes within the RTC in order to plan use of resources and workload related to operation of multiple aerodromes within a single MRTM.
Category	<Functional>,<Safety>,, <Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-SP02.0003
<SATISFIES>	<Enabler>	AERODROME-ATC-82
<ALLOCATED_TO>	<Functional block>	Technical Supervision ATC
<ALLOCATED_TO>	<Functional block>	Operational Supervision
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	RTC Supervisor
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	Function Identifier

<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

#### 4.2.4 Technical Supervision

[REQ]

Identifier	REQ-05.35-TS-SP02.0001
Title	RTC Technical Supervision
Requirement	The system should display the technical status of the systems involved (e.g. surveillance system, MRTM...), both in the RTC and the connected aerodromes to the technical personnel In order to support maintenance coordination to be carried out by a qualified engineer/technician.
Status	<Validated>
Rationale	The RTC Supervisor and the Controller need to be aware of the operational status of the systems in order to make their decisions. Failures´ detection and analysis assistance are provided by the system. Technical personnel need to be aware of the technical status.
Category	<Functional>,<Safety>,, <Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-SP02.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-82
<ALLOCATED_TO>	<Functional block>	Technical Supervision ATC
<ALLOCATED_TO>	<Functional block>	Operational Supervision
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	RTC Supervisor
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	Function Identifier

<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

#### 4.2.4.1 RTC SUP Planning Tools

[REQ]

Identifier	REQ-05.03-TS-SP03.0002
Title	Demand and Capacity Data
Requirement	The system should provide the RTC supervisor role with available information on the forecasted traffic demand, forecasted weather and other forecasted activities (maintenance, snow removal etc.) for each aerodrome under control of the RTC.
Status	<Validated>
Rationale	This is used to combine aerodromes at one specific MRTM, giving a total predicted workload. The RTC supervisor needs help for planning issues. Planning time horizon defined according to local needs.
Category	<Functional>,<Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-SP03.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-83
<ALLOCATED_TO>	<Functional block>	Multiple Remote Aerodrome Management
<ALLOCATED_TO>	<Functional block>	Operational Supervision Aerodrome ATC
<ALLOCATED_TO>	<Role>	RTC Supervisor
<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier

<ALLOCATED_TO>	<System Port>	System Port Identifier
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[REQ]

Identifier	REQ-05.03-TS-SP03.0004
Title	ATCO Valid Endorsements Information
Requirement	The RTC long term planning tool may use information on valid ATCO endorsements for specific aerodromes in order to determine how to allocate the different aerodromes to MRTMs.
Status	<Validated>
Rationale	ATCOs will not necessarily have endorsements for all the aerodromes under control of the RTC. The long term planning tool may use information on what ATCOs (and their corresponding endorsements) may be associated to which MRTMs for aerodrome allocation issues.
Category	<Functional>,<Safety>,<Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-SP03.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-83
<ALLOCATED_TO>	<Functional block>	Multiple Remote Aerodromes Management
<ALLOCATED_TO>	<Role>	RTC Supervisor
<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

## 4.2.5 Approach

[REQ]

Identifier	REQ-05.35-TS-TA01.0001
Title	Combined Tower and Approach Service
Requirement	When the system provides services for both Tower and Approach for the same MRTM, the system shall provide tools meeting the requirements for each service.
Status	<Validated>
Rationale	<p>During specific periods there may be a need to combine TWR and APP services from the same MRTM. It is paramount that this service can be provided with access to relevant tools to support situational awareness.</p> <p>It is also important that the ATCO can keep track of traffic on the aerodrome(s) and in the APP area simultaneously.</p>
Category	< Functional >,<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.35-SPRINTEROP-TA01.0001
<SATISFIES>	<Enabler>	Enabler identifier
<ALLOCATED_TO>	<Functional block>	Multiple Remote Aerodromes Management
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

## 5 Recommendation for Implementation

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In this document there are not different available options identified that can be chosen when implementing the solution.

## 6 Assumptions

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There are in this document three assumptions made that have an impact on the technical specification:

1. It has been assumed by the project that all requirements referred to cameras and technical installation defined, verified and validated in SESAR1 are valid for PJ05 project. It should be noted that Solution 35 is more focused on addressing the capability of the ATCO to manage three airports simultaneously through Real Time Simulations more than in the technology solution.
2. It has been assumed by the project that the roles described in the SESAR 1 deliverable 12.04.07 D09 Remote Tower Technical Specifications [43] are valid for PJ05 project as described in section 2.4 User Characteristics.
3. It has been assumed by the project that the following assumptions made in the SPR-INTEROP/OSED are applicable for the TS/IRS:
  - a. An ATCO can hold endorsements for 4 aerodromes which can be grouped together and flexibly allocated at two MRTMs.
  - b. Supervisor Planning Tool, supporting RTC Supervisor, provides data like traffic volume/complexity and weather conditions at the different airports, as well as ATCO endorsements and availability.



# 7 References and Applicable Documents

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## 7.1 Applicable Documents

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

### Content Integration

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- [1] B.04.01 D138 EATMA Guidance Material PJ19.D5.11 EATMA guidance material and report
- [2] EATMA Community pages
- [3] SESAR ATM Lexicon

### Content Development

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- [4] PJ19 D2.5 SESAR Concept of Operations (CONOPS 2019)

### System and Service Development

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- [5] 08.01.01 D52: SWIM Foundation v2
- [6] 08.01.01 D49: SWIM Compliance Criteria
- [7] 08.01.03 D47: AIRM v4.1.0
- [8] 08.03.10 D45: ISRM Foundation v00.08.00
- [9] B.04.03 D102 SESAR Working Method on Services
- [10] B.04.03 D128 ADD SESAR1
- [11] B.04.05 Common Service Foundation Method

### Performance Management

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- [12] SESAR Performance Framework ed. 01.00.01 - 2019
- [13] Validation Target W2 (1.0)
- [14] B.05 D86 Guidance on KPIs and Data Collection support to SESAR 2020 transition.
- [15] 16.06.06-D68 Part 1 –SESAR Cost Benefit Analysis – Integrated Model
- [16] 16.06.06-D51-SESAR\_1 Business Case Consolidated\_Deliverable-00.01.00 and CBA
- [17] Method to assess cost of European ATM improvements and technologies, EUROCONTROL (2014)
- [18] ATM Cost Breakdown Structure\_ed02\_2014
- [19] Standard Inputs for EUROCONTROL Cost Benefit Analyses

[20]16.06.06\_D26-08 ATM CBA Quality Checklist

[21]16.06.06\_D26\_04\_Guidelines\_for\_Producing\_Benefit\_and\_Impact\_Mechanisms

#### Validation

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[22] 03.00 D16 WP3 Engineering methodology

[23]Validation Strategy VALS (2019.0)

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

#### System Engineering

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[25] SESAR 2020 Requirements and Validation Guidelines

#### Safety

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

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

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

[29]SESAR, Resilience Engineering Guidance, May 2016

#### Human Performance

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[30]16.06.05 D 27 HP Reference Material D27

[31]16.04.02 D04 e-HP Repository - Release note

#### Environment Assessment

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

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

#### Security

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[34] 16.06.02 D103 SESAR Security Ref Material Level

[35]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[36]16.06.02 D131 Security Database Application (CTRL\_S)

## 7.2 Reference Documents

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

[37] ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.<sup>1</sup>

[38] EUROCAE ED-240A, 'MINIMUM AVIATION SYSTEM PERFORMANCE STANDARDS (MASPS) FOR REMOTE TOWER OPTICAL SYSTEMS', October 2018

[39] EASA ED Decision 2019/004/R, 'Guidance Material on remote aerodrome air traffic services'.

[40] SESAR Solution PJ.05-W2-35 SPR-INTEROP/OSED for V3 - Part I ver 00.01.00

[41] SESAR Solution PJ.05-02: Validation Plan (VALP) for V3 - Part I ver [00.01.01]

[42] SESAR Solution PJ.05.02 Validation Report (VALR) for V3 - Part I ver 00.03.13

[43] SESAR 1 12.04.07.D09 – Technical Specifications, 01.00.00, 07/03/2016

[44] SESAR 2020 PJ.05.03 TS/IRS for V2

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1

## Appendix A Baseline Requirements for Single Remote Tower (from SESAR 1)

This Appendix contains the Single Remote Tower baseline requirements from SESAR 1 - forming the baseline for Multiple Remote Tower. The requirements listed below/herein are fully replicated from the final SESAR 1 TS (TS for Remotely Operated Tower Multiple Controlled Airports with Integrated Working Position – D09 – Edition 01.00.00 – 27/08/2016), **unless specified by red text**.

### A.1 Baseline Concept Requirements

[REQ]

Identifier	REQ-12.04.07-TS-0010.0001
Requirement	Each RTM shall allow an ATCO to provide Air Traffic Services (ATS) for the active Remote Airport(s).

[REQ]

Identifier	REQ-12.04.07-TS-0010.0003
Requirement	All technical failures on an RTM or remote airport shall be categorized by severity and technical procedures shall be defined how to handle each severity level.

[REQ]

Identifier	REQ-12.04.07-TS-0010.0004
Requirement	The RTMs in the RTC should be designed uniformly so that it is possible to operate any airport connected to that RTC from any of its RTMs.

### A.2 General Service / Functional requirements

#### A.2.1 Communications

[REQ]

Identifier	REQ-12.04.07-TS-0100.0001
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Requirement	The RTM shall provide access to aeronautical mobile services (air-ground communications) to the ATCO/AFISO for active Remote Airport(s), in accordance with ICAO Annex 11, Chapter 6.1
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[REQ]

Identifier	REQ-12.04.07-TS-0100.0002
Requirement	The RTM shall provide access to aeronautical fixed service (ground-ground communications) to the ATCO/AFISO for active Remote Airport(s), in accordance with ICAO Annex 11, Chapter 6.2

[REQ]

Identifier	REQ-12.04.07-TS-0100.0003
Requirement	The RTM shall provide access to surface movement control service (communications for the control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes) to the ATCO/AFISO for active Remote Airport(s)

[REQ]

Identifier	REQ-12.04.07-TS-0100.0004
Requirement	The RTM shall provide a signalling lamp functionality to the ATCO/AFISO on the active Remote Airport(s), in accordance with ICAO Annex 14 section 5.1.3 / Eurocontrol Manual for AFIS section 4.2.2.3.2.

## A.2.2 MET-functions

[REQ]

Identifier	REQ-12.04.07-TS-0101.0001
Requirement	The RTM shall provide the ATCO/AFISO access to meteorological info from the active Remote Airport(s).

[REQ]

Identifier	REQ-12.04.07-TS-0101.0006
Requirement	The meteorological info provided by an RTM shall be in accordance with ICAO Annex III, ICAO Annex 11 Chapter 7.1 and national regulations.

[REQ]

Identifier	REQ-12.04.07-TS-0101.0007
Requirement	The RTM shall continuously present the current MET report from the currently active Remote Airport(s).

[REQ]

Identifier	REQ-12.04.07-TS-0101.0003
Requirement	The RTM shall continuously present the actual wind information from the currently active Remote Airport(s).

[REQ]

Identifier	REQ-12.04.07-TS-0101.0004
Requirement	The RTM shall continuously present the actual QNH from the currently active Remote Airport(s).

[REQ]

Identifier	REQ-12.04.07-TS-0101.0005
Requirement	The RTM shall, if measured for the particular airport, continuously present the RVR values from the active Remote Airport(s).

## A.2.3 NAV functions

[REQ]

Identifier	REQ-12.04.07-TS-0103.0001
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Requirement	The RTM shall include functionality for the ATCO/AFISO to monitor, adjust intensity and on/off status of visual navigational aids for the active Remote Airport(s).
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[REQ]

Identifier	REQ-12.04.07-TS-0103.0002
Requirement	The RTM shall include functionality for the ATCO/AFISO to monitor and adjust the status of non-visual aids for the active Remote Airport(s).

## A.2.4 Other ATS Systems / Functions

[REQ]

Identifier	REQ-12.04.07-TS-0104.0001
Requirement	The RTM should allow the ATCO/AFISO to access surveillance data such as radar presentation, when available, from the active Remote Airport(s).

[REQ]

Identifier	REQ-12.04.07-TS-0104.0002
Requirement	The RTM shall allow the ATCO/AFISO to access and handle ATS messages (as described in ICAO Doc 4444 Chapter 11).

[REQ]

Identifier	REQ-12.04.07-TS-0104.0003
Requirement	The RTM shall allow the ATCO/AFISO to access and update flight plan and control data for all flights being provided with the ATS service (in accordance with ICAO Doc 4444 Chapter 4.13).

[REQ]

Identifier	REQ-12.04.07-TS-0104.0004
Requirement	The RTM shall allow the ATCO/AFISO to monitor and manage accident, incident and distress alarms as applicable to the active Remote Airport(s).

[REQ]

Identifier	REQ-12.04.07-TS-0104.0005
Requirement	The RTM shall include functionality to present the correct time, in the format of hours, minutes and seconds in UTC, to the ATCO/AFISO.

[REQ]

Identifier	REQ-12.04.07-TS-0104.0006
Requirement	The RTM shall include functionality to notify the ATCO/AFISO about any technical status of systems that can affect the safety or efficiency of flight operations and/or the provision of air traffic service for the RTC and for the active Remote Airport(s).

[REQ]

Identifier	REQ-12.04.07-TS-0104.0009
Requirement	The RTM shall enable the ATCO/AFISO to alert the rescue and firefighting services.

## A.2.5 Voice and Data Recording

[REQ]

Identifier	REQ-12.04.07-TS-0105.0006
Requirement	ATCO/AFISO direct-speech communication via Aeronautical mobile service, Aeronautical fixed service and Surface movement control service shall be recorded.

[REQ]

Identifier	REQ-12.04.07-TS-0105.0007
Requirement	Data-link communication via Aeronautical mobile service (air-ground communications), Aeronautical fixed service (ground-ground



	communications) , Surface movement control service and Aeronautical radio navigation service shall be recorded.
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[REQ]

Identifier	REQ-12.04.07-TS-0105.0008
Requirement	Aeronautical radio navigation service data and surveillance data (from primary and secondary radar equipment or other systems (e.g. ADS-B, ADS-C)) shall be recorded.

[REQ]

Identifier	REQ-12.04.07-TS-0105.0005
Requirement	It shall be possible to access recorded data up to 30 days after it has been recorded.

## A.3 Remote Functional Requirements

### A.3.1 Concept Requirements Single aerodrome Applications

[REQ]

Identifier	REQ-12.04.07-TS-1001.0001
Requirement	An RTM shall be able to connect to a remote airport.

[REQ]

Identifier	REQ-12.04.07-TS-1001.0002
Requirement	An RTM should be able to connect to and be connected to multiple remote airports sequentially, one at a time.

### A.3.2 RTC level requirements

[REQ]

Identifier	REQ-12.04.07-TS-1002.0001
Requirement	The graphical user interfaces should be unified between RTMs within a RTC.

[REQ]

Identifier	REQ-12.04.07-TS-1002.0002
Requirement	The hardware used by ATCO/AFISO to operate the RTM should be unified between RTMs within a RTC.

[REQ]

Identifier	REQ-12.04.07-TS-1002.0003
Requirement	The RTM should enable the ATCO/AFISO to a transfer the active Remote Airport and all the associated services active in an RTM (source RTM) to another RTM (destination RTM).

[REQ]

Identifier	REQ-12.04.07-TS-1002.0004
Requirement	The RTM shall enable ATCO/AFISO in the destination RTM to see the state of all active services from the source Remote Airport before assuming control over it.

[REQ]

Identifier	REQ-12.04.07-TS-1002.0005
Requirement	All services active in the source RTM shall remain active until the transfer is finalized.

[REQ]

Identifier	REQ-12.04.07-TS-1002.0006
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Requirement	The RTM shall enable the ATCO/AFISO in the destination RTM to acknowledge the transfer of the active Remote Airport and all the associated services before it is finalized.
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[REQ]

Identifier	REQ-12.04.07-TS-1002.0007
Requirement	The ATCO/AFISO/RTC Supervisor shall be able to see the state of all active services of a Remote Airport before assuming control.

### A.3.3 RTC Supervisor

[REQ]

Identifier	REQ-12.04.07-TS-1003.0001
Requirement	If the RTC enables transfer of responsibility of ATS for aerodromes between RTMs within the RTC, the RTC should enable a RTC Supervisor role for the RTC.

[REQ]

Identifier	REQ-12.04.07-TS-1003.0002
Requirement	The RTC supervisor role shall have access to functions for planning, coordination and monitoring of the upcoming and present traffic flow for all aerodromes that can be handled by the RTC, in the purpose of tactical opening and closure of RTMs and allocation of airports to them.

[REQ]

Identifier	REQ-12.04.07-TS-1003.0003
Requirement	The RTC supervisor role shall have access to information about <ul style="list-style-type: none"> <li>- what aerodromes are connected to each RTM</li> <li>- transfer status for each RTM (if transferral of responsibility is ongoing)</li> </ul>

	- what aerodromes are selectable for each RTM
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[REQ]

Identifier	REQ-12.04.07-TS-1003.0004
Requirement	The RTC supervisor role should have access to airport system status for all aerodromes connected to the RTC.

[REQ]

Identifier	REQ-12.04.07-TS-1003.0005
Requirement	The RTC supervisor role shall have access to RTC system status.

[REQ]

Identifier	REQ-12.04.07-TS-1003.0006
Requirement	The RTC supervisor role shall have access to weather condition information for all aerodromes connected to the RTC.

[REQ]

Identifier	REQ-12.04.07-TS-1003.0007
Requirement	The technical status of each RTM and all aerodrome(s) connected to the RTC shall be accessible to the RTC supervisor.

### A.3.4 Visualization

#### General

[REQ]

Identifier	REQ-12.04.07-TS-0102.0009
Requirement	The ATCO/AFISO shall have access to live video image of flight operations on and in the vicinity of the aerodrome as well as vehicles and personnel on the manoeuvring area through the use of camera(s).

[REQ]

Identifier	REQ-12.04.07-TS-0102.0010
Requirement	The visual presentation shall have a sufficient horizontal coverage to include the manoeuvring area and the vicinity of the aerodrome.

[REQ]

Identifier	REQ-12.04.07-TS-0102.0011
Requirement	The vertical coverage shall be a sufficient number of degrees above the imagined horizon to include the manoeuvring area and the vicinity of the aerodrome.

[REQ]

Identifier	REQ-12.04.07-TS-0102.0012
Requirement	The vertical coverage shall be a sufficient number of degrees below the imagined horizon to include the manoeuvring area and the vicinity of the aerodrome.

[REQ]

Identifier	REQ-12.04.07-TS-0102.0013
Requirement	The RTM should include functionality for the ATCO/AFISO to be able to activate any additional sensors which improve visual range and resolution, compared to unaided viewing in the visual presentation.

[REQ]

Identifier	REQ-12.04.07-TS-0102.0014
Requirement	The RTM shall enable the ATCO/AFISO to see if additional sensors are activated in the visual presentation

[REQ]

Identifier	REQ-12.04.07-TS-0110.0002
Requirement	The visual presentation may include additional (digital) information to provide the ATCO/AFISO with a greater level of information and/or situational awareness.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0058
Requirement	The visual presentation should incorporate enhancements such as high-dynamic-range imaging, automatic contrast management and other techniques to improve the "raw" picture to provide a greater situational awareness to the ATCO/AFISO.

## Characteristics

[REQ]

Identifier	REQ-12.04.07-TS-0110.0003
Requirement	The visual presentation shall be designed so as to avoid unnecessary discontinuities or non-uniformities in terms of the presented scale, orientation and field of view of the area under observation by the ATCO/AFISO.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0006
Requirement	The video image of the visual presentation (including any additional sensors and the binocular functionality) shall be captured and rendered on the display at a frequency of a sufficient amount of frames per second to provide a smooth and regular impression of moving objects to the human eye.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0007
Requirement	The implementation requirement specification shall define the maximum allowed delay from the capturing of the video image to displaying the video image on the visual presentation.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0005
Requirement	The visual presentation shall provide a non-flickering impression to the human eye.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0053
Requirement	If there is a difference in the perception of daylight / darkness conditions between the visual presentation and the reality, the RTM should provide access to information about the current daylight/dusk/darkness/dawn condition at the remote aerodrome as well as the expected time for the transitioning between these phases

## Quality

This section intends to set a minimum standard for the quality of the visual presentation, in terms of what the ATCO/AFISO needs to be able to visually observe/see. For this reason a terminology based on the Johnson Criteria model and adapted for use in an ATS context has been introduced. Whenever one of the terms below is used within the following requirements, they should be interpreted as follows:

**Detect** (Visual Detection): Something in the image raises the observer’s attention

- “There is something!”

**Recognise** (Visual Recognition): Classes of objects can be differentiated

- Class/category/type of aircraft, to be determined with the help of e.g. one or several of the following parameters;
  - aircraft size & fuselage configuration (e.g. fighter/gliders/ commercial aircraft, etc.)
  - engine configuration (e.g. wing mounted (below / above) or tail mounted, number and type of engines)
  - wing configuration (e.g. mid or top mounted wings)
  - stabilizer configuration
  - landing gear configuration
  - aircraft painting
- Vehicle type/class; e.g. Fire Truck / Car / Snow Sweeping Truck / Luggage Trolley

- Personnel and obstructions; e.g. Person / Wildlife of potential hazards, e.g. birds, dears etc. / / FOD (Foreign Object (Damage))

[REQ]

Identifier	REQ-12.04.07-TS-0110.0008
Requirement	The visual presentation shall have a resolution of a sufficient number of pixels per degree to be able to detect an aircraft of type A320, ATR72 or similar size on 4NM final during daylight CAVOK.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0054
Requirement	The visual presentation shall enable the ATCO/AFISO to detect all flight operations and vehicles on the manoeuvring area during CAVOK conditions.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0055
Requirement	The visual presentation in combination with the binocular functionality shall enable the ATCO/AFISO to visually recognise all flight operations and vehicles on the manoeuvring area during CAVOK conditions.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0056
Requirement	The visual presentation in combination with the binocular functionality shall enable the ATCO/AFISO to visually recognise personnel on the manoeuvring area during daylight CAVOK conditions.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0048
Requirement	During daylight and good visibility conditions, the visual presentation in combination with binocular functionality should enable the ATCO/AFISO to detect obstructions on the manoeuvring area.



[REQ]

Identifier	REQ-12.04.07-TS-0110.0049
Requirement	Depending on visibility and daylight/darkness conditions, the visual presentation in combination with binocular functionality may enable the ATCO/AFISO to observe significant meteorological conditions in the take-off and climb-out area.

[REQ]

Identifier	REQ-12.04.07-TS-0102.0005
Requirement	The visual presentation shall include functionality that reduces the negative impact caused by counter light on the visual presentation (as applicable depending on the technical solution)

[REQ]

Identifier	REQ-12.04.07-TS-0102.0006
Requirement	The visual presentation should include functionality that reduces the negative impact caused by variable light conditions across the field of view of the visual presentation (as applicable depending on the technical solution).

[REQ]

Identifier	REQ-12.04.07-TS-0102.0007
Requirement	The visual presentation shall include functionality that reduces the negative impact caused by precipitation (rain, snow, etc) on the visual presentation (as applicable depending on the technical solution).

[REQ]

Identifier	REQ-12.04.07-TS-0102.0008
Requirement	The visual presentation shall include functionality that reduces the negative impact caused by insects, birds, etc. on the visual presentation (as applicable depending on the technical solution).

[REQ]

Identifier	REQ-12.04.07-TS-0100.0005
Requirement	The RTM visual presentation in combination with binocular functionality shall allow an ATCO/AFISO to observe the visual communication from aircraft that are within the Remote Airport visual range, if meteorological conditions permits.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0043
Requirement	The resolution of the zoom camera shall be sufficient to produce at enough pixels per degree for the ATCO/AFISO to be able to recognise an aircraft of type A320, ATR72 or similar size on 4NM final, in combination with visual presentation, during daylight CAVOK conditions.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0051
Requirement	The resolution of the zoom camera should be sufficient to produce enough pixels per degree for the ATCO/AFISO to be able to judge the position of a light aircraft (e.g. C172 or P28A) in the traffic circuit, and to observe abnormal configurations (such as landing gear not or only partly extended or unusual smoke emissions from any part of the aircraft).

## Augmentation

[REQ]

Identifier	REQ-12.04.07-TS-0110.0050
Requirement	The implementation requirement specification should specify if the visual presentation is to include overlaid information regarding elements or specific targets (tracks, labels, obstacles, runways, and other objects of interest).

[REQ]

Identifier	REQ-12.04.07-TS-0110.0033
Requirement	The implementation requirement specification should specify if the visual presentation is to include overlaid information to indicate / high light specific parts of the aerodrome.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0034
Requirement	The implementation requirement specification should specify if the visual presentation shall include overlaid information to present information pertinent to the general area of interest or area of responsibility.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0035
Requirement	Tracked targets presented as overlaid information within the visual presentation shall be possible to toggle on/off as well as adjust in light intensity by the ATCO/AFISO.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0036
Requirement	Aerodrome indications/high lights presented as overlaid information within the visual presentation shall be possible to toggle on/off as well as adjust in light intensity by the ATCO/AFISO.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0037
Requirement	Areas of responsibility or areas of interest presented as overlaid information within the visual presentation shall be possible to toggle on/off as well as adjust in light intensity by the ATCO/AFISO.

## Binocular functionality

[REQ]

Identifier	REQ-12.04.07-TS-0110.0052
Requirement	The airport shall be equipped with at least one camera with pan, tilt and zoom capabilities. (Corresponding to binoculars in a local tower.)

[REQ]

Identifier	REQ-12.04.07-TS-0110.0038
Requirement	The binocular functionality shall be as simple, quick and easy to use as manually operated binoculars (in a local tower).

[REQ]

Identifier	REQ-12.04.07-TS-0110.0039
Requirement	It shall be possible to manoeuvre the zoom camera to any given location and be presented with an image of that location within ATCO/AFISO operational acceptable limits.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0040
Requirement	The direction of bore sight shall be visually indicated to the ATCO/AFISO.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0046
Requirement	The implementation requirement specification shall specify the required zoom factor for the zoom camera.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0041
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Requirement	It shall be possible for the ATCO/AFISO to change the zoom level of the zoom camera.
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[REQ]

Identifier	REQ-12.04.07-TS-0110.0047
Requirement	The implementation requirement specification shall specify the required zoom speed for the zoom camera.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0027
Requirement	It should be possible to predefine and user-define positions (direction, zoom and focus) for the zoom camera.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0028
Requirement	It should be possible to predefine and user-define automatic scanning patterns, such as runway sweeps, for the zoom camera.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0029
Requirement	The zoom camera should be able to automatically track moving aircrafts, vehicles or obstructions (e.g. personnel or large animals).

[REQ]

Identifier	REQ-12.04.07-TS-0110.0042
Requirement	The visual representation provided by the binocular functionality shall be of sufficient quality (image sharpness, magnification, contrast) to support the related ATCO/AFISO tasks.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0044
Requirement	The contrast of the zoom camera image shall be of sufficient quality to support the related ATCO/AFISO tasks.

[REQ]

Identifier	REQ-12.04.07-TS-0110.0045
Requirement	It should be possible to display the image from the zoom camera in the same presentation area as the static visual presentation (if applicable).

[REQ]

Identifier	REQ-12.04.07-TS-0110.0057
Requirement	The means of directing the signalling lamp towards the applicable aircraft may be combined with the binocular functionality.

### A.3.5 Airport sound reproduction

[REQ]

Identifier	REQ-12.04.07-TS-0111.0004
Requirement	The airport may be equipped with at least one microphone for collecting the outdoor sound.

[REQ]

Identifier	REQ-12.04.07-TS-0111.0005
Requirement	The airport may be equipped with two or more microphones pointed, or placed, at different parts of the manoeuvring area to create stereo sound.

[REQ]

Identifier	REQ-12.04.07-TS-0111.0006
Requirement	The RTM may be equipped with at least one speaker for reproducing the airport sound.

[REQ]

Identifier	REQ-12.04.07-TS-0111.0007
Requirement	The RTM may be equipped with two or more speakers able to reproduce airport stereo sound.

[REQ]

Identifier	REQ-12.04.07-TS-0111.0003
Requirement	The ATCO/AFISO shall be able to adjust the volume, and turn off, any reproduced sound from the airport.

### A.3.6 Other ATS System/Functions

[REQ]

Identifier	REQ-12.04.07-TS-0112.0001
Requirement	The implementation requirement specification should specify if the RTC shall be equipped with an electronic system for presentation and updating of flight plan and control data.

[REQ]

Identifier	REQ-12.04.07-TS-0112.0002
Requirement	If the RTC enables transfer of responsibility of ATS for aerodromes between RTMs within the RTC, the RTC shall be equipped with an electronic system for presentation and updating of flight plan and control data .

[REQ]

Identifier	REQ-12.04.07-TS-0112.0003
Requirement	If the RTM is equipped with an electronic system for presentation and updating of flight data, the implementation requirement specification should specify what pre-sets to use to access common actions .

[REQ]

Identifier	REQ-12.04.07-TS-0112.0004
Requirement	The implementation requirement specification should specify if updates for flight plan and control data to other ATS units is to be done automatically

[REQ]

Identifier	REQ-12.04.07-TS-0112.0005
Requirement	The implementation requirement specification may specify that functionality shall exist to notify when an aircraft or vehicle is entering or vacating a runway.

[REQ]

Identifier	REQ-12.04.07-TS-0112.0006
Requirement	The implementation requirement specification may specify that functionality shall exist to warn when an aircraft or vehicle is entering a runway without clearance.

[REQ]

Identifier	REQ-12.04.07-TS-0112.0007
Requirement	The implementation requirement specification may specify that functionality shall exist to warn when an aircraft or vehicle is entering the manoeuvring area without clearance.

[REQ]

Identifier	REQ-12.04.07-TS-0112.0008
Requirement	The RTM shall enable the ATCO/AFISO to be notified of changes in the technical status of the system, including systems and/or data that are specific



	to remote tower operations, in all respects that may affect safety or efficiency of flight operations and/or the provision of air traffic service.
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### A.3.7 Voice and Data Recording

[REQ]

Identifier	REQ-12.04.07-TS-0113.0001
Requirement	The voice and data recording shall include the visual presentation data.

[REQ]

Identifier	REQ-12.04.07-TS-0113.0003
Requirement	It shall be possible to access the visual presentation data up to 30 days after it has been recorded.

[REQ]

Identifier	REQ-12.04.07-TS-0113.0004
Requirement	It shall be possible to reproduce the recorded visual presentation at the same quality as it was presented to the ATCO at the time of the recording.

[REQ]

Identifier	REQ-12.04.07-TS-0113.0005
Requirement	It shall be possible to retain the recorded data for longer periods until it is evident that they will no longer be required, when recordings are pertinent to accident and incident investigations.

### A.3.8 Work Environment

[REQ]

Identifier	REQ-12.04.07-TS-0114.0001
Requirement	Any information presented within an RTM shall still be visible in office daylight conditions.

[REQ]

Identifier	REQ-12.04.07-TS-0114.0002
Requirement	The technical solution shall describe the temperature and noise levels generated.

[REQ]

Identifier	REQ-12.04.07-TS-0114.0003
Requirement	It shall be possible for the ATCO/AFISO to adjust the lighting conditions in the RTM, in order to adapt to conditions at the remote airport(s).

[REQ]

Identifier	REQ-12.04.07-TS-0114.0005
Requirement	If several RTMs are collocated in an RTC, it should be possible for the ATCO/AFISO to control the lights individually for each RTM in a RTC.

[REQ]

Identifier	REQ-12.04.07-TS-0114.0004
Requirement	Each CWP shall have a place available for taking notes, not less than roughly the size of an A5 sheet.

[REQ]

Identifier	REQ-12.04.07-TS-0114.0006
Requirement	Each CWP should be designed to suit both left and right handed persons.

[REQ]

Identifier	REQ-12.04.07-TS-0114.0007
Requirement	Each CWP should be designed to accommodate users of different heights and sizes.

### A.3.9 Reliability and integrity

[REQ]

Identifier	REQ-12.04.07-TS-0205.0001
Requirement	The implementation specific requirement specification shall define the operational acceptable level of failure or degradation as per local implementation and as per applicable regulations.

[REQ]

Identifier	REQ-12.04.07-TS-0205.0002
Requirement	The remote tower implementation, including both remote tower specific systems and non-remote tower specific systems, shall conform to the implementation specific requirement as defined by REQ-12.04.07-TS-0205.0001 in order to be operationally acceptable.

## A.4 Additional requirements for multiple aerodrome applications

### A.4.1 Concept requirements multiple aerodrome applications

[REQ]

Identifier	REQ-12.04.07-TS-0115.0001
Requirement	It shall be possible to connect an RTM to more than one Remote Airport, in parallel.

### A.4.2 Remote functional requirements

#### Multiple Handling

[REQ]

Identifier	REQ-12.04.07-TS-0116.0001
Requirement	Each RTM shall be able to provide ATC/AFIS services simultaneously for all aerodrome(s) served by that RTM

[REQ]

Identifier	REQ-12.04.07-TS-0116.0002
Requirement	The HMI in the RTM shall clearly indicate which aerodrome(s) that are currently being served.

[REQ]

Identifier	REQ-12.04.07-TS-0116.0003
Requirement	The aerodrome that is being affected when manoeuvring airport systems shall be clearly shown within the RTM.

[REQ]

Identifier	REQ-12.04.07-TS-0116.0004
Requirement	Each RTM shall provide the ATCO/AFISO with all systems and data required to perform the ATS for all connected aerodromes.

## Communication

[REQ]

Identifier	REQ-12.04.07-TS-0117.0001
Requirement	Each RTM that is able to provide ATC/AFIS services for multiple airports shall be able to receive and play aeronautical mobile services (air-ground communications) communication channels for all aerodromes being served to the ATCO/AFISO.

[REQ]

Identifier	REQ-12.04.07-TS-0117.0002
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Requirement	Each RTM that is able to provide ATC/AFIS services for multiple airports shall enable the ATCO/AFISO to transmit aeronautical mobile services (air-ground communications) either to "all aerodromes" being served or to an "individual aerodrome" when ATS is performed to more than one aerodrome simultaneously .
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[REQ]

Identifier	REQ-12.04.07-TS-0117.0003
Requirement	Each RTM that is able to provide ATC/AFIS services for multiple airports simultaneously should enable retransmission and relay of aeronautical mobile service (air-ground communications) between all aerodromes being served from the RTM.

[REQ]

Identifier	REQ-12.04.07-TS-0117.0004
Requirement	Each RTM that is able to provide ATC/AFIS services for multiple airports shall be extended to enable aeronautical fixed service (ground-ground communications) to cover communications with all units relevant for all aerodromes being served.

[REQ]

Identifier	REQ-12.04.07-TS-0117.0005
Requirement	Each RTM that is able to provide ATC/AFIS services for multiple airports shall enable the ATCO/AFISO to listen to all surface movement control service (communications for the control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes) communication channels for all aerodromes being served.

[REQ]

Identifier	REQ-12.04.07-TS-0117.0006
Requirement	Each RTM that is able to provide ATC/AFIS services for multiple airports shall enable the ATCO/AFISO to transmit surface movement control service (communications for the control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes) to individual aerodromes.

### A.4.3 Visualization

[REQ]

Identifier	REQ-12.04.07-TS-0119.0001
Requirement	The visual presentation should include additional (digital) information to enhance visibility (e.g. in identifying the runway and key areas).

### A.4.4 Sound

[REQ]

Identifier	REQ-12.04.07-TS-0206.0001
Requirement	Each RTM that is able to provide ATC/AFIS services for multiple airports should enable the ATCO/AFISO to hear the outdoor sounds from the controlled remote airports.

[REQ]

Identifier	REQ-12.04.07-TS-0206.0002
Requirement	If requirement REQ-12.04.07-TS-0206.0001 is implemented, the RTM shall enable the ATCO/AFISO to turn off and adjust the volume for the outdoor sound for each airport individually.

[REQ]

Identifier	REQ-12.04.07-TS-0206.0003
Requirement	If requirement REQ-12.04.07-TS-0206.0001 is implemented, the outdoor sound reproduction shall be directionally linked to the visual presentation of the aerodromes.

### A.4.5 Work environment

[REQ]

Identifier	REQ-12.04.07-TS-0207.0001
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Requirement	The RTM shall be designed to use as few input devices for the same functionality for different aerodromes as possible.
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## A.5 Contingency requirements

### A.5.1 Concept requirements

[REQ]

Identifier	REQ-12.04.07-TS-0122.0001
Requirement	The RCT shall not be located in the primary ATS tower.

[REQ]

Identifier	REQ-12.04.07-TS-0122.0002
Requirement	The RCT should not be any single points of failure affecting both the RCT and the primary ATC tower.

### A.5.2 Performance and functional requirements

[REQ]

Identifier	REQ-12.04.07-TS-0122.0003
Requirement	The implementation specification shall define the minimum requirements on safety, security, reliability, integrity, and adaptability, for each contingency application.

[REQ]

Identifier	REQ-12.04.07-TS-0122.0004
Requirement	The implementation specification shall define the minimum requirements on capacity, duration of service and switchover time, for each contingency application.

[REQ]

Identifier	REQ-12.04.07-TS-0122.0005
Requirement	The implementation specification shall define the required level of commonality of HMI for each application with respect to the tower being served by the contingency application.

[REQ]

Identifier	REQ-12.04.07-TS-0122.0006
Requirement	The implementation specification shall for each contingency application define the character and form of visual presentation, airport sound presentation, other ATS systems/functions, (extension of) voice and data recording and working environment.



## Appendix B Reference Requirements for Multiple Remote Tower Module (from SESAR 2020 Wave 1 PJ.05-02-V3)

This Appendix contains the Multiple Remote Tower Module requirements from PJ.05-02-V3, SESAR 2020 Wave 1.

### B.1 Performance Requirements

[REQ]

Identifier	REQ-05.02-TS-PR01.0001
Title	MRTM-Airports connection
Requirement	An MRTM shall be connected to multiple (two or more than two) remote airports simultaneously.
Status	<Validated>
Rationale	MRTM will provide all remote tower functions required to provide ATS to a set of aerodrome(s).  Implementing remote management of airports should reduce the costs providing ATS and contribute to the overall improvement of ATM services.
Category	<Functional><Performance>

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-PR01.0001
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-PR01.0002
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-PR01.0003
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-PR01.0002
Title	Technical procedures and failures
Requirement	All technical failures on an MRTM or remote airport shall be categorized by severity and technical procedures shall be defined how to handle each severity level.
Status	<Validated>
Rationale	<p>Security Management systems are already a regulatory requirement on ANSPs, however needs to be expanded to cover e.g. for the transmission of remote airport data.</p> <p>Security measures is to be determined in the scope of local implementations, but may include controls such as;</p> <ul style="list-style-type: none"> <li>-Data Input Credibility and Authentication,</li> <li>-Data Encoding / Encryption.</li> <li>-Technical controls against different threats such as viruses, malware, Trojans, electromagnetic interference etc.</li> <li>-Alternate Supply Systems.</li> </ul>
Category	<Performance><Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-PR01.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-82
<ALLOCATED_TO>	<Functional block>	Technical Supervision ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## B.2 Multiple Remote Tower Module (MRTM)

### B.2.1 General Requirements

## [REQ]

Identifier	REQ-05.02-TS-CO01.0001
Title	MRTM aeronautical mobile services
Requirement	The MRTM shall provide access to aeronautical mobile services (air-ground communications) to the ATCO for active Remote Airport(s), in accordance with ICAO Annex 11, Chapter 6.1
Status	<Validated>
Rationale	ICAO Annex 11, Chapter 6.1
Category	<Functional> <Interface>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-CO01.0001
<SATISFIES>	<Enabler>	CTE-C14
<ALLOCATED_TO>	<Functional block>	G/G Voice Communication
<ALLOCATED_TO>	<Functional block>	A/G Communications
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## [REQ]

Identifier	REQ-05.02-TS-CO01.0002
Title	MRTM aeronautical fixed service
Requirement	The MRTM shall provide access to aeronautical fixed service (ground-ground communications) to the ATCO for active Remote Airport(s), in accordance with ICAO Annex 11, Chapter 6.2
Status	<Validated>
Rationale	ICAO Annex 11, Chapter 6.2
Category	<Functional> <Interface>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.0205.02-SPRINTEROP-CO01.0002
<SATISFIES>	<Enabler>	CTE-C14
<ALLOCATED_TO>	<Functional block>	G/G Voice Communication
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-CO01.0003
Title	MRTM surface movement control service
Requirement	The MRTM shall provide access to ground frequency (communications for the control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes) to the ATCO for the aerodrome(s) under control, in accordance with ICAO Annex 11, Chapter 6.3.
Status	<Validated>
Rationale	ICAO Annex 11, Chapter 6.3
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-CO01.0003
<SATISFIES>	<Enabler>	CTE-C14
<ALLOCATED_TO>	<Functional block>	G/G Voice Communication
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-CO01.0004
Title	Signalling lamp functionality
Requirement	The MRTM shall provide a signalling lamp functionality to the ATCO on the active Remote Airport(s), in accordance with ICAO Annex 14 section 5.1.3.
Status	<Validated>
Rationale	ICAO Annex 14, Volume 1, chapter 5.1.3  (5.1.3.1 A signalling lamp shall be provided at a controlled aerodrome in the aerodrome control tower.)  ICAO Annex 2, Appendix 1, chapter 4.1.  (4.1 Light and pyrotechnic signals, Figure 1.1)
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-CO01.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	A/G Voice Communication
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## B.2.2 Communications

### Visual Communication

[REQ]

Identifier	REQ-05.02-TS-CO02.0001
Title	Airport visual communication
Requirement	The MRTM visual presentation in combination with binocular functionality shall allow an ATCO to observe the visual communication from aircraft that

	are within the Remote Airport visual range, if meteorological conditions permits.
Status	<Validated>
Rationale	ICAO Doc 4444 12.3.4 “Phraseologies for use on and in the vicinity of the aerodrome” defines rocking wings, moving ailerons (or rudder), and flashing / showing landing lights as a possible means of acknowledgement of visual communication.
Category	<Design><Functional><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-CO02.0001
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-CO02.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## Voice Communication System (VCS)

[REQ]

Identifier	REQ-05.02-TS-CO03.0001
Title	“Listen to all” functionality
Requirement	The VCS of the MRTM shall be able to receive aeronautical mobile services (air-ground communications) communication channels for all aerodromes being served to the ATCO.
Status	<Validated>
Rationale	When ATS is performed to more than one aerodrome simultaneously from one MRTM, the ATCO shall listen to all aeronautical mobile service (air-ground communications) communication channels for all aerodromes being served.

	Note: If a separate ground controller position is introduced, a separate communication channel for the control of traffic operating on the manoeuvring area would be needed for each aerodrome served by a ground controller.
Category	<Functional> <IRS>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-CO03.0001
<SATISFIES>	<Enabler>	CTE-C14
<ALLOCATED_TO>	<Functional block>	A/G Voice Communication
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-CO03.0002
Title	“Transmit to all/individual” functionality
Requirement	The VCS of the MRTM should enable the ATCO to transmit aeronautical mobile services (air-ground communications) either to "all aerodromes" being served or to an "individual aerodrome" when ATS is performed to more than one aerodrome simultaneously.
Status	<Validated>
Rationale	When ATS is performed to more than one aerodrome simultaneously from one MRTM, the ATCO shall for the aeronautical mobile service (air-ground communications), be able to transmit either to “all aerodromes” being served or to an “individual aerodrome”.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02

<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-CO03.0002
<SATISFIES>	<Enabler>	CTE-C14
<ALLOCATED_TO>	<Functional block>	A/G Voice communication
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## [REQ]

Identifier	REQ-05.00-TS-CO03.0007
Title	Surface Movement Control Service for vehicles
Requirement	The input/output devices for controlling the vehicles (surface movement control service) shall be integrated in the CWP in a way that they are easily distinguishable between airports.
Status	<Validated>
Rationale	<p>With a multiple remote tower display, consistency is considered a strong supporting barrier in helping ATCOs distinguish the input/ output devices per each aerodrome.</p> <p>E.g. if airports are represented side-by-side, push-buttons for these should also be located side-by-side.</p> <p>This REQ originates from REQ.05.00_HPdesign_10 of the [HPAR].</p>
Category	<Functional>,<Human Performance>,<HMI>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<SESAR Solution>	PJ.05.35
<SATISFIES>	<ATMS Requirement>	REQ-05.00-SPRINTEROP-CO03.0007
<SATISFIES>	<Enabler>	N/A
<ALLOCATED_TO>	<Functional block>	G/G Voice Communication
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A



## [REQ]

Identifier	REQ-05.02-TS-CO03.0003
Title	"Relay/retransmit between all aerodromes" functionality
Requirement	The VCS of the MRTM should enable retransmission and relay of aeronautical mobile service (air-ground communications) between all aerodromes being served from the MRTM.
Status	<Validated>
Rationale	When ATS is performed to more than one aerodrome simultaneously from one MRTM, aeronautical mobile service (air-ground communications) should be retransmitted / relayed between all aerodromes being served from the MRTM.
Category	<Functional>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-CO03.0003
<SATISFIES>	<Enabler>	CTE-C14
<ALLOCATED_TO>	<Functional block>	A/G Voice communication
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## [REQ]

Identifier	REQ-05.02-TS-CO03.0004
Title	MRTM Aerodromes Communication
Requirement	The VCS of the MRTM shall be capable to cover communications with all units relevant to the aerodromes allocated into the MRTM
Status	<Validated>

Rationale	Each MRTM has the necessity to have all the information of the aerodromes the ATCO has under control
Category	<Functional> <Safety> <Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-CO03.0004
<SATISFIES>	<Enabler>	CTE-C14
<ALLOCATED_TO>	<Functional block>	A/G Voice Communication
<ALLOCATED_TO>	<Functional block>	G/G Voice Communication
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-CO03.0005
Title	Surface movement listen to all functionality
Requirement	The VCS of the MRTM should enable the ATCO to listen to all surface movement control service (communications for the control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes) communication channels for all aerodromes being served.
Status	<Validated>
Rationale	When ATS is performed to more than one aerodrome simultaneously from one MRTM, the ATCO shall be able to listen to all surface movement control service (communications for the control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes) communication channels for all aerodromes being served.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-CO03.0005
<SATISFIES>	<Enabler>	CTE-C14
<ALLOCATED_TO>	<Functional block>	G/G Voice Communication
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-CO03.0006
Title	Surface Transmit to individual functionality
Requirement	The VCS of the MRTM should be able to transmit to individual aerodromes to provide access to surface movement control service (communications for the control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes)
Status	<Validated>
Rationale	ICAO Annex 11, Chapter 6.3
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-CO03.0006
<SATISFIES>	<Enabler>	CTE-C14
<ALLOCATED_TO>	<Functional block>	G/G Voice Communication
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

### B.2.3 MET-functions

[REQ]

Identifier	REQ-05.02-TS-MT01.0001
Title	MRTM meteorological information
Requirement	The MRTM shall provide the ATCO access to meteorological info from the active Remote Airport(s) in accordance with ICAO Annex III, ICAO Annex 11 Chapter 7.1 and national regulations.
Status	<Validated>
Rationale	ICAO Annex III, ICAO Annex 11 Chapter 7.1 and national regulations.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-MT01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Aerodrome Weather Information Management
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-MT01.0002
Title	Airports MET report
Requirement	The MRTM shall continuously present the current MET report from the currently active Remote Airport(s). This MET info shall include wind information, QNH and RVR, if measured.
Status	<Validated>
Rationale	ICAO Doc 4444 Chapter 7.3.1.2 & ICAO Annex 11 Chapter 7.1.4.

	This is essential information used very frequently by the ATCOs to inform pilots in real time.
Category	<Functional>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-MT01.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Aerodrome Weather Information Management
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## [REQ]

Identifier	REQ-05.02-TS-MT01.0003
Title	SIGMET data
Requirement	SIGMET data for all the aerodromes under control shall be available in the MRTM for the controller
Status	<Validated>
Rationale	In accordance with Doc 4444, the ATCO shall have SIGMET information presented
Category	<Data>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-MT01.0003
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Aerodrome Weather Information Management

<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## B.2.4 Visualization

### ICAO Regulation

[REQ]

Identifier	REQ-05.02-TS-VS01.0001
Title	Live video images
Requirement	The ATCO shall have access to live video image of flight operations on and in the vicinity of the aerodrome as well as vehicles and personnel on the manoeuvring area through the use of camera(s).
Status	<Validated>
Rationale	In order to fulfil the task of keeping watch by visual observation while not being physically present at the aerodrome, a technical solution is needed that presents visual sensor data - collected from the aerodrome and its vicinity and transmitted to the remote tower facility - to the ATCO in a way that provides him/her with the situational awareness required for conducting the associated services. This technical solution will be termed the Visual Presentation.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS01.0001
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS01.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A

<ALLOCATED_TO>	<Service>	N/A
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[REQ]

Identifier	REQ-05.02-TS-VS01.0002
Title	Reduction of negative impacts in visual presentation
Requirement	The visual presentation shall include functionalities that reduce any negative impact (e.g. caused by variable light conditions, precipitation, insects, etc.) on the visual presentation.
Status	<Validated>
Rationale	Negative impact such as direct sunlight within the camera field of view. Set as shall requirement since if not implemented, impact of counter light will negatively affect the performance of the visual presentation.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS01.0001
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS01.0002
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS02.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-VS01.0003
Title	Visual presentation non-flickering impression

Requirement	The visual presentation shall provide a non-flickering impression to the human eye.
Status	<Validated>
Rationale	Flickering displays causes tiredness
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS01.0001
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS01.0002
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS02.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

**General**

[REQ]

Identifier	REQ-05.02-TS-VS02.0001
Title	Additional sensors activation 1
Requirement	The MRTM should include functionality for the ATCO to be able to activate any additional sensors which improve visual range and resolution, compared to unaided viewing in the visual presentation.
Status	<Validated>
Rationale	The sensors considered in this requirement may utilise additional “hot spot cameras” or sensors/cameras other than narrowly light band spectrum, such as UV and IR.



	<p>The purpose of such sensors would e.g. be to assist the ATCO to;</p> <ul style="list-style-type: none"> <li>- monitor aircraft/vehicles entering or vacating the runway, (or to confirm stopping at holding points) during low visibility conditions,</li> <li>- detect obstructions/objects/personnel/animals (without its own light source) during darkness</li> </ul>
Category	<Functional><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS02.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-VS02.0002
Title	Additional sensors activation 2
Requirement	The MRTM should enable the ATCO to see if additional sensors are activated in the visual presentation
Status	<Validated>
Rationale	<p>So to not mislead the ATCO regarding the information provided by the non-improved visual presentation.</p> <p>The sensors considered in this requirement may utilise additional “hot spot cameras” or sensors/cameras other than narrowly light band spectrum, such as UV and IR.</p>
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS02.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-VS02.0003
Title	Visual presentation design
Requirement	The visual presentation shall be designed so as to avoid unnecessary discontinuities or non-uniformities in terms of the presented scale, orientation and field of view of the area under observation by the ATCO.
Status	<Validated>
Rationale	<p>Additionally, existing discontinuities and non-uniformities needs to be clearly indicated so as to avoid misleading impressions of the observed area.</p> <p>Avoid eventual (screen) seams / joints in the visual presentation located at “hot spot” areas, e.g. holding positions, RWY entrance / exits etc as far as possible. If that is not possible, consider to implement mitigations such as hot spot cameras (if the PTZ camera is not sufficient) in order for the ATCO to get an undivided/unbroken/unobscured presentation of these “hot spot” areas.</p>
Category	<Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS02.0003
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC

<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-VS02.0004
Title	Video image visual presentation frequency
Requirement	The video image of the visual presentation (including any additional sensors and the binocular functionality) shall be captured and rendered on the display at a frequency of a sufficient amount of frames per second to provide a smooth and regular impression of moving objects to the human eye.
Status	<Validated>
Rationale	This requirement is also related to transient phenomena, e.g. flashing lights such as Runway Guard Lights (RGL) or aircraft strobe lights. It is of high operational importance for an ATCO to be able to see/judge if a light is flashing or not, e.g. confirming RGL on/off status.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS02.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-VS02.0005
Title	Video image maximum delay

Requirement	The implementation requirement specification shall define the maximum allowed delay from the capturing of the video image to displaying the video image on the visual presentation.
Status	<Validated>
Rationale	Refer to ED-240 REQ 01 VIDEO LATENCY
Category	<Performance><Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VS02.0005
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	G/G Communication Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## [REQ]

Identifier	REQ-05.00-TS-VS02.0006
Title	Possibility to scan/view all parts of the CTR
Requirement	<p>The MRTM shall provide parts of the CTR not presented by default to be available through pan or binocular functionality.</p> <p>If the VP enables a possibility turn/pan the view, then a feature that would allow the view to return to a "fixed" position should be available.</p>
Status	<Validated>
Rationale	<p>This would allow the ATCOs to access the remaining part of the CTR which is not covered by the standard Visual Presentation (for weather observations, specific traffic situations etc.).</p> <p>This REQ originates from REQ.05.00 HPdesign_22 and HPdesign_16of the [HPAR].</p>
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.00-SPRINTEROP-VS02.0008
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## Quality

[REQ]

Identifier	REQ-05.02-TS-VQ01.0001
Title	Visual presentation resolution 1
Requirement	The visual presentation shall have a resolution of a sufficient number of pixels per degree to be able to detect an aircraft of type A320, ATR72 or similar size on 4NM final during daylight CAVOK.
Status	<Validated>
Rationale	<p>Detection of an aircraft of type ATR72 (7x7 m according to EUROCAE WG-100) or similar size at a distance of 4NM requires at least 36 pixels per degree according to Johnson's criteria.</p> <p>Dependent on camera placement, aerodrome and manoeuvring area layout. Requires approx. 31 pixels per degree to detect humans at a distance of 1,5km. Requires approx. 120 pixels per degree to recognise them as humans.</p>
Category	<Design> <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02

<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VQ01.0001
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VQ01.0003
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VQ01.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-VQ01.0002
Title	Zoom camera resolution
Requirement	The resolution of the camera shall be sufficient to produce enough pixels per degree for the ATCO to be able to judge the position of a light aircraft (e.g. C172 or P28A) in the traffic circuit, and to observe abnormal configurations (such as landing gear not or only partly extended or unusual smoke emissions from any part of the aircraft).
Status	<Validated>
Rationale	Dependent on camera placement, aerodrome and manoeuvring area layout. Requires at least 460 pixels per degree to recognise a light aircraft of type C172 (2.25x2.25m according to EUROCAE WG-100) or similar size at a distance of 4NM. Requires at least 512 pixels per degree to detect gear down (0,5x0,5m gear) at a distance of 4NM.
Category	<Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VQ01.0002
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VQ01.0003
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VQ01.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-79

<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-VQ01.0003
Title	Visual presentation resolution 2
Requirement	During daylight and VMC conditions, the visual presentation in combination with binocular functionality should enable the ATCO to detect obstructions on the manoeuvring area.
Status	<Validated>
Rationale	The fulfilment of this requirement will be dependent on distance to and size of the obstruction as well as on meteorological conditions - as already implicit in current ICAO regulations.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VQ01.0005
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## Augmentation

[REQ]

Identifier	REQ-05.02-TS-VG01.0002
Title	Visual presentation additional information
Requirement	The visual presentation may include additional (digital) information to provide the ATCO with a greater level of information and/or situational awareness.
Status	<Validated>
Rationale	The aim with this requirement is to present additional information directly in the visual presentation (compare with head up displays in aircrafts) in order to minimise ATCO head down time.
Category	<Functional> <HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VG01.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-VG01.0004
Title	Visual presentation overlaid information 2
Requirement	Tracked targets may be presented as overlaid information within the visual presentation.
Status	<Validated>
Rationale	Tracked targets need to be displayed for the controllers to increase situational awareness
Category	<Functional><HMI>



[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VG01.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-VG01.0005
Title	Visual presentation overlaid information 1
Requirement	The visual presentation may include overlaid information to indicate / high light specific parts of the aerodrome or responsibility areas.
Status	<Validated>
Rationale	<p>This requirement primarily targets framings around runways, taxiways, aprons etc., in order to enhance the ATCO situational awareness. The exact configuration of these features is to be determined in the scope of local implementations.</p> <p>Requirement likely to be more important in a Multiple Aerodrome application environment or in a high traffic density environment.</p>
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	Q-05.02-SPRINTEROP-VG01.0005
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama

<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-VG01.0006
Title	Visual presentation overlaid information 3
Requirement	The visual presentation may include overlaid information such as meteo or UTC time to the controller corresponding to the area of responsibility or area of interest.
Status	<Validated>
Rationale	<p>This requirement is primarily targeting geographic, meteorological and operational and service status and handover information. Instances of element classes include:</p> <ul style="list-style-type: none"> <li>- Geographic: cardinal / compass directions</li> <li>- Meteorological: current wind and RVR values, met report, METAR; TAF</li> <li>- Operational and service: runway/taxiway/apron designators, aerodrome systems status such as lighting, clock, checklists, maps</li> <li>- Visual reminders such as “RWY blocked” markings to aid with runway incursion prevention.</li> </ul> <p>Requirement likely to be more important in a Multiple Aerodrome application environment or in a high traffic density environment.</p>
Category	<Metadata>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VG01.0006
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller

<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-VG01.0007
Title	Enable/Disable overlaid presentation
Requirement	It shall be possible to toggle on/off the information as well as adjust in light intensity by the ATCO.
Status	<Validated>
Rationale	All information presented in the MRTM must be able to be switched on and off according to controller needs.
Category	<Functional><HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VG01.0007
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.35-TS-VG01.0008
Title	Wind information overlaid presentation
Requirement	Wind information (speed and direction) related to the RWY operating directions in use shall be presented as overlaid information within the visual presentation.

Status	<Validated>
Rationale	Meteorological information need to be displayed to the controller to provide information to flights.
Category	<Functional><HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-VG01.0008
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## Binocular Functionality

[REQ]

Identifier	REQ-05.02-TS-BF01.0001
Title	MRTM Binocular functionality 1
Requirement	The visual reproduction shall provide functionality corresponding to the binoculars in a local Tower (including a moveable zoom feature with a visual indication of the direction of boresight).
Status	<Validated>
Rationale	Functionality corresponding to the binoculars in a local tower, including moveable zoom feature with a visual indication of the direction of sight
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-BF01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-BF01.0002
Title	Zoom camera contrast quality
Requirement	The visual presentation provided by the binocular functionality shall be of sufficient quality (image sharpness, magnification) and contrast to support the related ATCO tasks.
Status	<Validated>
Rationale	Dependent on camera placement, aerodrome and manoeuvring area layout.
Category	<Design><Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-BF01.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-BF01.0003
Title	MRTM Binocular functionality 2
Requirement	The binocular functionality shall be as simple, quick and easy to use as manually operated binoculars (in a local tower).
Status	<Validated>
Rationale	It shall be possible to determine where the zoom camera is aiming. This can for example be accomplished by overlaying the zoom camera image in the corresponding position of the OTW view, or presenting the current direction within the PTZ view.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-BF01.0003
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-BF01.0004
Title	Bore sight direction
Requirement	The direction of bore sight shall be visually indicated to the ATCO
Status	<Validated>
Rationale	It shall be possible to determine where the zoom camera is aiming. This can, for example, be accomplished by overlaying the zoom camera image in the corresponding position of the OTW view, or presenting the current direction within the PTZ view.

Category	<Functional>
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[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-BF01.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-BF01.0005
Title	Zoom camera user-define
Requirement	It should be possible to predefine and user-define positions (direction, zoom and focus) for the zoom camera
Status	<Validated>
Rationale	Assisting the ATCO in performing checks on fixed points of interest, such as holding points etc.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-BF01.0005
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A

<ALLOCATED_TO>	<Service>	N/A
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[REQ]

Identifier	REQ-05.02-TS-BF01.0006
Title	Scanning patterns user-define
Requirement	It should be possible to predefine and user-define automatic scanning patterns, such as runway sweeps, for the zoom camera.
Status	<Validated>
Rationale	Assisting the ATCO in performing e.g. runway sweeps or sweeps of any of other area of interest within the area of responsibility.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-BF01.0006
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-BF01.0007
Title	Zoom camera aircrafts and vehicles tracking
Requirement	The zoom camera should be able to automatically track moving aircrafts, vehicles or obstructions (e.g. personnel or large animals).
Status	<Validated>
Rationale	Assisting the ATCO to automatically follow moving objects with the binocular function improves usability of the system.



Category	<Functional>
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[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-BF01.0007
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## B.2.5 NAV-functions

[REQ]

Identifier	REQ-05.02-TS-NV01.0001
Title	MRTM navigational aids
Requirement	The MRTM shall include functionality for the ATCO to monitor, adjust intensity and on/off status of visual navigational aids for the active Remote Airport(s).
Status	<Validated>
Rationale	ICAO Annex 11 Chapter 7.3 & ICAO Doc 4444 Chapter 7.15  Visual navigational aids, such as:  Approach, PAPI, runway, taxiway, RGL
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-NV01.0001

<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-NV01.0002
Title	MRTM non-visual aids status
Requirement	The MRTM shall include functionality for the ATCO to monitor and adjust the status of non-visual aids for the active Remote Airport(s).
Status	<Validated>
Rationale	ICAO Annex 11 Chapter 7.3. Non-visual navigational aids., such as: ILS LOC/GP,LO NDB,OM/MM/IM, VOR, DME.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-NV01.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-82
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Technical Supervision ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## B.2.6 Other ATS System/Functions

## Surveillance

[REQ]

Identifier	REQ-05.02-TS-FN01.0001
Title	MRTM surveillance data
Requirement	The MRTM should allow the ATCO to access surveillance data such as radar presentation, when available, from the active Remote Airport(s).
Status	<Validated>
Rationale	ICAO Doc 4444, Chapter 7.1.1.2
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-FN01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Aerodrome Surveillance
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-FN03.0001
Title	Aircraft and vehicle runway conformance monitoring
Requirement	The surveillance system implemented in the MRTM may warn when an aircraft or vehicle is entering a runway without clearance.
Status	<Validated>
Rationale	To assist in identifying/avoiding RWY incursions.
Category	<Metadata>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-FN01.0003
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Conformance Monitoring
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## B.2.7 Voice and Data Recording

## [REQ]

Identifier	REQ-05.02-TS-DR01.0001
Title	Radio navigation service and surveillance data recording
Requirement	Aeronautical radio navigation service data and surveillance data (from primary and secondary radar equipment or other systems (e.g. ADS-B, ADS-C)) shall be recorded for a period of at least thirty days.
Status	<Validated>
Rationale	ICAO Annex 11 Chapters 6.4.1.1 & 6.4.1.2
Category	<Functional>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-DR01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Support Functions Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A

<ALLOCATED_TO>	<Service>	N/A
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[REQ]

Identifier	REQ-05.02-TS-DR01.0002
Title	ATCO voice recording
Requirement	ATCO direct-speech communication via Aeronautical mobile service, Aeronautical fixed service and Surface movement control service shall be recorded.
Status	<Validated>
Rationale	ICAO Annex 11, Chapters 6.1, 6.2, 6.3 & 6.4
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-DR01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Support Functions Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-DR01.0003
Title	Data-link recording
Requirement	Data-link communication via Aeronautical mobile service (air-ground communications), Aeronautical fixed service (ground-ground communications), Surface movement control service and Aeronautical radio navigation service shall be recorded.
Status	<Validated>

Rationale	ICAO Annex 11, Chapter 6.4 ICAO Annex 11, Chapter 6.2.2.3.3 ICAO Annex 11, Chapter 6.2.2.3.7 ICAO Annex 11, Chapter 6.2.3.5
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-DR01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Support Functions Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-DR01.0004
Title	Visual presentation data recording
Requirement	Visual presentation data shall be recorded
Status	<Validated>
Rationale	ICAO Annex 11 Chapter 6.
Category	<Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-DR01.0001

<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Support Functions Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-DR01.0005
Title	Reproduction of visual presentation
Requirement	It shall be possible to reproduce the recorded visual presentation at the same quality as it was presented to the ATCO at the time of the recording.
Status	<Validated>
Rationale	ICAO Annex 11 Chapter 6.4.1.1 & 6.4.1.2.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-DR01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Support Functions Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-DR01.0006
Title	Recorded data retention

Requirement	It shall be possible to retain the recorded data for a period of at least thirty days, and in addition for longer periods until it is evident that they will no longer be required when recordings are pertinent to accident and incident investigations.
Status	<Validated>
Rationale	ICAO Annex 11 Chapter 6.4.1.1 & 6.4.1.2.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-DR01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Support Functions Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## B.2.8 Airport sound reproduction

[REQ]

Identifier	REQ-05.02-TS-AS01.0001
Title	Aerodrome Sound
Requirement	The MRTM may reproduce the aerodrome sound of each airport in the MRTM.
Status	<Validated>
Rationale	The ATCO's situational awareness will be increased
Category	<Functional>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier



<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-AS01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-AS01.0002
Title	Aerodrome Directional Sound
Requirement	The MRTM shall reproduce directional sound so the controller can identify the orientation of the audio.
Status	<Validated>
Rationale	The ATCO's situational awareness will be increased
Category	<Functional>,<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-AS01.0003
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-AS01.0003
Title	Airport equipment

Requirement	The airport may be equipped with one or more microphones for collecting the outdoor sound.
Status	<Validated>
Rationale	In order to increase situational awareness and compensate for being placed remote.
Category	<Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-AS01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-AS01.0004
Title	MRTM equipment
Requirement	The MRTM may be equipped with one or more speakers for reproducing the airport sound.
Status	<Validated>
Rationale	In order to increase situational awareness and compensate for being placed remote.
Category	<Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02

<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-AS01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-AS01.0005
Title	Sound adjustment
Requirement	The MRTM shall allow to adjust the volume and turn-off/on the outdoor sound reproduction by the ATCO.
Status	<Validated>
Rationale	In order to minimise disturbing background noise
Category	<Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-AS01.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## B.2.9 Technical Supervision

[REQ]

Identifier	REQ-05.02-TS-TS01.0001
Title	Systems technical status

Requirement	The MRTM shall include functionality to notify the ATCO about any technical status of systems that can affect the safety or efficiency of flight operations and/or the provision of air traffic service for the RTC and for the active Remote Airport(s).
Status	<Validated>
Rationale	ICAO Doc 4444, Chapter 4.14
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-TS01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-82
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Technical Supervision ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## B.2.10 ATCO Planning Tool

[REQ]

Identifier	REQ-05.02-TS-AP01.0001
Title	Aerodromes Traffic Information
Requirement	The MRTM shall display to the controller information about the upcoming traffic situation at the airports under control to make him aware of parallel traffic activities at different airports
Status	<Validated>
Rationale	This will help the ATCO to adjust and plan traffic to any constraints
Category	<Functional>,<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-AP01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-81
<ALLOCATED_TO>	<Functional block>	Multiple Remote Aerodromes Management
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## B.3 Transfer/Merging

### B.3.1 General

[REQ]

Identifier	REQ-05.02-TS-TM01.0001
Title	Airport transfer - Services
Requirement	All services active in the source MRTM shall remain active until the transfer is finalized.
Status	<Validated>
Rationale	The transfer shall not interrupt any ongoing services
Category	<Functional><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-TM01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## B.3.2 Static

[REQ]

Identifier	REQ-05.02-TS-TM02.0001
Title	Aerodrome Transfer 1
Requirement	The MRTM shall be able to transfer aerodrome data and video to another MRTM
Status	<Validated>
Rationale	In case of overload or an RTC supervisor decision, a controlled aerodrome can be transferred from one MRTM to another.
Category	<Functional>,<Safety>,<Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-TM02.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-TM02.0002
Title	Aerodrome Transfer 2
Requirement	An MRTM shall be able to receive aerodrome data and video from another MRTM
Status	<Validated>

Rationale	In case of overload or an RTC supervisor decision, a controlled aerodrome can be transferred from one MRTM to another.
Category	<Functional> <Safety> <Data> <IRS>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-TM02.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-TM02.0003
Title	Aerodromes Replicas
Requirement	When a split is done, aerodromes data replicas should be displayed in both MRTMs until the transfer is completely done.
Status	<Validated>
Rationale	When a transfer is going to be done, the ATCO receiving the control of the aerodrome needs to ensure if he/she can safely take it. For this purpose, both ATCOs need to have the aerodrome data until the transition is done.
Category	<Functional> <Safety> <Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-TM02.0003
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-TM02.0004

<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Visual Panorama
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.03-TS-TM03.0007
Title	Airport transfer – Services status
Requirement	The system shall provide ATCO and/or RTC Supervisor with relevant information on the status of an aerodrome and it’s related systems before the ATCO assumes control of the aerodrome.
Status	<In Progress>
Rationale	In order to be sure about the airport and related system status before assuming the responsibility.  <b>Validated in SESAR1</b>
Category	<Functional><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-TM03.0007
<SATISFIES>	<Enabler>	AERODROME-ATC-84
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Functional block>	Operational Supervision Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Role>	RTC Supervisor
<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier



<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

## B.4 Remote Tower Centre (RTC)

[REQ]

Identifier	REQ-05.03-TS-RC02.0001
Title	MRTM uniform design
Requirement	The MRTMs in the RTC should be designed uniformly so that it is possible to operate any airport connected to that RTC from any of its MRTMs.
Status	<Validated>
Rationale	<p>Applying standards and uniform principles, and ensuring the technical and operational interoperability of aircraft and ATM systems.</p> <p>This requirement also aims to ensure flexibility within an RTC regarding airport and CWP allocation, as well as to simplify ATCO/AFISO licensing &amp; training issues.</p> <p><b>Validated in SESAR1</b></p>
Category	<Design><Interoperability>

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-RC02.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

[REQ]

Identifier	REQ-05.03-TS-RC02.0002
Title	Uniform design of MRTM Graphical user interface
Requirement	The graphical user interfaces (HMI) should be uniform between MRTMs within a RTC.
Status	<Validated>
Rationale	<p>No significant adjustment in HMI should be necessary when an ATCO change MRTM, enabling uniform procedures for all MRTMs.</p> <p>This requirement also aims to ensure flexibility within an RTC regarding airport and CWP allocation, as well as to simplify ATCO/AFISO licensing &amp; training issues.</p> <p><b>Validated in SESAR1</b></p>
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.03-SPRINTEROP-RC02.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	Function Identifier
<ALLOCATED_TO>	<Service>	Service Identifier
<ALLOCATED_TO>	<Information exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Data>	Data Identifier
<ALLOCATED_TO>	<System Port>	System Port Identifier

## B.5 Work Environment

[REQ]

Identifier	REQ-05.02-TS-WE01.0001
Title	MRTM information visibility
Requirement	Any information presented within a MRTM should still be visible in office daylight conditions.
Status	<Validated>
Rationale	ATCOs are used to working in a daylight environment (normal towers). Compare with modern ACCs, which are also designed to allow for daylight conditions to avoid fatigue etc.
Category	<HMI><Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-WE01.0001
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## [REQ]

Identifier	REQ-05.02-TS-WE01.0002
Title	Temperature and noise levels
Requirement	The technical solution shall describe the temperature and noise levels generated.
Status	<Validated>
Rationale	In order to ensure good working environment to avoid fatigue etc.
Category	<Metadata>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-WE01.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-WE01.0003
Title	Lighting conditions adjustments
Requirement	Each MRTM Working Environment shall be designed according to national regulations for normal office establishments.
Status	<Validated>
Rationale	E.g., during darkness at the remote aerodrome, the room/MRTM is likely needed to be darker.
Category	<Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-WE01.0002
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

[REQ]

Identifier	REQ-05.02-TS-WE01.0004
Title	MRTM lights control
Requirement	If several MRTMs are collocated in a RTC, it shall be possible for the ATCO to control the lights individually for each MRTM in a RTC.
Status	<Validated>
Rationale	It can be daylight conditions (at the remote airport) in one MRTM, and darkness (at the remote airport) in the MRTM next beside.
Category	<HMI>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-WE01.0003
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A

## [REQ]

Identifier	REQ-05.02-TS-WE01.0005
Title	MRTM notes
Requirement	Each MRTM shall have a place available for taking notes, not less than roughly the size of an A5 sheet.
Status	<Validated>
Rationale	Taking manual notes are often common practice in small towers due to e.g. lot unplanned traffic. Making manual paper notes is ultimately also the final fall-back procedure if all technical systems would stop functioning.
Category	<Design>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<SESAR Solution>	PJ.05.02
<SATISFIES>	<ATMS Requirement>	REQ-05.02-SPRINTEROP-WE01.0004
<SATISFIES>	<Enabler>	AERODROME-ATC-79
<ALLOCATED_TO>	<Functional block>	CHMIM Aerodrome ATC
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A



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