

# SESAR Solution PJ.05-W2-35 SPR-INTEROP/OSED for V3 - Part I

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# PJ.05-W2-DTT

## DIGITAL TECHNOLOGIES FOR TOWER

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### Abstract

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The Remote Tower concept is changing the provision of Air Traffic Services (ATS) in a way that it is more service tailored, dynamically positioned and available when needed, enabled by digital solutions replacing the need for controllers and tower buildings being located at aerodromes.

Remotely Provided Air Traffic Service for Multiple Aerodromes and development of the Remote Tower Centre are part of this development, which started with Single Remote Towers and continued with development of the Multiple Remote Tower Modules (MRTM) from a technological, functional and operational point of view. At the last stage, the development of Remotely Provided Air Traffic Services for Multiple Aerodromes expanded with development of the flexible allocation of the aerodromes between the Multiple Remote Tower Modules in the same RTC, as well as within the same Multiple Remote Tower Module.

The main driver for the Remote Tower Centre concept development, in SESAR PJ05 solution 35, is increased cost efficiency by an increase of ATCO productivity, achieved by a flexible allocation of aerodromes between the MRTMs. Since this cannot be measured directly in the exercises (commonly used: shorter routes or increased movement per ATCO), the cost reduction calculations will use the validation results of Safety and Human Performance. Kept Safety levels with support from Human Machine Interface, with a capability to keep capacity at each of the targeted aerodromes, will in fact reduce cost. Kept capacity at each of the targeted aerodromes is, in this solution, possible through a flexible allocation of aerodromes between the ATCOs in the MRTMs.

The OI step addressed in this OSED document is:

- **SDM-0210: Highly Flexible Allocation of Aerodromes to Remote Tower Modules**  
*'The provision of remote ATS service to the remote aerodromes can be dynamically assigned (over time) to any other Remote Tower Module (RTM) within a Remote Tower Centre (RTC). RTC planning tools supporting the RTC supervisor enable an efficient usage of all RTMs and staff in an RTC.'*

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# 1 Executive Summary

This document is the OSED (Operational Services and Environment Description), SPR (Safety and Performance Requirements) and INTEROP (Interoperability Requirements) for solution PJ05-W2-35 – “Multiple Remote Tower and Remote Tower Centre”. Solution PJ05-W2-35 will be referred to as Solution 35 in the present document. The OSED describes Solution 35 at V3 maturity level. The Operational Improvement Step addressed in this solution is:

- SDM-0210 - “Highly Flexible Allocation of Aerodromes to Remote Tower Modules”.

*‘The provision of remote ATS service to the remote aerodromes can be dynamically assigned (over time) to any other Remote Tower Module (RTM) within a Remote Tower Centre (RTC). RTC planning tools supporting the RTC supervisor enable an efficient usage of all RTMs and staff in an RTC.’*

The previous work done in SESAR 2020 Wave1, has delivered results determining the solution PJ05-02-V3 as a reference for Solution 35 regarding Multiple Remote Tower Modules. Solution 35 is focusing on Remote Tower Centre and highly flexible allocation of aerodromes between different MRTMs, with validations at V3 maturity level.

The objective of Solution 35 is to increase ATCO productivity (i.e. reduce the number of ATCOs required to control multiple aerodromes simultaneously) by balancing the workload between different MRTMs accommodated within a Remote Tower Centre. The balanced workload refers to a tolerable workload acceptable for ATCOs, achieved by a flexible allocation of grouped aerodromes in dedicated MRTMs.

The allocation imply that a particular aerodrome can take different positions in the same MRTM prior transfer to another MRTM and after receiving it back. The expectation is that the flexibility will increase the complexity and it might be more difficult to maintain situational awareness for the ATCO (this compared to a fixed presentation of 2 or 3 aerodromes). However, the results from the validations has proven that the ATCOs appreciate the possibility to flexibly allocate the aerodromes depending on which aerodromes they have in their control.

The traffic load kept at a certain amount defined in the scope of Solution 35, by taking into account traffic complexity and required controller workload for providing simultaneous ATC services. Aerodrome complexity regarding layout or traffic patterns, e.g. backtracking vs. use of parallel taxiways, or ILS for just one RWY, are example of factors which impact ATCO workload.

It should be highlighted that already validations on preceding Remote Tower OIs revealed that workload can consist of other tasks than simultaneous movements which will impact amount of traffic a single ATCO can handle. The same findings apply to this solution. Examples for these tasks are:

- Monitor weather changes
- Possible communication with meteorologist
- Locating technical problems and assessing consequences
- Possible communication with technical supervisor
- Coordination with airport e.g. snow sweeping, electrical service etc.
- Coordination with other Air Traffic Control units
- Monitor changes in traffic load

- Replying to general phone calls e.g. pilots calling to file a flight plan

In order to avoid all uncertainties that could affect the ATCO's ability to provide simultaneous Air Traffic Control (ATC) in a safe and efficient manner the following possibilities were considered:

- Possibility for ATCOs in charge to self-decide the positioning of the aerodromes within the particular MRTM.
- The ATCO workload was balanced to an appropriate level by additional automation/technical support.

A controller with a specific role as a RTC supervisor can support the task of flexible allocation of grouped aerodromes to dedicated MRTMs. Support tools that incorporates data like traffic volume/complexity, planned maintenance and other activities, weather conditions at the different airports as well as ATCO endorsements and availability, can aid the supervisor. The Supervisor planning tool might include a what-if functionality to allow the RTC supervisor to compare different parameters.

*Note: With a limited number (decided by each ANSP) of connected aerodromes, one of the ATCOs available in the RTC may carry out the RTC Supervisor role.*

The conducted validations covering the scope of Solution 35 are based on the assumption that an ATCO can hold endorsements for 4 aerodromes. Nevertheless, having 4 endorsements is not a requirement to implement the concept but it needs to be considered locally within each RTC depending on aspects such as harmonised procedures, airspace class and type of traffic. These 4 aerodromes are grouped together and can be flexibly allocated to the MRTMs. The concept could also be valid for a higher number of grouped aerodromes if the ATCO can hold more endorsements. The Real Time Simulations address a setup with two MRTMs, each providing the capability to allocate 3 aerodromes at a time. The validations are focusing on evaluation of human performance and safety aspects.

Solution 35 addresses any combination of Small Operating Environment aerodromes according to EATMA aerodrome classification (between 15K and 40K annual IFR movements), taking into consideration the different kinds of environments composed of:

- Different levels of airport complexity (RWYs, taxiways, etc.).
- Traffic volumes and their distribution over the controlled aerodromes.
- Various conditions at the different aerodromes (weather, daylight, geographical difference).
- Variable traffic mixes (VFR-IFR-mix, rotor-fixed wing, special).

The results from Solution 35 are also valid for aerodromes within category Other Operating Environment (less than 15K annual IFR movements)

Technical aspects, such as network quality of service, SWIM infrastructure and other resilience/redundancy related issues that are of key importance to the regulatory authorities are in place for the baseline Single Remote Tower.

Information needs for maintaining situational awareness including the local actual and forecasted weather (MET) and the local actual and forecasted status of the infrastructure (AIM) will need to be addressed from various operational perspectives.

Training and endorsement aspects were considered in the validations but need to be further investigated in order to be prepared for the deployment phase.

## 2 Introduction

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### 2.1 Purpose of the document

This document provides the requirements specification, covering functional, non-functional and interface requirements related to SESAR Solution PJ05-W2-35 at V3 level.

The SESAR Solution Development Life Cycle aims to structure and perform the work at project level and progressively increase SESAR Solution maturity, with the final objective of delivering a SESAR Solution data pack for industrialisation and deployment. The SPR-INTEROP/OSED represents one of the key parts of this SESAR Solution data pack.

The document is part I of the concept development documents, Operational Services and Environment Description (OSED), Safety and Performance Requirements (SPR) and INTEROP relating to solution PJ05-W2-35 – “Multiple Remote Tower and Remote Tower Centre”.

The SPR/INTEROP-OSED Template includes the following parts:

- **SPR/INTEROP-OSED Template – Part I (this volume)**
- SPR/INTEROP-OSED Template – Part II Safety Assessment Report (SAR)
- SPR/INTEROP – OSED Template – Part IV Human Performance Assessment Report (HPAR)
- SPR/INTEROP – OSED Template – Part V Performance Assessment Report (PAR)

### 2.2 Scope

This document describes the SPR-INTEROP/OSED related to a Remote Tower Centre with flexible allocation of aerodromes to a MRTM.

The solution addressed in this OSED is:

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

The OI step addressed in this OSED is:

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

The requirements in this document will cover safety, performance, operational aspects as well as the interoperability aspects related to a specific technology to support the SESAR 2020 Wave 2, Solution 35.

### 2.3 Intended readership

The intended audience for this document primarily consists of all the partners involved in SESAR 2020, PJ05 addressing Solution 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 staff organisations;

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

PJ14-W2-84b - Multi Tower Remote Surveillance Module SESAR 2020 Transversal Projects:

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

## 2.4 Background

The work done for Single Remote Tower, and Contingency Remote Tower, 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 Appendix B at the end of this document). These solutions have provided initial benefits in terms of cost efficiency (Single Remote Tower) and resilience (contingency) while providing the required level of safety. Information can be found in the data packs for the following operational improvements:

- SDM-0201 - Single Remote Tower for low density aerodromes
- SDM-0204 - Contingency solutions for aerodromes with one main RWY

Resulting in the following SESAR solutions:

- Solution #71  
Single Remote Tower Services for small airports
- Solution #12  
Single Remote Tower Services for medium traffic volumes
- Solution #13  
Remotely-provided air traffic services for contingency situations at aerodromes
- Solution PJ05.02-V3  
Multiple Remote Tower Module

The previous validations regarding Multiple Remote Tower concept, have delivered results determining the solution PJ05-02-V3 as reference for Solution 35 regarding Multiple Remote Tower Modules. (The requirements for this solution can be found in the Appendix C at the end of this document). Information can be found in the data packs for the following operational improvements:

- SDM-0205 - Multiple solution for two low density aerodromes simultaneously
- SDM-0207 – Multiple Remote Tower Modules

- SDM-0210 – Highly Flexible Allocation of Aerodromes to remote Tower Modules – V2 level

Resulting in the following SESAR solutions:

- Solution #52  
Remote Tower Services for two low-density aerodromes
- Solution PJ05.02-V3  
Multiple Remote Tower Module
- Solution PJ05.03-V2  
Highly Flexible Allocation of Aerodromes to Remote Tower Modules

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, has been validated at V3 maturity level.

## 2.5 Structure of the document

The structure of the document is as follows:

**Section 1:** Contains the executive summary of the document;

**Section 2:** This section introduces the document and scopes the document.

**Section 3:** Describes the operational services and the environment that is applicable for each SESAR Solution

**Section 4:** Contains the Safety, Performance and Interoperability Requirements and their allocation to the solutions.

**Section 5:** Lists the reference documents used in the production of this OSED.

The following appendices complement the document:

- Appendix A: Cost Benefit Mechanism, showing how the SESAR Solution elements contribute (positively or negatively) to the delivery of performance benefits and the costs.
- Appendix B: Baseline requirements for Single Remote Tower from SESAR 1.
- Appendix C: Baseline requirements for Multiple Remote Tower Module from SESAR 2020 wave 1 reference solution PJ05-02-V3.

The SPR-INTEROP/OSED is composed of different parts. This document covers Part I providing the Safety and Performance Requirements (SPR) and Interoperability Requirements (INTEROP), related to the SESAR 2020 Wave 2, Solution 35. This validated during activities at V3 level, all presented in the context of the Operational Service and Environment Definition (OSED), which describes the environment, assumptions, etc., that are applicable to the SPR and INTEROP requirements.

## 2.6 Glossary of terms

Term	Definition	Source of the definition
ATS (Air Traffic Service)	A generic term meaning variously, Flight Information Service (FIS), Alerting Service (ALRS) and Air Traffic Control Service (ATC) (area control service, approach control service or aerodrome control service). In this document, when the term ATS is used, it is usually referring to TWR or AFIS.	ICAO, Annex 11
Aerodrome ATS	Air traffic service for aerodrome traffic, in the form of aerodrome Air Traffic Control service (ATC) or Aerodrome Flight Information Service' (AFIS).	EASA
Aerodrome Control Service (TWR)	The air traffic control (ATC) service provided by the Air Traffic Control Officer (ATCO) for aerodrome traffic.	ICAO, Annex 11
APP (Approach control service)	The service for Arrival and Departing traffic (before and after they will be/have been under the TWR control. APP is provided by a single ATCO for one or more airports, either separate or in combination with TWR (TWR & APP from the Tower).	ICAO
Conventional Tower	A facility located at an aerodrome from which aerodrome ATS is provided principally through direct out-of-the-window observation of the aerodrome and its vicinity.	EASA
Multiple mode of operation	The provision of ATS from one remote tower/remote tower module for two or more aerodromes at the same time (i.e. simultaneously).	EASA
Multiple Remote Tower Module (MRTM)	A Remote Tower Module (RTM) which enables the possibility to provide ATS to two or more aerodromes at the same time (i.e. simultaneously).	PJ.05 definition
Out-of-the-window (OTW) view'	A view of the area of responsibility of the aerodrome ATS unit from a conventional tower, obtained via direct visual observation.	EASA
Remote Tower	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 facility housing one or more remote tower modules.	EASA
Remote Tower Module (RTM)	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. (a comparison can be with the tower cabin of an aerodrome conventional tower.)	EASA
Remote Tower Centre Supervisor (RTC supervisor)	<p>A role established in order to provide an efficient set up at all times and guarantee a flexible system by means of: performing 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.</p> <p><i>Note: With a limited number (decided by each ANSP) of connected aerodromes, one of the ATCOs available in the RTC may carry out the RTC Supervisor role</i></p>	PJ.05 definition
Simultaneous movements	All aircraft and vehicle movements under the control of the ATCO or on the frequency at the same time.	PJ.05 definition
Single mode of operation	The provision of ATS from one remote tower/remote tower module for one aerodrome at a time.	EASA
Technical Enablers	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 are given within this document.	EASA
Visual Presentation	A view of the area(s) of responsibility of the aerodrome ATS unit, provided by a visual display.	EASA
Visual Surveillance System	A number of integrated elements, normally consisting of optical sensor(s), data transmission links, data processing systems and situation displays providing an electronic visual presentation of traffic and any other information necessary to maintain situational awareness at an aerodrome and its vicinity.	ICAO, Doc 4444 EASA



**Note:** EUROCAE ED-240/ED-240A is using the term 'remote tower optical system' for the same.

**Table 1: Glossary of terms**

## 2.7 List of Acronyms

Acronym	Definition
ACC	Area Control Centre
ADI	Aerodrome Control Instrument (Rating)
AFIS	Aerodrome Flight Information Service
AFISO	Aerodrome Flight Information Service Officer
AIM	Aeronautical Information Management
ALRS	Alerting Service
ANS	Air Navigation Services
ANSP	Air Navigation services Provider
APP	Approach Control
APS	Approach Control Surveillance (Rating)
ATCC	Air Traffic Control Centre
ATCO	Air Traffic Control Officer
ATM	Air Traffic Management
ATS	Air Traffic Service
AVF	Advance Visual Features
CNS	Communication Navigation and Surveillance
CONOPS	Concept of Operations
CR	Change Request
CTR	Control Zone
CWP	Controller Working Position
DME	Distance Measuring Equipment
EASA	European Aviation Safety Agency
EATMA	European ATM Architecture
E-ATMS	European Air Traffic Management System
FATO	Final approach and take-off area
HPAR	Human Performance Assessment Report
IFR	Instrument Flight Rules

<b>ILS</b>	Instrument Landing System
<b>INTEROP</b>	Interoperability Requirements
<b>KPA</b>	Key Performance Area
<b>LVO</b>	Low Visibility Operations
<b>LVP</b>	Low Visibility Procedures
<b>MET</b>	Meteorology, meteorological
<b>MRTM</b>	Multiple Remote Tower Module
<b>NDB</b>	Non Directional Beacon
<b>NSA</b>	National Supervisory Authority
<b>OI</b>	Operational Improvement
<b>OSED</b>	Operational Service and Environment Definition
<b>OTW</b>	Out-The-Window
<b>PAR</b>	Performance Assessment Report
<b>PTZ</b>	Pan-Tilt-Zoom
<b>QoS</b>	Quality of Service
<b>RNAV</b>	Area Navigation (Random Navigation)
<b>RPAS</b>	Remotely Piloted Aircraft Systems
<b>RTC</b>	Remote Tower Centre
<b>RTM</b>	Remote Tower Module
<b>RTO</b>	Remote Tower Operations
<b>RVR</b>	Runway Visual Range
<b>RWS</b>	RTC supervisor
<b>RWY</b>	Runway
<b>SAC</b>	Safety Criteria
<b>SAR</b>	Safety Assessment Report
<b>STK</b>	Stakeholder
<b>TGL</b>	Touch-and-Go Landing
<b>U/S</b>	Unserviceable
<b>VFR</b>	Visual Flight Rules

Table 2: List of acronyms

## 3 Operational Service and Environment Definition

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In the following sub-sections, the document describes the operational environment that is applicable for the SESAR 2020 wave 2, Solution PJ05-W2-35.

### 3.1 SESAR Solution PJ.05-W2-35: a summary

The previous work done in SESAR 1 on Single Remote Tower is the baseline for the Multiple Remote Tower. Furthermore, the PJ05.02-V3 (a part of Multiple Remote Tower concept) has delivered results determining this solution as reference for Solution 35 regarding MRTM from a technological, functional and operational point of view. Solution 35 is focusing on Remote Tower Centre with highly flexible allocation of aerodromes between different MRTMs, and it is validated at V3 maturity level.

The objective of solution 35 is to increase ATCO productivity (i.e. reduce the number of ATCOs required to control multiple aerodromes simultaneously) by balancing the workload between different MRTMs within a Remote Tower Centre. The balanced workload is achieved by a flexible allocation of grouped aerodromes to dedicated MRTMs.

In addition to this, solution 35 addresses extended automation support in order to balance ATCO workload to an acceptable level, i.e. enable flexible allocation or higher traffic amounts/complexity as given by small aerodromes.

Research within SESAR LSD.02.05 has shown that equipment costs can be reduced further for AFIS. As PJ.05 is focusing on more complex environments and increased traffic, AFIS is not considered as an R&D objective even though all parts are applicable for such a service, but with different impact on savings.

#### Operational Service

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##### [Flexible Allocation of Aerodromes to MRTMs / Automation Support](#)

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The objective of solution 35 is to increase ATCO productivity (i.e. reduce the number of ATCOs required to control multiple aerodromes simultaneously) by balancing the workload between different MRTMs accommodated within a Remote Tower Centre. The balanced workload - a workload on levels that shall be acceptable for involved ATCOs, is achieved by a flexible allocation of grouped aerodromes to dedicated MRTMs. The allocation of the aerodromes could be initiated and conducted either, by the ATCOs in charge, or by a role of Remote Tower Centre Supervisor (RTC supervisor). Both actors are supported respectively with planning tools, a short-term planning tool for the ATCOs and a long-term planning tool for the RTC Supervisor. Provided data to the planning tools, allowing the ATCOs and RTC supervisor more accurate assessment of the current and the future traffic situation in order to predict the most suitable time for transfer of the aerodromes to be initiated and conducted. Regardless whom requested transfer of the aerodromes, the both involved ATCOs, should be supported with pre-defined checklists in order to accomplish a safe and consistent transfer process.

This allocation of the aerodromes can imply that a particular aerodrome, which is subject of flexible allocation between the modules, can take different positions in the same MRTM prior transfer to

another MRTM and after receiving it back. The expectation is that this will increase the complexity, and might be more difficult to maintain situational awareness for the ATCO with this flexibility (this compared to a fixed presentation of 2 or 3 aerodromes).

The flexible allocation can also imply that higher traffic levels should be handled by the ATCOs. While some situations might result in small delays, aerodrome capacity will not be reduced by introducing multiple remote tower concept (if more capacity is required, flexible allocation needs to be adjusted or another MRTM to be opened).

All issues that could affect the ATCOs ability to provide simultaneous ATS in a safe and efficient manner should be taken into consideration, including the following possibilities:

- The traffic load will be kept at a certain amount defined in the scope of Solution 35 by taking into account traffic complexity and required controller workload for providing simultaneous ATC services. Such workload is generally caused by aerodrome complexity regarding layout or traffic patterns, e.g. backtracking vs. use of parallel taxiways, or ILS for just one RWY.
- Possibility for ATCOs in charge to self-decide the positioning of the aerodromes within the particular MRTM.
- The workload could be balanced at an appropriate level by extended automation support.

It should be highlighted that already validations on preceding Remote Tower OIs revealed that workload can consist of other tasks than simultaneous movements which will impact amount of traffic a single ATCO can handle. The same findings apply to this solution. Examples for these tasks are:

- Monitor weather changes
- Possible communication with meteorologist
- Locating technical problems and assessing consequences
- Possible communication with technical supervisor
- Coordination with airport e.g. snow sweeping, electrical service etc.
- Coordination with other Air Traffic Control units
- Monitor changes in traffic load
- Replying to general phone calls e.g. pilots calling to file a flight plan

#### Supervisor Role and Supervisor Planning Tool

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The complexity of the task of flexible allocation of grouped aerodromes to dedicated MRTMs, located to the same RTC can vary depending on few factors such:

- The size of an RTC in terms of:
  - Number of aerodromes allocated to the RTC.
  - Number of MRTMs required for accommodating the aerodromes.
- The circumstances under which the allocation is envisaged to conduct:
  - During nominal operating conditions, or
  - Caused by some abnormal or degraded operational conditions.

Depending on the listed complexities, the task of flexible allocation can be assigned to a controller with a specific role – RTC supervisor. The RTC supervisor role should cover the following tasks with respect to the flexible allocation of aerodromes between MRTMs:

- plan allocation of aerodromes to MRTMs
- plan staffing of the MRTMs
- monitor the situation at the MRTMs
- support the ATCO in cases of high workload (e.g. emergencies or degraded mode),
- initiate allocation of aerodromes to MRTMs

The workload associated with these tasks might be quite different depending on the specific local implementation, mostly affected by the size of an RTC (e.g. big RTC with many aerodromes vs. 2-3 aerodrome RTC). Depending on this, the SUP role might also cover different general coordination and administration tasks.

Depending on complexity as result from the specific local implementation or the associated workload, the SUP Role might be allocated either to an ATCO or to a dedicated Supervisor.

The ATCOs working in an RTM shall be allowed to request a transfer of the aerodromes between the different MRTMs, when they assess that the current or future traffic situation demands it.

In order to enable an efficient allocation, it is assumed that a Supervisor Planning Tool that incorporates data like traffic volume/complexity and weather conditions at the different airports as well as ATCO endorsements and availability will support the RTC supervisor. The planning tool might include a what-if functionality to allow the RTC supervisor to compare different parameters.

Automation planning support tools has a possibility to assist the Supervisor in an efficient allocation of aerodromes to MRTMs (strategic, pre-tactical and tactical). In the validations, this was made through usage of more aerodromes than those within each validation, meaning not the ones operated by the ATCOs. Validation activities used virtual aerodromes, not part of the main validation. This to support the supervisor role in an RTC with several connected airports with aim to find a more efficient allocation of aerodromes and ATCOs.

*Note: With a limited number (decided by each ANSP) of connected aerodromes, one of the ATCOs available in the RTC may carry out the RTC Supervisor role. Similar to larger ATS units during night operations when the tasks of a supervisor is handed over the ATCOs rostered for night shift.*

## Environment

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Solution 35 addresses any combination of Small Operating Environment Aerodromes, according to EATMA aerodrome classification. The results gained through the validation process is also valid for Other Operating Environment Aerodromes.

## Validation setup and Assumptions

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The validations were based on the assumption that an ATCO hold endorsements for up to 4 aerodromes, which are grouped together and flexibly allocated at two MRTMs. The MRTM-systems and procedures were harmonised in order to support the ATCOs in the RTC when providing simultaneous ATS in a Multiple RTM.

The Real Time Simulations addressed, in general, a setup with two MRTMs, each providing the capability to allocate 3 aerodromes simultaneously within each MRTM. Aerodromes could be allocated as follows or vice versa:

- MRTM1 with 3 airports imposing allocation of 1 airport to MRTM2; and
- MRTM1 with 2 airports imposing allocation of 2 airports to MRTM2.

In order to achieve even higher level of flexibility, the MRTMs allows the possibility for flexible positioning of the aerodromes within the same RTM depending on ATCOs preferences. Apart from increased level of flexibility, a preferred positioning of the aerodromes had positive impact on ATCOs situational awareness.

Nevertheless, due to the nature of the validation method - Real Time Simulation, It was not possible to fully reflect all the aspects of the operational environment and operational conditions, the new concept has faced-off some limitations, such:

- The number of occurrences for degraded modes were limited
- In the planning tools the flight plans for all movements were available (including for all VFR traffic)
- Not all ATCOs participating in the validations have a local endorsement at the aerodromes in the validations. therefore methods and procedures where simplified
- All validations, except one, were run as Real Time Simulations ensuring perfect conditions with respect to surveillance.
- Not all the tasks a supervisor has to do in an operational environment were covered.
- The duration of an exercise run never exceeded 90 minutes.

The validations were focusing on evaluation of human performance and safety aspects.

### Validation Scenarios

Different use cases were tested to assess their effects on ATCOs performance (e.g. situational awareness, workload etc.). The scenarios had up to maximum 30 movements and up to 6 simultaneous movements per hour in total per MRTM. The mix of traffic, vehicle and aircraft, IFR and VFR, or traffic with different speeds were considered as well as aerodromes with different types of infrastructure leading to e.g. backtracking. The complexity was also impacted by the flexibility of allocation of aerodromes.

The scenarios covered different parameters such as same or different runway directions, similar or different airport layouts, a single taxiway or several, different weather, further described in the table 7.

## Enablers

The table below provides allocated enablers related to solution 35 covering OI step SDM-0210:

SESAR Solution ID	SESAR Solution Title	OI Steps ID	OI Steps Title	Enabler ID	Enabler Title	OI Step/Enabler Coverage
PJ05-W2-35	Multiple Remote Tower and Remote Tower Center	SDM-0210	Highly Flexible Allocation of Aerodromes to Remote Tower Modules	Aerodromes ATC - 83	Multiple Remote Tower planning tools for Supervisor	OI Step SDM0210: Fully Enabler: <ul style="list-style-type: none"> <li>Required</li> </ul>
				Aerodromes ATC - 84	Multiple Remote Tower allowing dynamic allocation of aerodromes	OI Step SDM0210: Fully Enabler: <ul style="list-style-type: none"> <li>Required</li> </ul>
				Aerodromes ATC - 85	Provide the MRTM with automation functionalities to reduce controller workload	OI Step SDM0210: Fully Enabler: <ul style="list-style-type: none"> <li>Required</li> </ul>
				SVC-072	Aerodrome Transfer service	OI Step SDM0210: Fully Enabler: Required
				CTE – S10	Multiple Remote Tower Control - Surveillance	OI Step SDM0210: Fully Enabler: <ul style="list-style-type: none"> <li>Optional</li> </ul>
				REG-0537	EPAS – 7.11 RMT.0624  Technical and operational requirements	N/A

					for remote tower operation	
				HUM-066	RTC Supervisor Role	OI Step SDM0210: Fully Enabler: Required
				STD-162	ED-240A MASPS for Remote Tower Optical Systems Ch. 1	N/A

Table 3: SESAR Solution PJ.05-W2-35 Scope and related OI steps/enablers

High Level Concept of Operations Requirement ID	High Level Concept of Operations Requirement	Reference to relevant Concept of Operations Sections e.g. Operational Scenario applicable to the SESAR Solution
S05-035-HLOR-01	<p>The Remotely Provided Air Traffic Services from a Remote Tower Centre with flexible allocation of aerodromes to Remote Tower Modules shall:</p> <ul style="list-style-type: none"> <li>optimize the balance between traffic demand and the number of ATCOs/AFISOs required</li> <li>increase cost-efficiency</li> </ul> <p>by</p> <ul style="list-style-type: none"> <li>flexible allocation of airports to the different RTMs within the RTC</li> <li>supporting the RTC supervisor role with appropriate functionalities</li> <li>supporting the ATCO with appropriate functionalities</li> <li>integrating MET information in the RTM</li> <li>supporting RTC supervisor role planning tasks with appropriate tools</li> <li>connection with ATCO planning tools</li> </ul> <p>while</p> <ul style="list-style-type: none"> <li>finding the balance between providing all information required at a certain</li> </ul>	Chapter 3.2.4

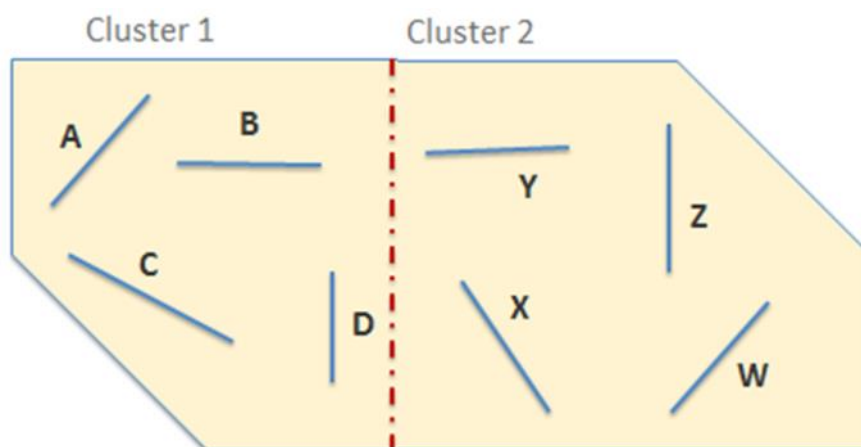


	moment while avoiding clutter of information <ul style="list-style-type: none"> <li>• applying handover procedures for a flexible transfer of aerodromes between MRTM</li> </ul>	
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**Table 4: Link to Concept of Operations**

The numbers endorsements an ATCO had, set the limit of how airports were distributed, in a flexible way. One solution to keep a larger RTC running is to divide airports in different groups, clusters, to enable endorsements on all airports within a cluster.

Figure 1 below shows feasible grouping of different aerodromes in two separate clusters (4 aerodromes in each cluster) within one RTC.

**Figure 1 Airport cluster configurations in a RTC**

The flexible allocation of airports and ATCOs within an RTC adds a need for a RTC Supervisor or a similar role with planning tools to enable an efficient run of an RTC.

Figure 2 below adds a view on how an RTC with a flexible allocation of aerodromes could function:

- Four different aerodromes are flexibly allocated between two MRTMs in the one RTC, while maximum three aerodromes can be allocated to one MRTM

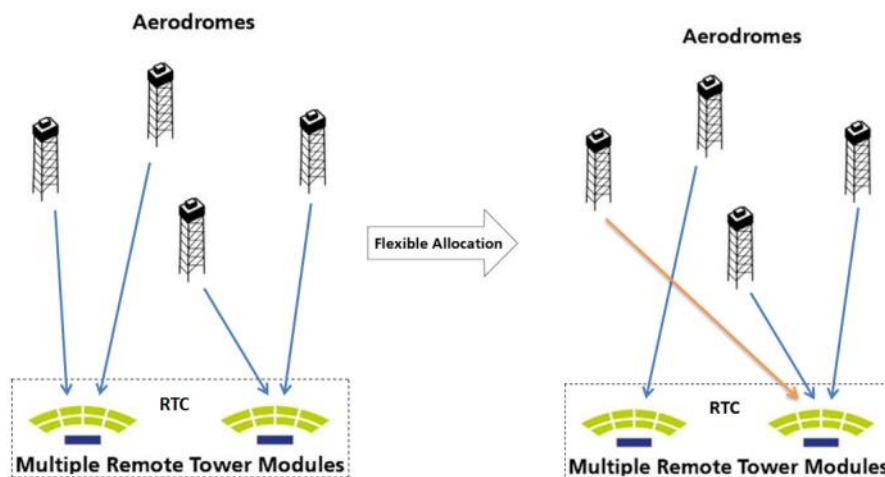


Figure 2 Flexible allocation of aerodromes to MRTM's in RTC

- RTC supervisor should be provided with all necessary data to flexibly allocate aerodromes between the different MRTMs achieving, as much as possible, a balanced workload between the MRTMs

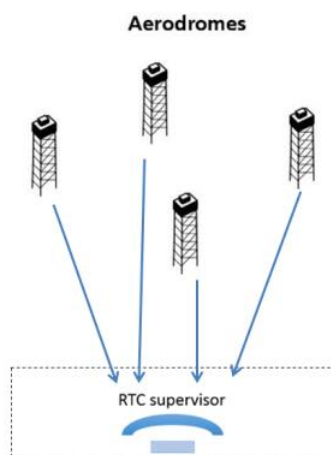


Figure 3 RTC Supervisor role with data from all connected airports

- The picture below shows how a larger number of aerodromes could be allocated between several MRTMs placed inside one RTC. The RTC supervisor role being supported by the supervisor planning tool will allocate aerodromes between different MRTMs.

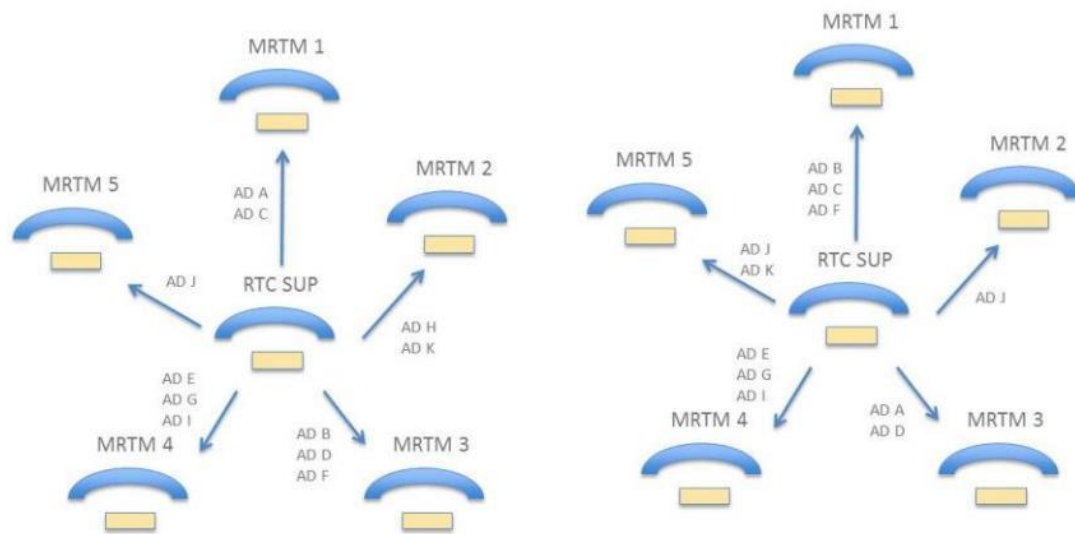


Figure 4 Aerodrome allocation examples within an RTC

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

The SESAR Solutions are described according to CONOPS update. There are no deviations from DS 23.

## 3.2 Detailed Operational Environment

### Operational Environment in EATMA

The EATMA elements impacted by PJ05-W2-35 are shown below.

This matrix show, according to EATMA elements, which nodes operate in the different environments involved in PJ.05.

Operating Environment	Node
Small Airport Operating Environment	Aerodrome ATS (Remote Tower)
Other Operating Environment Airports	Aerodrome ATS (Remote Tower)

Table 5: Nodes related to Operating Environments

The capabilities affected by this project are shown in the table hereunder.

Capability
ATM Performance Management
ATM Service Management / Remote Tower Operations Provision

Table 6: Capabilities

No measures are available in EATMA for this project as it is focused on Human Performance and Safety.

### 3.2.1 Operational Characteristics

The operational characteristics for environments where the solution can be applied are outlined in the table below. ATC for small category of airports are addressed.

The characteristics should be interpreted as common across all candidate countries and ANSPs are not restrictive i.e. they represent a baseline operating environment that may be slightly different in each individual country or ANSP.

Solution PJ05-W2-35 is aiming for increased cost efficiency for ATC services compared to conventional air traffic services. It is applicable for AFIS as service provided in the same way as a conventional tower that is feasible for both AFIS and ATC.

		Environment
Services	TWR	Yes (Including Clearance delivery / Ground Control / Tower Control / TWR Apron Control/ AFIS). Roles EATMA involved: Tower Clearance Delivery Controller, Tower Ground Controller, Tower Runway Controller, Apron Manager
	APP	Optional (including combined TWR/APP) Roles EATMA involved: Approach Controller
	Opening Hours	Up to 24H (including night)
Staffing	Number of ATS staff	One ATCO per MRTM More than one ATCO in the RTC, including MRTMs and RTC Supervisor
	Ratings	ADI, possibly APP, APS/RAD (ratings are optional dependent on service delivered from the RTC or MRTM)
Airspace	Airspace Classification	Class C and/or D
	CTR	10- 15 NM radius/rectangular, Vertical extension up to about 3000 ft MSL
	TMA	Optional (dependent on regional regulations/procedures)
	Procedures	Specific IFR routes & approach procedures Established VFR procedures
Aerodrome	Number of RWY	One Runway
	Taxiway and runway entries	Typically one major taxiway parallel with the RWY, number of RWY intersections/entries varying typically between 1 and 3. Also smaller aerodromes with apron connected directly to runway by one to three shorter taxiways.
	Aprons	Typically 1 or 2 (ordinary and GA/freight)
Traffic	Number of movements	

	Number of simultaneous movements	Corresponding to the “small” airport operating environments (up to a maximum of 40.000 movements as described in the PJ.20 Operation environment description’) The solution PJ05-W2-35 only apply when the traffic volume can be controlled by one ATCO from the MRTM (which might be limited to certain time periods) The number of simultaneous movements depends on the traffic complexity. Up to maximum 6 simultaneous movements.
	Traffic Type	VFR and IFR Mainly scheduled, charter and GA.
	Aircraft Fleet mix	All aircraft types are included.

**Table 7: Operational Environment Characteristics for PJ05-W2-35**

Validations took place with up to 4 aerodromes in a cluster, presented in Figure 1. The total numbers validated was up to 15 aerodromes within an RTC, with a maximum number of 4 within a single cluster (maximum 3 AD in a single MRTM) as in Figure 3. Traffic complexity is dependent on airport layout, number of taxiways, aprons etc. These factors will affect total number of simultaneous movements that one ATCO can handle at a time as well as number of movements per hour.

The airspace users are receivers of the ATS service. However, neither their role nor their responsibility will change because of the introduction of multiple remote ATS.

The primary actors impacted by multiple remotely provided ATS are the ATCOs. Based on the single remote tower environment, the overall roles and responsibilities of the ATCO will not change, as far as they will remain responsible for the provision of the required services at the airport/airports.

It will be the responsibility of the airport authority / service provider to ensure that the equipment are properly maintained and kept in acceptable condition. It is not an ATCO task to perform maintenance. These issues will be addressed by qualified engineers and technicians responsible for the calibration, maintenance and flight-testing.

### 3.2.2 Roles and Responsibilities

The ATCOs carry out the tasks for all roles described in this chapter. The RTC, Remote Tower Centre, consists of several MRTMs, connected aerodromes, and ACTOs on duty. Staffing at the targeted aerodromes are commonly one ATCO on duty (spare ATCOs may be available for times with more traffic, and to ensure breaks).

This section describes who is involved in the use of the operational activities and what the roles and responsibilities of the various actors are:

- Apron Manager
- Tower Clearance Delivery Controller
- Tower Ground Controller
- Tower Runway Controller

- Approach Controller
- RTC Supervisor

Referring to the reference solution a new role for solution 35 is considered when providing ATS remotely from a RTC - the RTC supervisor role. RTC Supervisor is responsible for the general management of activities in the Operations Room. This role may be filled by an ATCO or alternatively may be a distinct position with an endorsement for the task. Focus on this role is balancing workload between the different ATCOs in each MRTM through the flexible allocation of aerodromes.

This role is similar to an ACC and/or TWR Supervisor.

### 3.2.3 CNS/ATS description:

These CNS/ATS characteristics give an overview of the technical R&D needs in a Multiple Remote Tower environment and a Remote Tower Centre.

	Solution 35
<b>Communication</b>	<ul style="list-style-type: none"> <li>• ATC Voice Communications for multiple aerodromes</li> <li>• VHF and UHF-transmitters/receivers, Ground Radio System, Autonomous VHF-radio, SAR radio.</li> </ul>
<b>Voice Services</b>	<ul style="list-style-type: none"> <li>• Advanced Voice Services</li> </ul>
<b>Navigation</b>	<ul style="list-style-type: none"> <li>• Monitoring and manoeuvring of navigation specifications including ILS, RNAV, NDB, and DME.</li> </ul>
<b>Surveillance</b>	<ul style="list-style-type: none"> <li>• Air surveillance</li> <li>• Ground surveillance (optional)</li> </ul>
<b>Visual observation</b>	<ul style="list-style-type: none"> <li>• Visual information replacing the tower view with the Visual Presentation view (VP)</li> </ul>
<b>Visual features</b>	<ul style="list-style-type: none"> <li>• Visual tracking / object bounding</li> <li>• Radar tracking (optional)</li> </ul>
<b>Flight Plan Data Processing</b>	<ul style="list-style-type: none"> <li>• Electronic Flight Strips (Presentation and updating of flight plan and control data) or flight lists supporting silent coordination</li> </ul>
<b>Planning tools</b>	<ul style="list-style-type: none"> <li>• ATCO planning tools for planning ahead</li> <li>• RTC Supervisor planning tools for planning of an entire RTC and allocation of aerodromes to MRTM's</li> </ul>
<b>Other Systems</b>	<ul style="list-style-type: none"> <li>• The remote facility shall include all other technical functions and systems, currently found in an RTM and necessary to provide the services e.g.:</li> <li>• Monitoring and control of ground lighting, navigation aids, alarms, etc.;</li> <li>• Pan Tilt Zoom camera, PTZ;</li> <li>• MET presentation and information</li> </ul>

Table 8: CNS/ATS Characteristics

### 3.2.4 Applicable standards and regulations

## EUROCAE

EUROCAE Working Group 100 (WG-100), dealing with “Remote and Virtual Towers”, published the initial version of ED-240, ‘MINIMUM AVIATION SYSTEM PERFORMANCE SPECIFICATION FOR REMOTE TOWER OPTICAL SYSTEMS’, in September 2016, specifying the end-to-end performance of the optical (camera) system. However, this first version did not consider/cover any augmentation functions or sensors other than cameras.

*Enabler STD-014, linked to SDM-0201, captures this standardisation activity. It could be related to STD-HNA-06 and -07, also linked to SDM-0201.*

A second revision (ED-240A) was published in October 2018, also included performance requirements related to the visual tracking function.

WG-100 is now continuing its work with further revision/extension (ED-240B, yet not applicable for this OSED), which will include also performance requirements related to the incorporation of information from non-optical surveillance systems/sensors (i.e. the so called “radar tracking/radar labels” function).

EUROCAE ED-240 is not specifically addressing single or multiple aerodrome remote control requirements, as it is considered that the requirements set forth by ED-240/ED-240A are applicable regardless of Single or Multiple mode of operation. PJ.05 baseline is Single Remote Tower wherefore requirements on optical systems remain unchanged.

A new system enabler specifically introduced for multiple remote towers is CTE-C14, “Advanced VCS (Voice Com System) for a Multiple Remote Tower Module (MRTM)”, linked to SDM-0207 has been validated at V3 level.

*The enabler STD-014, linked to SDM-0201, captures this standardisation activity.*

## EASA

EASA rulemaking task RMT.0624 (Remote aerodrome ATS) was established to provide/develop a regulatory framework and guidance for remote tower operations/remote aerodrome ATS. Following the first phase of RMT.0624, EASA published ‘Guidance Material on the implementation of the remote tower concept for single mode of operation’ (Executive Director Decision 2015/014/R), as well as ‘Requirements on Air Traffic Controller licensing regarding remote tower operations’ (Executive Director Decision 2015/015/R), in July 2015.

*The enabler REG-0509, linked to SDM-0201, captures this regulatory activity.*

Following a second phase of RMT.0624, EASA issued ‘Guidance Material on remote aerodrome air traffic services’ — Issue 2 and ‘AMC & GM to Part ATCO’ — Issue 1, Amendment 2 (Executive Director Decision 2019/004/R), in February 2019, replacing the previously published EASA guidance in 2015. This new updated guidance takes into consideration the further evolution of the concept as well as experiences gained from R&D activities (e.g. all the SESAR 1 validation activities and Solutions) and initial implementations throughout the EU and US and it addresses also multiple and more complex modes of operation. Thus, the regulatory support/framework needed for multiple mode of operation is now in place.

*The enabler REG-0525, linked to SDM-0205, captures this regulatory activity.*



EASA will monitor the implementation of remote aerodrome ATS, and any future technological, and operational developments (e.g. the PJ.05 Solutions/SESAR 2020 results). This may amend and/or further evolve the existing guidance if/as deemed necessary (although the existing regulatory guidance/framework provided by EASA related to Multiple is generic enough, to most likely be able to accommodate also this PJ.05.35 Solution).

*A new REG-0537 enabler, linked to SDM-0210, capture this regulatory activity.*

## ICAO

The Air Traffic Management Operations Panel (ATMOPSP) developed proposed amendments to Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444) to facilitate the use of envisaged technology in the provision of remote aerodrome control service. This amendment was introduced in ICAO PANS-ATM Doc 4444 by Amendment 8, in force since 8 November 2018, thereby fully enabling remote aerodrome ATS in the ICAO context.

The amendments include, inter alia;

- A new definition ‘visual surveillance system’ definition.
- A new chapter 7.1.1.2.1 stating that visual observation can be achieved through direct out-of-the-window observation or through indirect observation utilizing a visual surveillance system.
- A new “Note” referring to the EASA Guidance Material, thereby giving it global recognition.

*The enablers STD-HNA-04 and 05, linked to SDM-0201, potentially cover this standardisation activity.*

## 3.3 Detailed Operating Method

### 3.3.1 Previous Operating Method

The Multiple Remote Tower concept, have been validated in different R&D projects described in chapter 2.4. Deployment is initiated, nevertheless, Air Traffic Services are currently not being provided to multiple aerodromes by a single ATCO.

The reference for Solution 35 regarding Multiple Remote Tower Module is solution PJ05-02 which was validated at V3 maturity level in SESAR 2020, wave1 but is not yet operational. All relevant information related to the reference scenario can be found in OSED part I document, PJ05.02-V3 D2.2.001 [27].

*Note: Provision of Remote Air Traffic Services is already in place, as Single Remote Tower, several airports in Sweden from two different RTC, RTC Sundsvall and RTC Stockholm, as well as for Saarbrücken airport in Germany, Brindisi airport in Italy and several AFIS airports in Norway from the RTC in Bodö. Furthermore, contingency Remote Air Traffic Services is provided for Budapest airport in Hungary. The first operational airport started in April 2015 and deployment is ongoing in several countries in Europe.*

### 3.3.2 New SESAR Operating Method

The objective of remote tower control for multiple aerodromes is to provide the ATS defined in ICAO Annex 11 [19], Documents 4444 [20], 9426 [21] for more than one aerodrome simultaneously.

Safety is the key for any change of Air Traffic Management. Flexible allocation of aerodromes between MRTMs within a Remote Tower Centre, as well as the possibility for ATCOs to self-decide the position



of the aerodromes to their MRTM has a possibility to support kept Safety levels and service. The full range of ATS should be offered in such a way that any negative impact on the airspace users is reduced to a minimum, while maintaining a safe and efficient service in comparison to the single remote tower operations. With support of ATCO planning tools and RTC planning tools for the supervisor the traffic load balance for the ATCO can be assured for in time. This will support decision making on when to transfer airports between MRTMs. It will also support the decision on which airports to combine, taking into consideration e.g. suitable airport combinations and ATCO endorsements.

Providing ATS to more than one airport by one ATCO, when it is safe and practical, will add benefits to airport providers, ANSPs, airlines and eventually the flying customers through a cut in costs and/or the provision of ATC to airports earlier not served with ATC.

When providing ATS to multiple aerodromes from an MRTM, there are certain specific considerations that should be taken into account, due to the requirement to share or ensure the availability of certain features required for the provision of ATS to more than one aerodrome.

Technical enablers, AVFs, communications, radar displays and other features/functions to assist with the provision of ATS can have varying degrees of integration and sharing between aerodromes.

Other features that are required continuously (such as the strip bay etc.) require redundancy for each aerodrome. Any duplication of equipment/features that occurs in the RTM may be accompanied by distinctive features to allow easy and instant recognition of the aerodrome the feature relates to.

The provision of ATS to more than one aerodrome will be made possible by the provision of visual presentations that allow constant monitoring of each aerodrome. The screens will display each aerodrome simultaneously and continue to do so even when the ATCO is providing ATS to one specific aerodrome. It is vitally important that the operator is, at all times, able to distinguish which aerodrome he/she is currently operating and which aerodrome any single set of displays or peripherals is linked to.

### Operating method EATMA Elements

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As described in chapter 3.2, the main affected node is Aerodrome ATS, in particular, the Remote Tower one has been created in DS18a. This Node will have different and new activities to be defined (some of them shown in the table below), nevertheless the communications and procedures between ATCO and crew are going to be the same with one main difference: the pilot should be notified that he/she is under remote control. Therefore, the only novelty in the NOV-2 diagram is this information exchange (ATC Remote Provision, described in AIP, Aeronautical Information Publication) between Aerodrome ATS and Flight Deck.

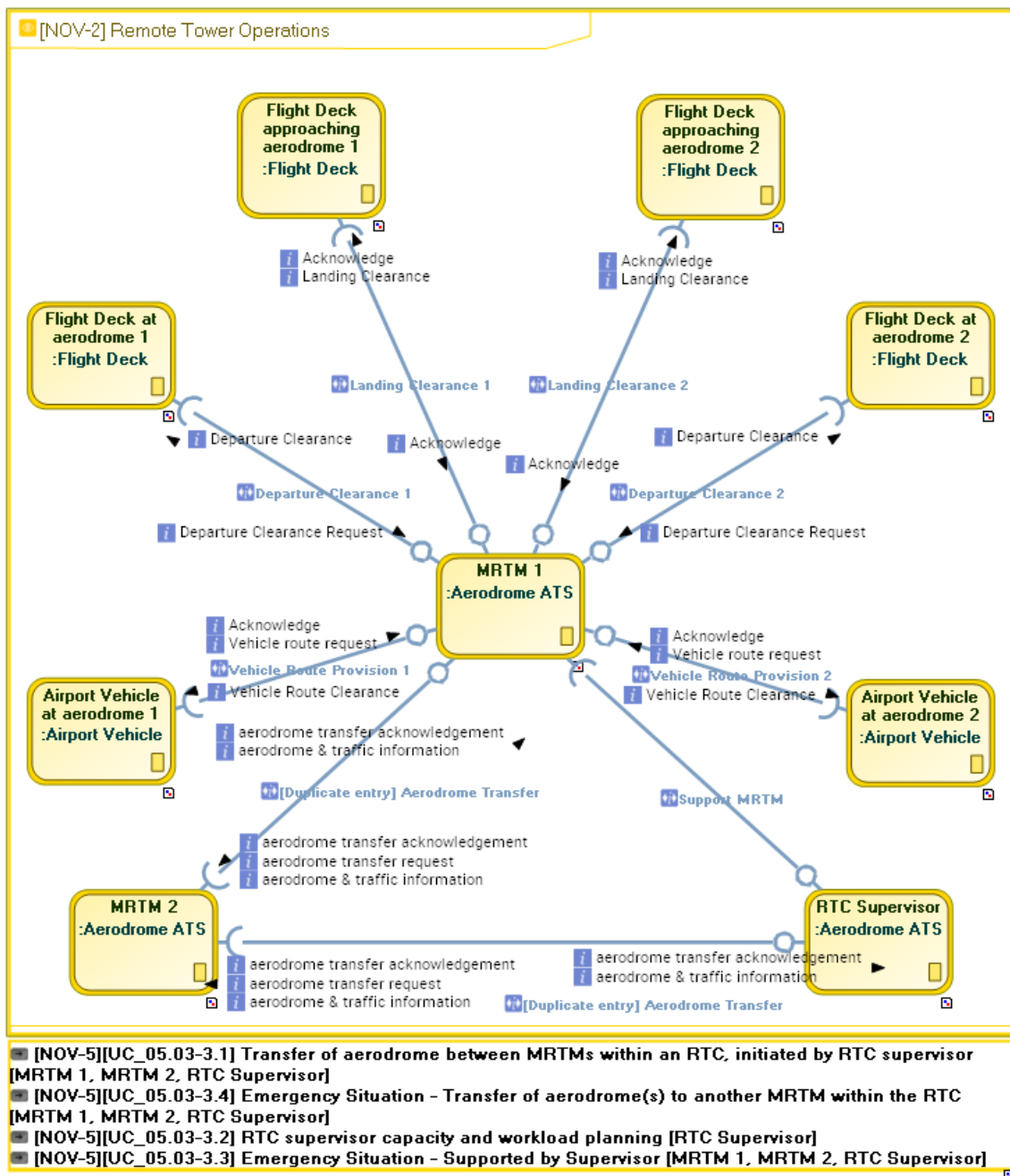


Figure 5: NOV-2 First Approach

### Activities SOL 35

Control aerodrome

Prioritize tasks

Request for clearance
Issue clearance
Execute clearance
Follow up clearance
Check traffic situation
Prioritize requests
Report established on final approach
Report ready for departure
Follow up operation
Decide to initiate aerodrome transfer
Request to transfer aerodrome
Prepare for a new aerodrome
Prepare for aerodrome transfer
Coordinate with another MRTM
Approve transfer of aerodrome
Plan RTC
Follow up RTC planning
Request supervisor support
Support MRTM
Terminate support to MRTM

**Table 9: First Activities Approach**

Both figure and table show the approach of the EATMA Activities and Information Exchange elements that concern our project according to the architecture done based on the use cases presented in chapter 3.3.2.1 Use Cases.

### 3.3.2.1 Use Cases

The OSED attempts to describe the key parts of remote provision of ATS. Many elements and functions of the service provision will be the same when provided remotely as if they had been provided locally and so may not be repeated in detail for the use cases in this OSED.

The objective of PJ05 solution 35 is to enlarge the scope of the multiple remote tower solutions, within an RTC including, traffic volumes with simultaneous movements and airports simultaneously controlled by one ATCO. A flexible allocation of aerodromes within the RTC will ensure efficiency within the RTC through an even distribution of workload for each ATCO.

Following Use Cases is focusing on the individual ATCOs situation serving multiple aerodromes within a MRTM together with RTC supervisor functionality. The selected use cases are based on certain criteria to give coverage against ICAO Doc 4444, [20] ICAO Doc 9426 [21]. The Normal conditions, abnormal conditions and degraded modes are described in the SESAR Safety Reference Material:

- ‘Normal conditions’ are those conditions of the operational environment the ATM/ANS functional system is expected to encounter in day-to-day operations and for which the system must always deliver full functionality and performance.
- ‘Abnormal conditions’ are those external changes in the operational environment that the ATM/ANS functional system may exceptionally encounter (e.g. severe WX, airport closure,

etc.). The system may under these circumstances enter a degraded state, if it can easily be recovered when the abnormal condition passes and the risk during the period of the degraded state is shown to be tolerable.

- ‘Degraded mode of operation’ is a pre-defined reduced level of operational service invoked by equipment outage or malfunction, staff shortage or procedures. Degraded mode covers the aspect of failure of parts of the system.

Use case 1.1-1.8 and 1.9 are the same in this validation as in previous multiple remote tower validations due to the fact that they are valid for all multiple remote tower control. This to keep a clear and consistent multiple remote tower set of use cases. Use cases 3.1 to 3.4 and 4.1 are more specific for Solution 35 that includes provision of ATS from an RTC with a flexible allocation of aerodromes between the RTMs.

The following table provides an overview on the use cases that are described in detail in the chapters below for solution PJ05-W2-35

PJ05-W2-35
NORMAL CONDITIONS
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 3:1 / Transfer of aerodrome between MRTMs within a RTC, initiated by RTC supervisor role or ATCO
UC 3:2 / RTC supervisor capacity and workload planning
UC 4:1 / Provide ATS with simultaneous TWR and APP from one MRTM
ABNORMAL CONDITIONS
UC 3:3 / Emergency Situation - Supported by Supervisor

UC 3:4 / Emergency Situation - Transfer of aerodrome(s) to another MRTM within the RTC
DEGRADED MODES
UC 1:9 / Failure of parts of the technical system building the Remote Tower Service, e.g. Camera view, screens, voice com

Table 10: Use cases

*Note: More detailed degraded modes will be part of the Safety assessment*

These use case scenarios exemplify how ATS can be provided from a Remote location, they are not intended to be a comprehensive description of all possible scenarios and focus is given to standard nominal scenarios. The precise operating methods to be applied in the handling of non-nominal or other nominal scenarios will, in many cases, will be dependent on the local operating procedures and the specific nuances of the implementation environment.

In case of an unexpected event, such as an emergency situation, at one of the airports - significantly increasing the ATCO workload and affecting her/his capability to continue to provide ATS to all airports under responsibility, the ATCO need to be able to handle the abnormal situation. Examples on actions can be to temporarily stop traffic at the other airport(s), transfer one aerodrome to another MRTM or other actions.

### 3.3.2.1.1 UC 1:1 / Provide ATS with simultaneous movements (ground and air) at different aerodromes from one MRTM

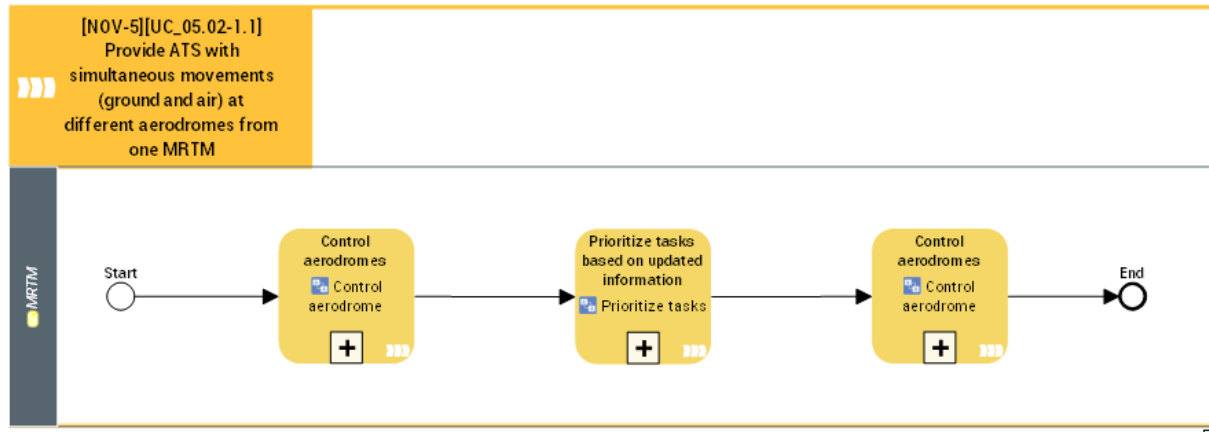


Figure 6 Use Case 1:1

#### General conditions

This use case describes the baseline for how to provide ATS for both air and ground movements in multiple remote towers.

#### Pre-conditions

The ATCO has a view and is equipped with all technical systems needed for all aerodromes connected to the MRTM.

#### Post conditions

The ATCO provides ATS to the aerodromes connected to the MRTM with the same level of service as if they were controlled in single remote tower mode.

#### **Actors**

ATCO, flight crew (pilots) and vehicle drivers

#### **Operating method / main flow**

1. A movement is active within the manoeuvring area or is established on final or in the CTR at one of the aerodromes connected to the MRTM
2. A movement, air or ground, becomes active on the other connected aerodrome to the MRTM
3. The ATCO is in control of all movements at the different aerodromes
4. The ATCO can prioritize and sequence the movements in order to maintain a safe and controlled air traffic service to all aerodromes
5. The ATCO follows up on the movements and is ready for a new movement
6. The use case is ended

#### **Operating method / alternative flow**

7. The ATCO has to prioritize the existing movements
8. The ATCO keeps other movements out of the flow by e.g. keeping vehicles outside the manoeuvring area, keeping aircraft on ground rather than departing a third movement, keep arriving aircraft outside the CTR
9. When traffic so permits the ATCO takes care of new movements at the different aerodromes
10. The alternative flow is ended

### **3.3.2.1.2 UC 1:2 / Provide ATS to co-operative RPAS and normal aircraft at a time to different aerodromes**

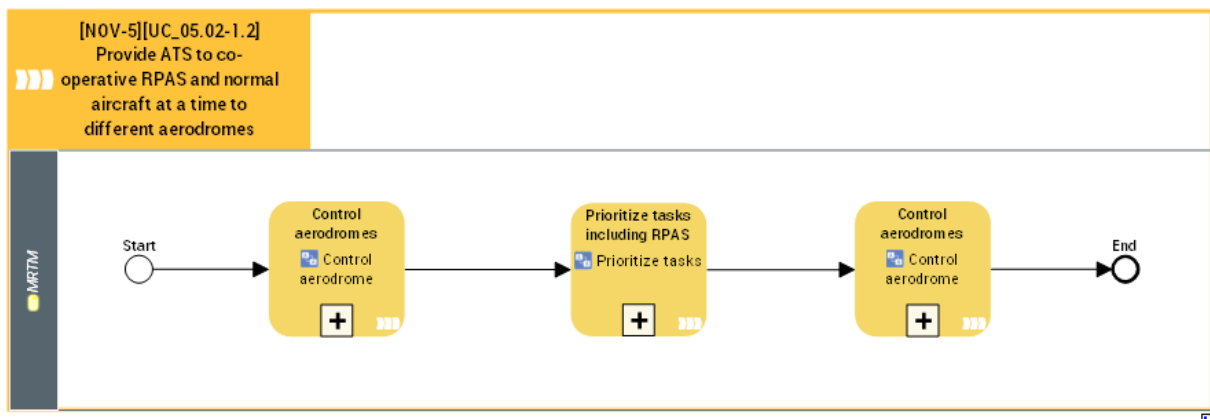


Figure 7 Use Case 1:2

*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).*

### General conditions

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

### Pre-conditions

The ATCO is in control and in contact with both pilots at the same time and both pilots are able to follow clearances

### Post conditions

The ATCO provides a safe and efficient service to both aircraft and both pilots are able to perform their tasks.

### Actors

ATCO and flight crew (pilots)

### Operating method / main flow

1. An RPAS is requesting a clearance to fly within the CTR (or near the aerodrome) at one of the aerodromes
2. A manned aircraft arrives or departs at the other aerodromes
3. The ATCO is in control of both aircraft at the different aerodromes
4. The ATCO can prioritize and sequence the simultaneous movements in order to maintain a safe and efficient air traffic service
5. The ATCO follows up on the movements
6. The use case is ended

### Operating method / alternative flow

7. The ATCO has to prioritize the existing movements
8. The ATCO has to delay one of the requested movements which can cause more than a common prioritisation which might cause a constrain for the pilot's planned activity
9. When traffic so permits the ATCO takes care of the pilot's request
10. The alternative flow is ended

### 3.3.2.1.3 UC 1:3 / Control of Vehicles in the Manoeuvring Area to different aerodromes

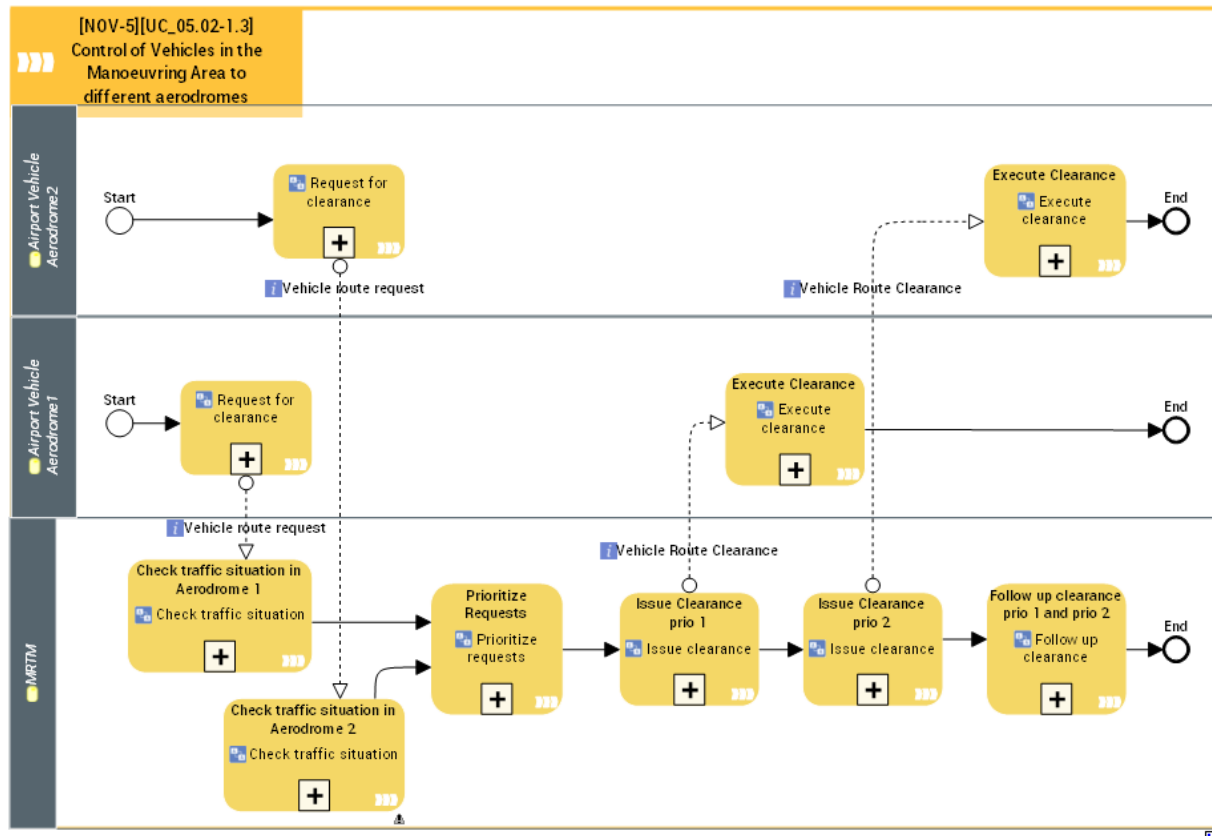


Figure 8 Use Case 1:3

#### General conditions

This use case describes how to provide ATS for vehicles on ground in multiple remote towers.

#### Pre-conditions

Vehicle drivers request a clearance to enter the manoeuvring area at different aerodromes simultaneously at the different aerodromes.

#### Post conditions

The ATCO provides ATS to vehicle drivers at different aerodromes and the vehicle drivers are able to perform their requested tasks.



## Actors

ATCO and vehicle drivers

## Operating method / main flow

1. A vehicle driver (or several) request a clearance to enter the manoeuvring area (TWY and/or RWY) at one of the aerodromes
2. Vehicle driver/drivers at the other (or all other) aerodromes request a clearance to enter the manoeuvring area
3. The vehicle drivers enter the manoeuvring areas at the different aerodromes
4. The ATCO controls movements at all aerodromes simultaneously
5. The ATCO follows up on the vehicles and is ready for a new movement
6. The use case is ended

## Operating method / alternative flow

7. The ATCO has to prioritize the existing movements
8. The ATCO has to instruct a vehicle driver to vacate from the manoeuvring area (or extend the traffic circuit for an arriving aircraft) earlier than expected to be able to avoid a situation with a need for closely monitoring of a situation at one aerodrome due to the need of split vision between the different activities at the aerodromes
9. The ATCO takes care of the previous request when the situation permits
10. The alternative flow is ended

## Operating method / failure flow

11. The ATCO has a high workload and is unable to have the runway vacated in time for the next movement to be accommodated
12. The ATCO is not able to plan and prioritize in time due to all vehicles combined. That causes a situation where a new movement cannot be accommodated, example: arriving aircraft, has to be given a go-around clearance to safely solve the situation
13. The ATCO has to instruct a vehicle driver to vacate the runway in time before the aircraft is on final approach again
14. The failure flow is ended

### 3.3.2.1.4 UC 1:4 / Provide ATS to simultaneous landings at different aerodromes

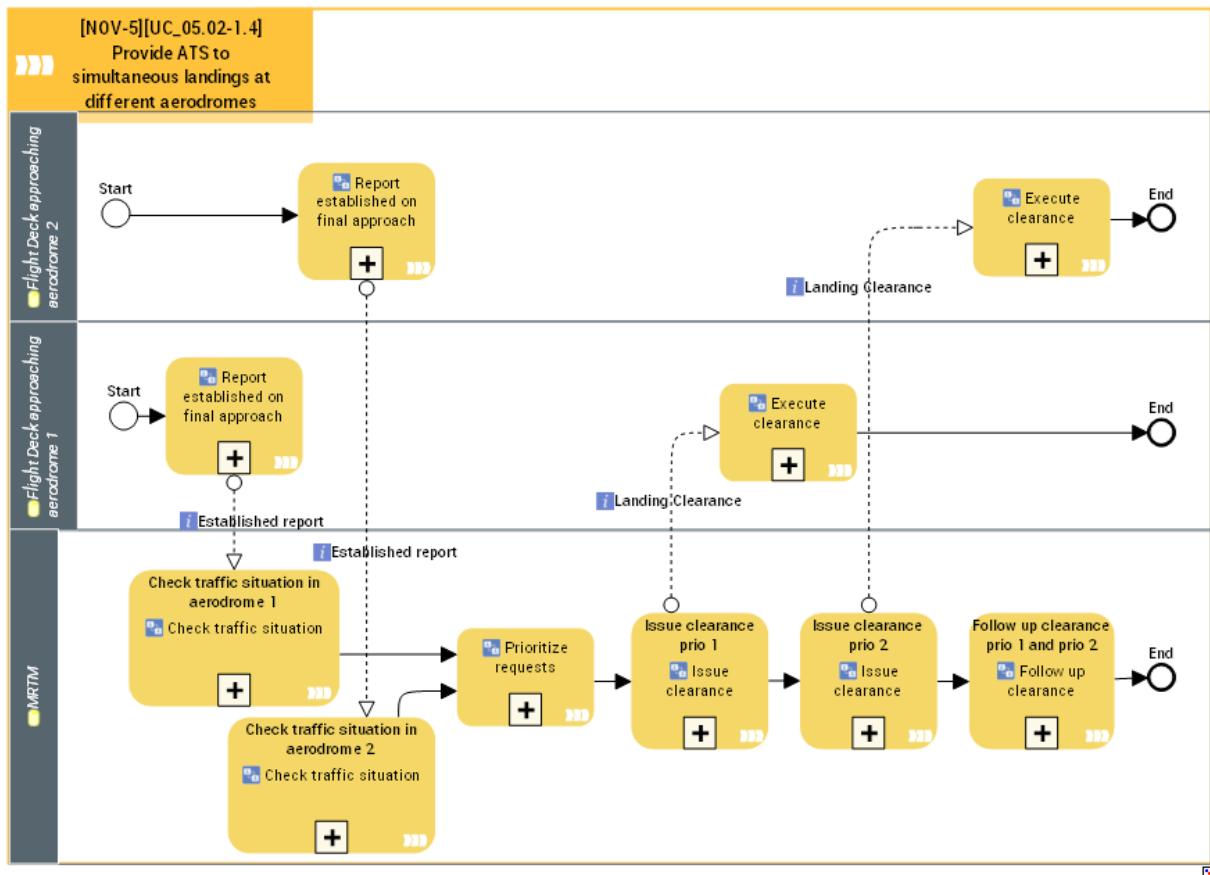


Figure 9 Use Case 1:4

### General conditions

This use case describes how to provide ATS to simultaneous landings to different airports

### Pre-conditions

The ATCO is in control and in contact with both pilots at the same time and both pilots are able to follow clearances

### Post conditions

The ATCO provides a safe and efficient service to both aircraft and both pilots are able to perform their tasks.

### Actors

ATCO and flight crew (pilots)

### Operating method / main flow

1. An aircraft is on final to one aerodrome in the MRTM requesting permission to land
2. Simultaneously an aircraft is on final to another aerodrome in the MRTM requesting permission to land
3. The ATCO is in control of all movements at the different aerodromes
4. The ATCO can prioritize and sequence the movements in order to maintain a safe and controlled air traffic service to all aerodromes
5. The ATCO follows up on the movements and is ready for a new movement
6. The use case is ended

**Operating method / alternative flow**

7. The ATCO has to prioritize the existing movements
8. If the ATCO has to delay one of the requested movements, it can be done by e.g. reducing speed on one of the landings, in advance asking the approach control to take measures to “stagger” the different approaches, with the intention, not to touch down at the exact same time at the different aerodromes.
9. The ATCO follows up on the movements at the different aerodromes
10. The alternative flow is ended

### 3.3.2.1.5 UC 1:5 / Provide ATS to simultaneous departures at different aerodromes

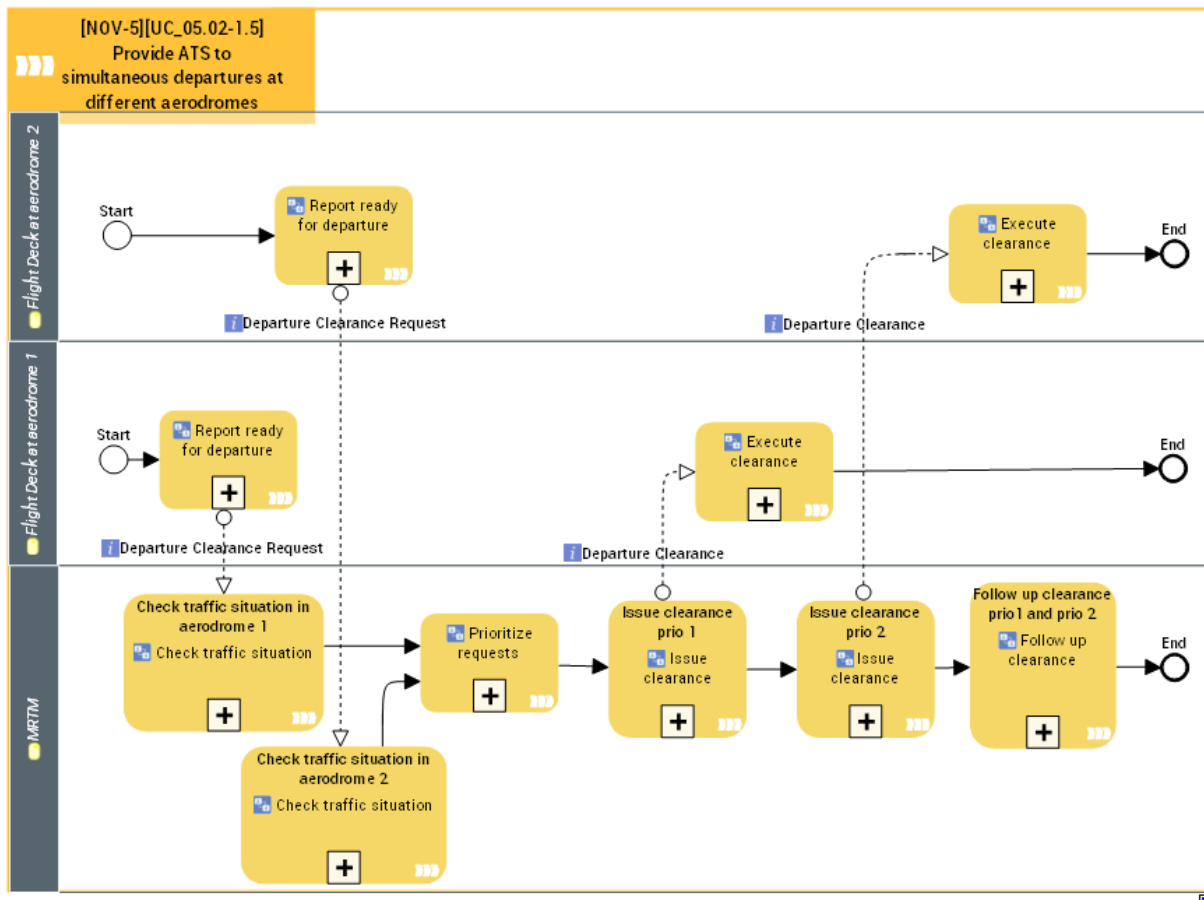


Figure 10 Use Case 1:5

#### General conditions

This use case describes how to provide ATS to simultaneous departures at different airports

#### Pre-conditions

The ATCO is in control and in contact with both pilots at the same time and both pilots are able to follow clearances

#### Post conditions

The ATCO provides a safe and efficient service to both aircraft at a time and both pilots are able to perform their tasks.

#### Actors

ATCO and flight crew (pilots)

### **Operating method / main flow**

1. An aircraft requests to depart from one aerodrome in the MRTM
2. Simultaneously an aircraft at another aerodrome in the MRTM requests to depart
3. The ATCO are in control of all movements at the different aerodromes
4. The ATCO can prioritize and sequence the movements in order to maintain a safe and controlled air traffic service to all aerodromes
5. The ATCO follows up on the movements and is ready for a new movement
6. The use case is ended

### **Operating method / alternative flow**

7. The ATCO has to prioritize the existing movements
8. The ATCO can, in order to give full attention to one departure at a time , e.g. hold one of the departing aircraft on ground at one aerodrome until the one departing from the other aerodrome is in the air
9. When traffic so permits the ATCO takes care of new movements at the different aerodromes
10. The alternative flow is ended

### 3.3.2.1.6 UC 1:6 / Provide ATS to a landing and a departing aircraft simultaneously at different aerodromes

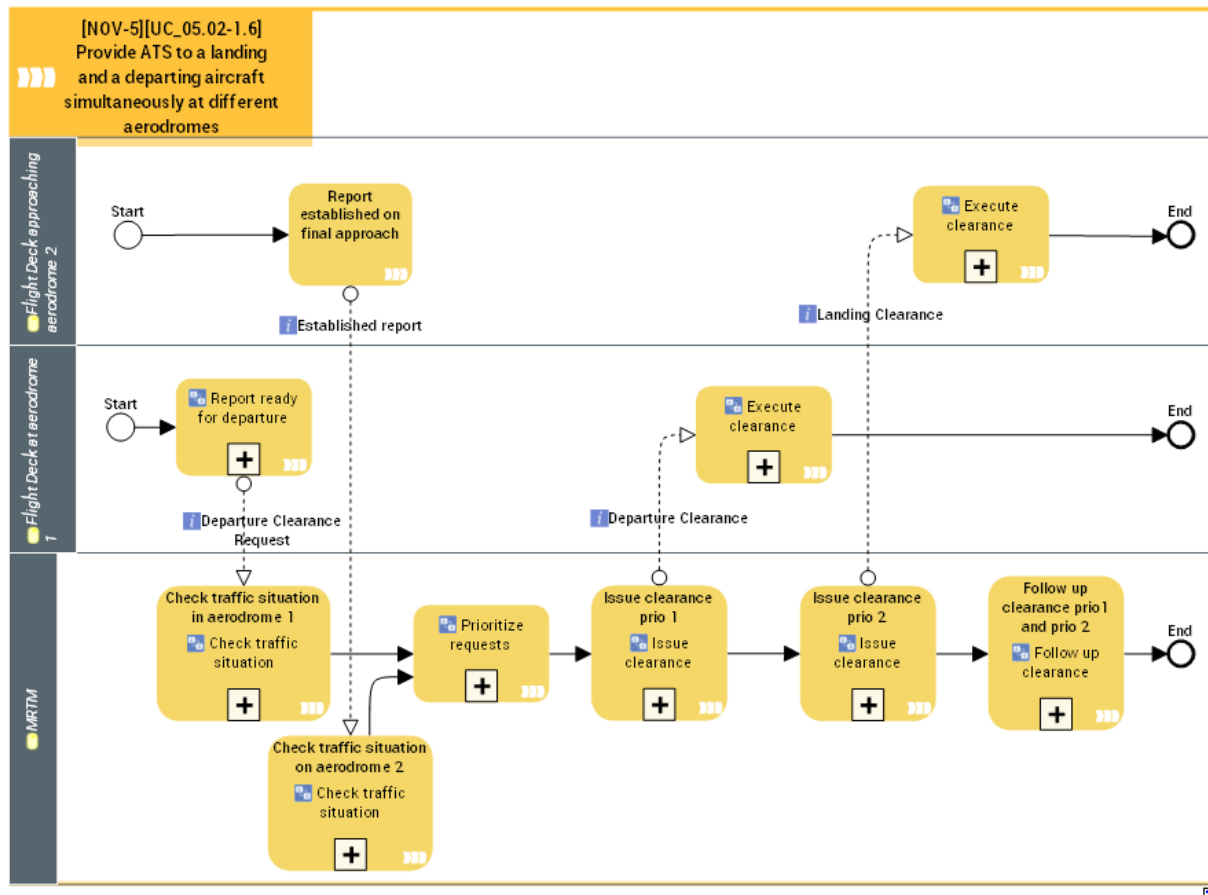


Figure 11 Use Case 1:6

#### General conditions

This use case describes how to provide ATS to a landing and a departing aircraft simultaneously at different airports

#### Pre-conditions

The ATCO is in control and in contact with both aircraft at the same time and both pilots are able to follow clearances

#### Post conditions

The ATCO provides a safe and efficient service to both aircraft and both pilots are able to perform their tasks.

#### Actors

ATCO and flight crew (pilots)

#### Operating method / main flow

1. An aircraft requests to depart from one aerodrome in the MRTM
2. Simultaneously an aircraft is on final to another aerodrome in the MRTM requesting permission to land
3. The ATCO is in control of all movements at the different aerodromes
4. The ATCO can prioritize and sequence the movements in order to maintain a safe and controlled air traffic service to all aerodromes
5. The ATCO follows up on the movements and is ready for a new movement
6. The use case is ended

**Operating method / alternative flow**

7. The ATCO has to prioritize the existing movements
8. The ATCO can, in order to give full attention to one movement at a time, e.g. hold the departing aircraft on ground at one aerodrome until the approaching aircraft at the other aerodrome has landed
9. When traffic so permits the ATCO takes care of new movements at the different aerodromes
- 10.** The alternative flow is ended

### 3.3.2.1.7 UC 1:7 / VFR flight in the traffic circuit with an arriving IFR flight with simultaneous movements on another aerodrome

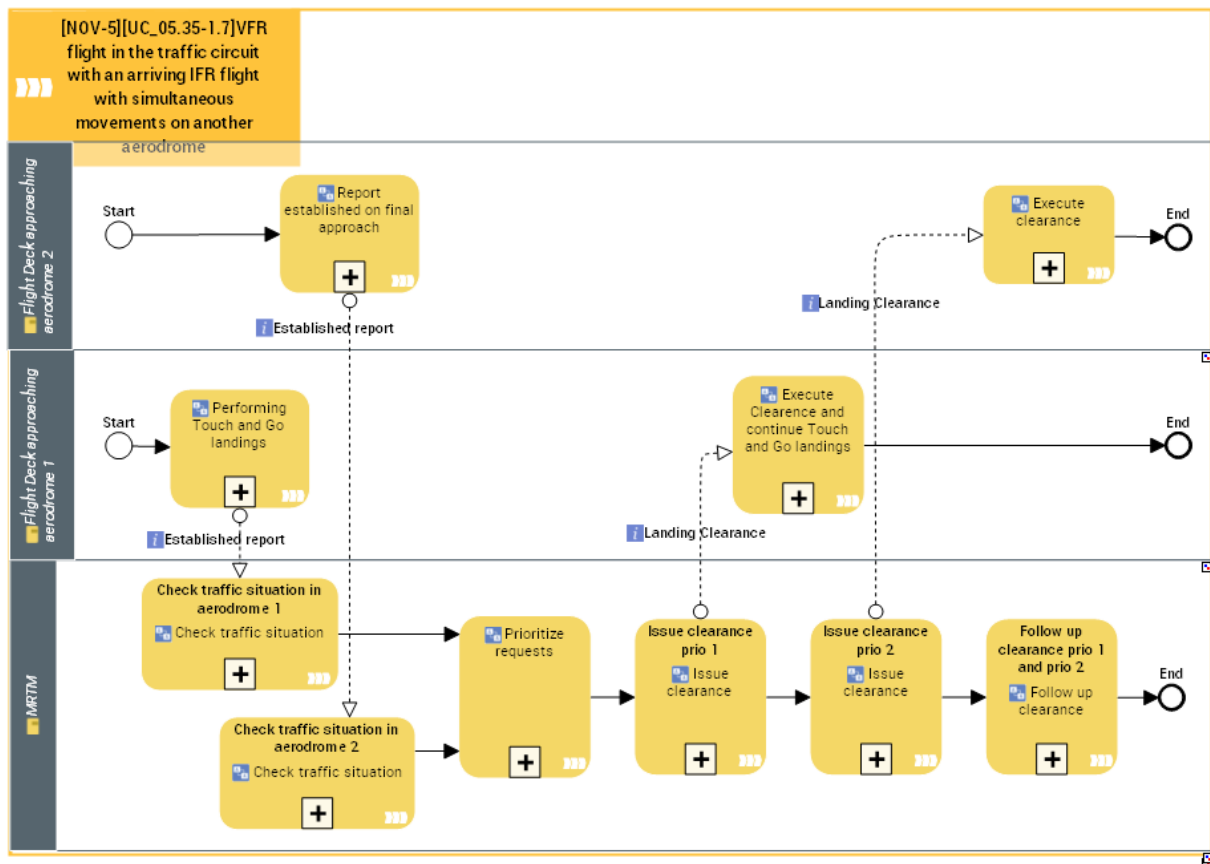


Figure 12 Use Case 1:7

#### General conditions

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

#### Pre-conditions

The ATCO is in control and in contact with all involved aircraft at the same time and the pilots are able to follow clearances

#### Post conditions

The ATCO provides a safe and efficient service to all involved aircraft and involved pilots are able to perform their tasks.

#### Actors

ATCO, flight crew (pilots) and vehicle drivers

#### Operating method / main flow

1. A VFR flight is flying in the traffic circuit at one of the aerodromes connected to the MRTM



2. An IFR flight is arriving to another connected aerodrome to the MRTM in which there is also other activity ongoing e.g. an aircraft, with the intention of departing, requesting pre-flight information or starting up or possibly a vehicle requesting to perform a runway inspection.
3. The ATCO is in control of all movements at the different aerodromes
4. The ATCO can prioritize and sequence the movements in order to maintain a safe and controlled air traffic service to all aerodromes
5. The ATCO follows up on the movements and is ready for a new movement
6. The use case is ended

#### Operating method / alternative flow

7. The ATCO has to prioritize the existing movements
8. The ATCO, in order to avoid overload, keeps other movements out of the flow by e.g. keeping vehicles outside the manoeuvring area, keeping aircraft on ground rather than departing a third movement, etc.
9. When traffic so permits the ATCO takes care of new movements at the different aerodromes
10. The alternative flow is ended

#### 3.3.2.1.8 UC 1:8 / ATCO planning of movements and workload supported by short term planning tool

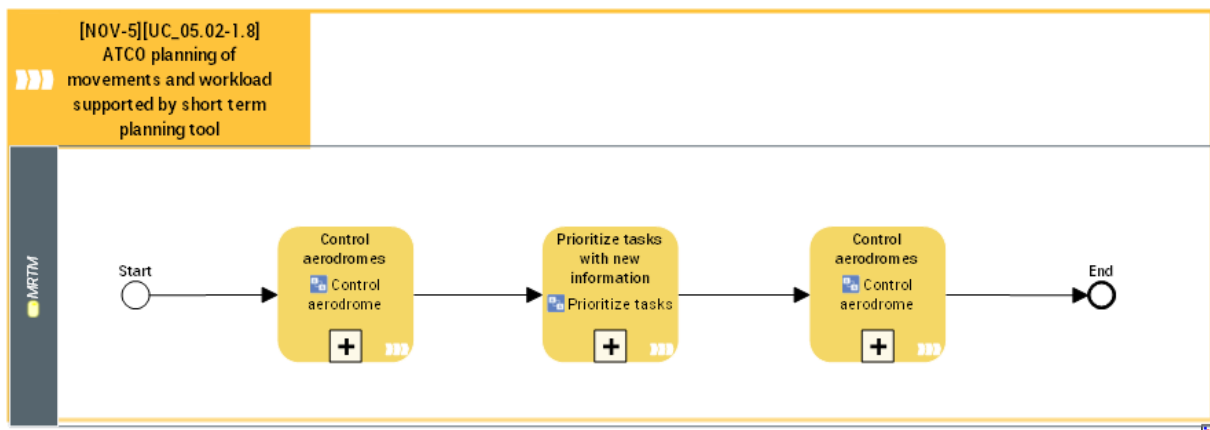


Figure 13 Use Case 1:8

#### General conditions

This use case describes how the ATCO is supported by planning tools in order to plan movements and workload up to 2 hours ahead to avoid task overload.

#### Pre-conditions

The MRTM has a short-term planning tool enabling the ATCO with a possibility to plan beyond the horizon of 30 minutes.

## Post conditions

The ATCO plans and prioritizes tasks for all aerodromes connected to the MRTM.

## Actors

ATCO, flight crew (pilots) and vehicle drivers

## Operating method / main flow

1. Movements are already active at the different aerodromes, e.g. vehicles on the manoeuvring area, aircrafts in traffic circuit, aircrafts getting ready for departure.
2. The ATCO becomes aware of new movements that will appear in 30 minutes, e.g. several arrivals/departures at one or both aerodromes, a VFR with plan to make continuous touch & go landings, TGL, snow sweeping (or causing a need for snow sweeping)
3. The ATCO prioritizes ahead of time by e.g. introducing snow-sweeping prior to a future landing/departure, informs a lawn mower about arriving traffic further ahead, limits the TGL landing to a lower number of TGLs or introduces a split in advance to hand over one aerodrome to another ATCO in another MRTM
4. The movements are prioritized and sequenced with minor delays, e.g. approach is asked to extend arrivals, asking a VFR to enter a holding or exiting the CTR
5. The ATCO follows up the situation and ensures that vehicles are ready in time or that aircraft act as requested according to demand or hands over an aerodrome in a split.
6. The use case is ended

## Operating method / alternative flow

7. The movements pop up unexpected for the ATCO
8. The ATCO has to prioritize existing movements and actions needed to ensure their requests. That leads to a situation where e.g. arriving traffic has to be cleared into a holding pattern, departures have to wait at stand/apron or wait for a split where another ATCO is ready for taking over one of the aerodromes in another MRTM
9. Existing tasks are reduced or another ATCO is ready to take over one of the aerodromes and traffic can continue as requested
10. The alternative flow is ended

### 3.3.2.1.9 UC 1:9 / Failure of parts of the technical system building the Remote Tower Service, e.g. Camera view, screens, voice com

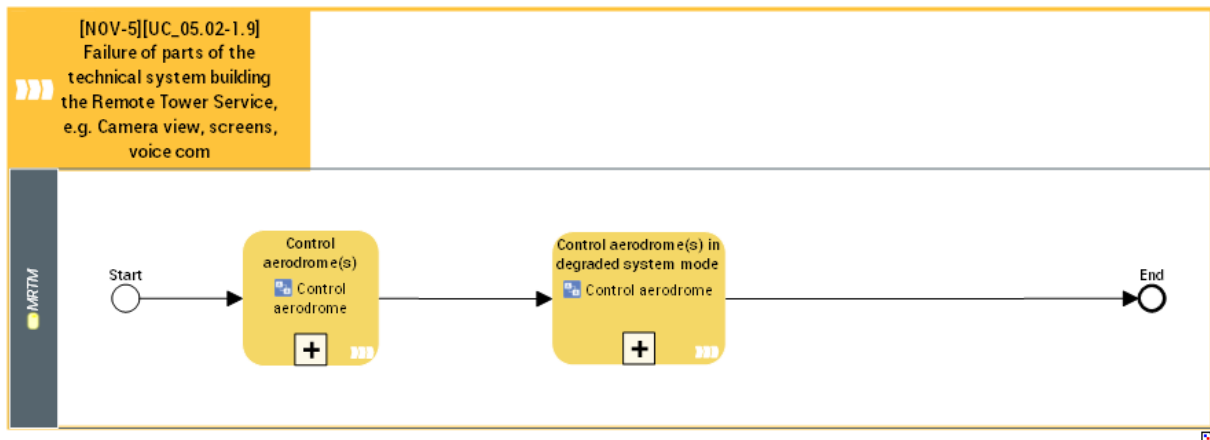


Figure 14 Use Case 1:9

#### General conditions

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.

#### Pre-conditions

The MRTM and airport equipment is functional and system failures are not limiting capacity when a degradation of a system occurs causing a reduction of capacity.

*Note: This use case has examples of system failures. System implementations need to find necessary mitigations and methods for continuous work in degraded modes.*

#### Post conditions

The aerodromes are open, even though limitations of traffic volumes may occur, with a degradation of the systems available for Remote Air Traffic Service.

#### Actors

ATCO, flight crew (pilots), vehicle drivers and ATSEP (technician).

#### Operating method / main flow

1. All aerodromes connected to the MRTM have traffic volumes without any kind of degradation of systems, causing a reduction on capacity.
2. The MRTM gets a screen failure, failure of flight-plan data or degradation at the airport such as camera failure or ILS u/s
3. The ATCO follows the check list for the concerned technical failure, which could imply e.g. any of the following actions;
  - a. Implying traffic restrictions as needed, e.g.: keep aircraft on ground, delay arrivals;

- b. Report the failure to a technician;
  - c. If needed, coordinate with affected stakeholders.
4. The ATCO is able to control the situation with the actions taken in the degraded system mode and/or follow guidelines at system degradations at one or all of the aerodromes
  5. The ATCO has an overview of the situation and is able to continue to handle traffic at all aerodromes, if needed with a limitation of number of movements due to system malfunction
  6. The use case is ended

#### Operating method / alternative flow

7. The system degradation causes an increased workload which leads to a stop of all movements at both airports
8. The ATCO contacts the approach unit to stop arriving traffic and keeps any pending departing traffic on ground.
9. When limitations caused by the technical degradation are clear, the ATCO continues with traffic according to limitations caused by the systems. Example of mitigations can be, support by another controller, limitations of traffic or split of airports to another MRTM/MRTMs
10. The alternative flow is ended

#### 3.3.2.1.10 UC3:1 / Transfer of aerodrome between MRTMs within an RTC, initiated by RTC supervisor role or ATCO

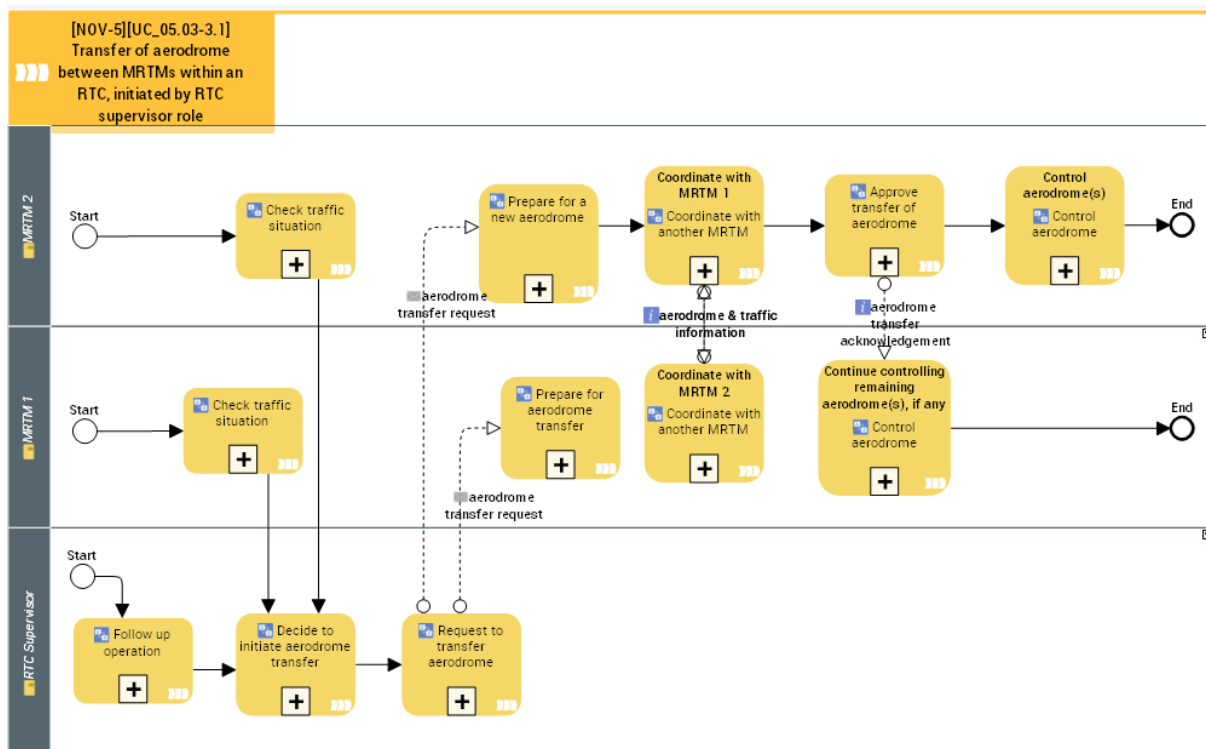


Figure 15 Use Case 3:1

## General conditions

This use case describes how the role of a RTC supervisor or an ATCO initiates a transfer of aerodromes between MRTMs in a flexible way within an RTC with several MRTMs.

## Pre-conditions

The RTC supervisor role has 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 RTC supervisor role or an ATCO initiates a transfer of a suitable aerodrome to another ATCO in another MRTM in the RTC.

## Post conditions

One aerodrome of all aerodromes connected to one particular MRTM is transferred to another MRTM to ensure that requested capacity is met.

## Actors

ATCOs and RTC supervisor role, RWS

## Operating method / main flow

1. The RTC supervisor role foresees an increase of requested movements on one/or several aerodromes for an ATCO in a MRTM
2. The RTC supervisor role works with planning tools to plan the allocation of aerodromes between MRTMs during the day and initiate a transfer of an aerodrome from one MRTM to another MRTM ahead of time
3. The ATCO transferring an aerodrome gets instructions from the RTC supervisor role on which aerodrome to transfer to which MRTM
4. The ATCO initiates a transfer when convenient and follows the transfer procedure when transferring the aerodrome
5. The ATCO that the aerodrome is transferred to is in control of the new aerodrome
6. The use case is ended

### 3.3.2.1.11 UC 3:2 / RTC supervisor capacity and workload planning

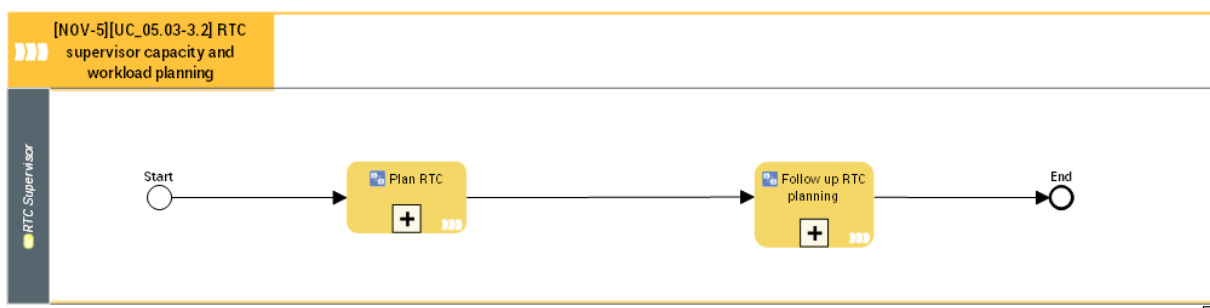


Figure 16 Use Case 3:2

## General conditions

This use case describes the daily flow in an RTC where aerodromes are allocated to MRTMs flexibly.

## Pre-conditions

The RTC supervisor has an overview of the technical status of the MRTMs and the aerodromes as well as the available ATCO endorsements used during the shift. The RTC supervisor has a balancing tool to visualize the requested traffic levels and plan for work that needs to be done, e.g. lawn mowing, maintenance, snow sweeping, at the aerodromes connected to the RTC.

## Post conditions

The RTC supervisor ensures that each and every aerodrome connected to the RTC can receive the same level of service as if they were controlled in single remote tower mode.

## Actors

RTC supervisor, ATCO

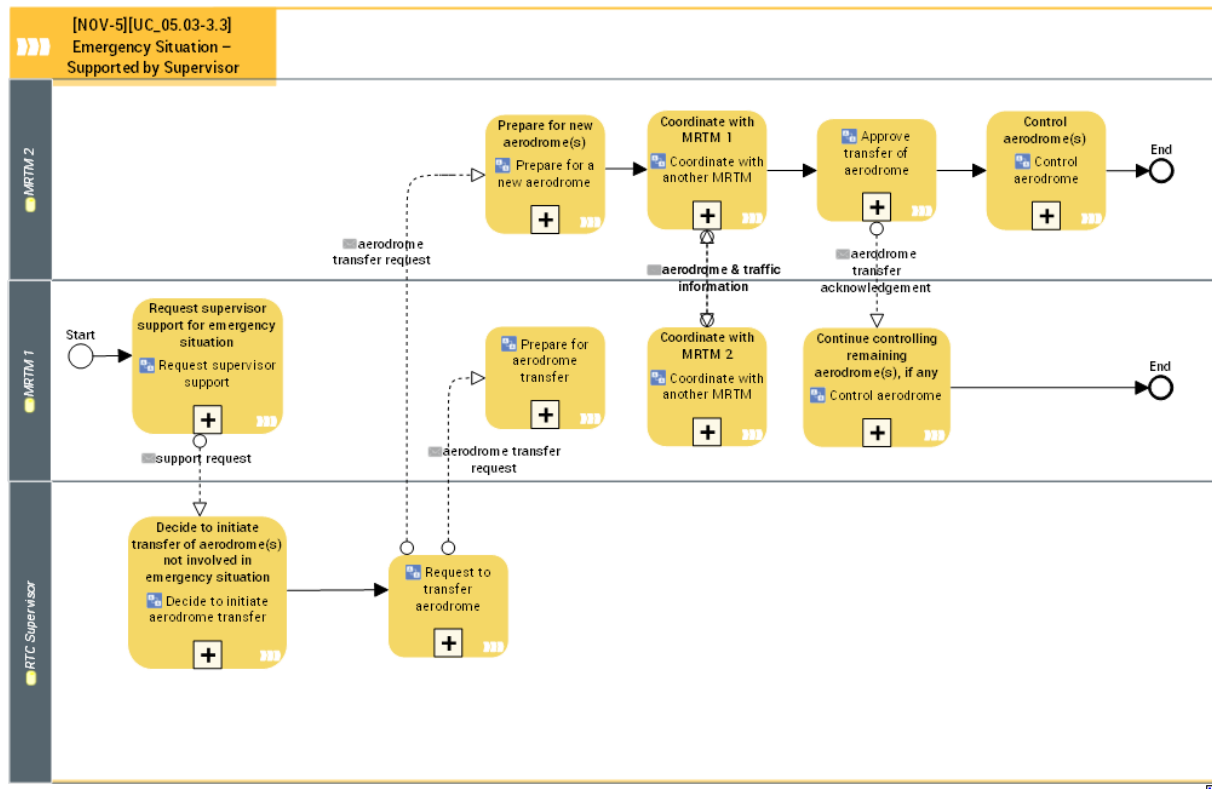
## Operating method / main flow

1. Active aerodromes are controlled by different ATCOs from different MRTMs
2. The RTC supervisor is planning daily activities and requests days ahead
3. The RTC supervisor has enough MRTMs and ATCOs to balance the levels of traffic by transferring of aerodromes between the MRTMs according to ATCO endorsements
4. The RTC supervisor is able to prioritize, ensures that the service of any MRTM can be realized in time, and keeps the RTC controlled in an efficient way
5. The RTC supervisor follows up traffic and technology affecting workload for each ATCO
6. The use case is ended

## Operating method / alternative flow

7. The RTC supervisor has to prioritize some particular event e.g. maintenance of an MRTM at the same time as an increase of traffic occurs at one aerodrome
8. The RTC supervisor evens the burden by transfer of different aerodromes to ensure that all connected aerodromes can continue to be operated without a decrease in capacity
9. When traffic is lowered or the particular event e.g. maintenance is over the RTC supervisor evens the distribution of aerodromes and requested capacity
10. The alternative flow is ended

### 3.3.2.1.12 UC 3:3 / Emergency Situation – Supported by Supervisor



### Figure 17 Use Case 3:3

## General conditions

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 a transfer of aerodrome/aerodromes to other MRTM/MRTMs

## Pre-conditions

One ATCO delivers air traffic services at an MRTM to the connected aerodromes when an emergency situation occurs, such as; aircraft arriving with one engine inoperable, flat tire after landing, fire on or in the vicinity of the aerodrome. The ATCO calls for support in the situation.

*Note: The emergency situations are only examples of situations that can occur.*

### Post conditions

The ATCO has transferred the aerodrome/aerodromes with normal operations to other MRTM/MRTMs.

*Note 2: The common solution is not to move a distressed situation to a second MRTM.*

## Actors

RTC supervisor, ATCO, flight crew (pilots) and vehicle drivers

### **Operating method / main flow**

1. An ATCO controls several aerodromes connected to an MRTM
2. There is an aircraft arriving with engine failure on one engine, or there is a fire near the aerodrome
3. The RTC supervisor works with the RTC planning overview and finds suitable MRTMs to transfer the aerodromes in normal operations to and informs the ATCO about it
4. The ATCO initiates a transfer of the aerodrome/aerodromes in normal operations to other MRTM/MRTMs
5. The ATCO is able to focus on the abnormal operations and follows up on that traffic without interfering with traffic at another aerodrome. The RTC supervisor is at the same time able to follow up on the alarm chain in distressed situations and support the ATCO if needed, e.g. perform needed co-ordinations with ACC, APP, fire brigade until the situation is ended
6. The use case is ended

### **Operating method / alternative flow**

7. The ATCO is affected by a very high level of stress during the distress situation and is unable to transfer any aerodrome to another MRTM
8. The supervisor can either support the ATCO directly in the MRTM or find another ATCO able to support the ATCO in distress with the increased workload
9. When the distress situation is over, operations return to normal. The ATCO affected might be replaced by a colleague, if deemed appropriate, in order to be able to calm down and relax after the stressful situation.
10. The alternative flow is ended



### 3.3.2.1.13 UC 3:4 / Emergency Situation – Transfer of aerodrome(s) to another MRTM within the RTC

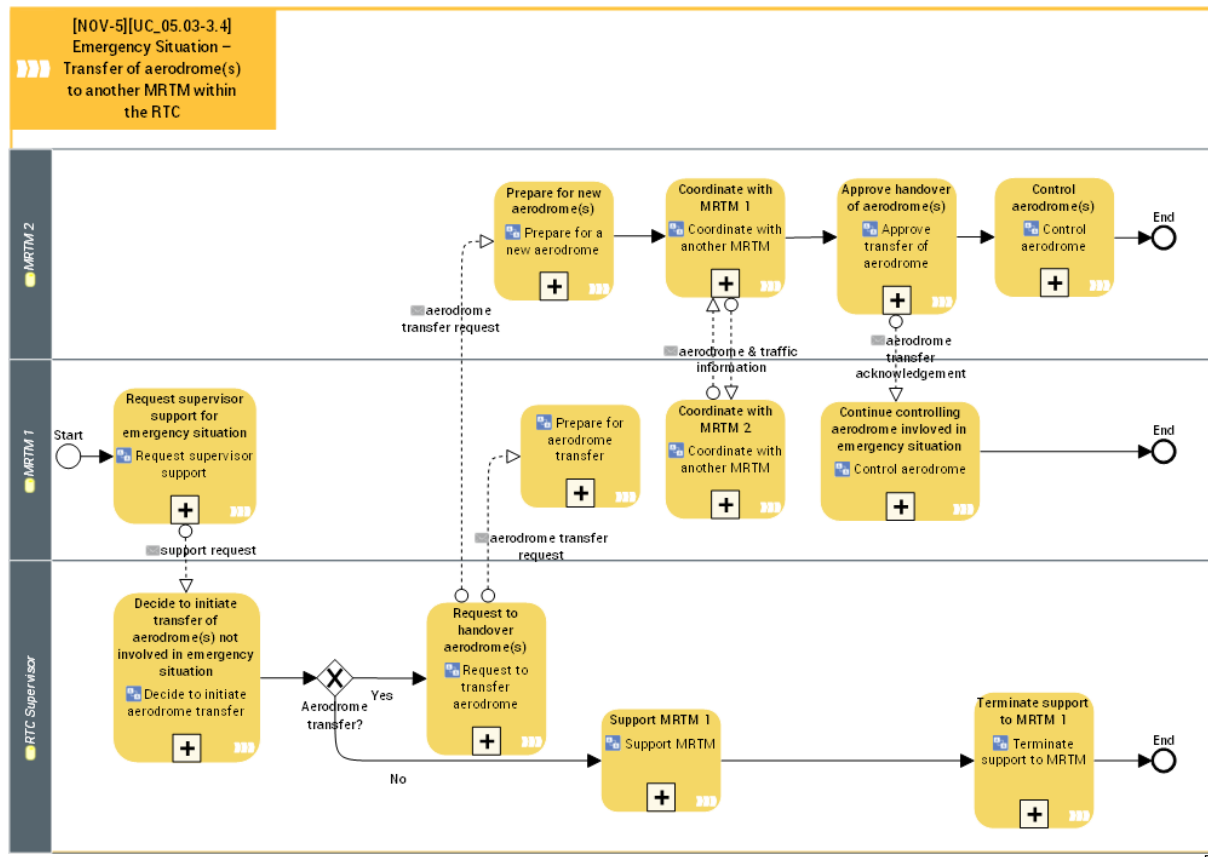


Figure 18 Use Case 3:4

#### General conditions

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.

#### Pre-conditions

One ATCO delivers air traffic services at an MRTM to the connected aerodromes when an emergency situation occurs, such as; fire due to overheated brakes, flat tire after landing, aircraft arriving with com/failure, C/F. The ATCO calls for a transfer of one of the aerodromes

*Note: The emergency situations are only examples of situations that can occur.*

#### Post conditions

The ATCO keeps on dealing with the aerodrome where the distress situation is happening and the RTC supervisor has supported the transfer to another ATCO in another MRTM within the RTC.

#### Actors

RTC supervisor, ATCO, flight crew (pilots) and vehicle drivers

### Operating method / main flow

1. Aerodromes are controlled by ATCOs from different MRTMs
2. There is an aircraft which gets a flat tire after landing (or overheated brakes causing a fire) at one of the aerodromes in an MRTM
3. The supervisor is informed of the situation and looks for a suitable MRTM to transfer the aerodrome/aerodromes to
4. The RTC supervisor prepares the ATCO taking over an aerodrome and ensures that the complete technical status is available prior to the transfer. Information is given to the ATCO with the abnormal case on where to transfer aerodrome/aerodromes to
5. Either one of the ATCOs initiates the transfer of the aerodromes depending on the situation or the aerodrome/aerodromes in normal operation are transferred.
6. The use case is ended

### Operating method / alternative flow

7. The RTC supervisor is unable to find another MRTM to transfer the connected aerodromes to
8. The RTC supervisor coordinates to ensure that all arriving and departing traffic at any of the other aerodromes is reduced to a minimum
9. When the situation is dealt with or another MRTM or ATCO is ready for a transfer, the RTC supervisor initiates a transfer or initiates an increase of traffic.

*Note: There is a risk for a closure of an aerodrome depending on the abnormal situation*

10. The alternative flow is ended

#### 3.3.2.1.14 UC 4:1 / Provide ATS with simultaneous TWR and APP from one MRTM

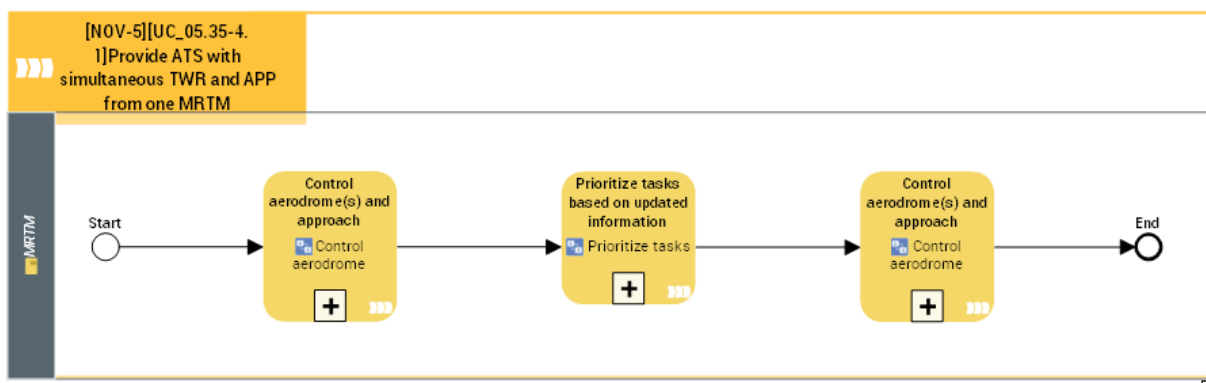


Figure 19 Use Case 4:1

### General conditions

This use case describes the baseline for how to provide simultaneous ATS for both approach and tower services in multiple remote towers.

**Pre-conditions**

The ATCO has a view and is equipped with all technical systems needed for all aerodromes connected to the MRTM. The ATCO also has technical systems needed to provide Approach services.

**Post conditions**

The ATCO provides ATS to the aerodromes connected to the MRTM with the same level of service as if they were controlled in single remote tower mode.

The ATCO provides ATS Approach services with the same level of service as if TWR and Approach were provided from a conventional tower.

**Actors**

ATCO, flight crew (pilots) and vehicle drivers

**Operating method / main flow**

1. A movement is active within the manoeuvring area at one of the aerodromes connected to the MRTM
2. A movement becomes active in the approach area connected to the MRTM
3. The ATCO is in control of all movements at the different aerodromes as well as within the approach area
4. The ATCO can prioritize and sequence the movements in order to maintain a safe and controlled air traffic service to all aerodromes and to the approach area
5. The ATCO follows up on the movements and is ready for a new movement
6. The use case is ended

**Operating method / alternative flow**

7. The ATCO has to prioritize the existing movements
8. The ATCO keeps other movements out of the flow by e.g. keeping vehicles outside the manoeuvring area, keeping aircraft on ground rather than departing a third movement, keeping arriving aircraft outside the CTR or putting approaching aircraft into a holding or vectoring them.
9. When traffic so permits the ATCO takes care of new movements at the different aerodromes
10. The alternative flow is ended

### 3.3.3 Differences between new and previous Operating Methods

The previous work done in SESAR 2020 Wave1, has delivered results determining the solution PJ05-02-V3 as a reference for Solution 35 regarding Multiple Remote Tower Modules from a technological, functional and operational point of view.

The objective of solution PJ05-W2-35 is to enlarge the scope of the multiple remote tower solutions addressing Remote Tower Centre capability through a flexible allocation of grouped aerodromes to dedicated MRTMs within a Remote Tower Centre. Such a flexible allocation allows increasing ATCO productivity by better balancing the workload between different MRTMs, acceptable by ATCOs i.e. reducing the number of required ATCOs.

A flexible allocation of aerodromes in the MRTM implies that one aerodrome can take different positions within MRTMs compared to a reference solution PJ05.02-V3 where the aerodromes were fix positioned. It is expected that this will increase the ATCO workload, as it might be more difficult to maintain situation awareness. In order to avoid this, the workload needs to be reduced by a flexible positioning of the aerodromes within the same MRTM based on ATCOs preferences or by e.g. extended automation support.

Depending on the complexity of the flexible allocation, or depending on specific local implementation (mostly affected by the size of an RTC), the task of the flexible allocation of grouped aerodromes to dedicated MRTMs will be allocated to a specific role RTC supervisor and requires a support tool.

The validations are based on the assumption that an ATCO can hold endorsements for 4 aerodromes. These 4 aerodromes are grouped together and can be flexibly allocated to dedicate MRTMs. As it is envisaged the provision of higher cost-effectiveness by this solution, the concept can also be valid for a higher number of grouped aerodromes if the ATCO can hold endorsements for more aerodromes. The Real time Simulations address a setup with two MRTMs, each MRTM providing the capability to allocate 3 aerodromes at time.

The validations are focusing on evaluation of human performance and safety aspects.

The principles and experiences gained through the operational usage of the Single Remote Tower operations are imposed as baseline for multiple remote tower operations. This New Operating Method of providing ATS from RTC that accommodates a locally determined number of MRTMs are using the outcomes from the PJ05.02-V3 validation as reference, and additionally takes into account the experiences and recommendations obtained by the previous PJ05.03-V2 validation.

As already described, the New Operational Method enlarge the scope of the Multiple Remote Tower solutions from fixed to flexible allocation of aerodromes between MRTMs within RTC thus provision of ATS will be more efficient.

## 4 Safety, Performance and Interoperability Requirements (SPR-INTEROP)

This chapter presents requirements related to Solution 35 and are relevant for the R&D activities within PJ.05-W2-35. Results obtained from validation activities have contributed to update and mature requirements, which were part in the previous edition.

Requirements for PJ05-W2-35 build upon SESAR 1 requirements and SESAR 2020 Wave 1 PJ.05-02-V3 requirements related to the remote tower concept.

The relevant requirements that form the baseline for solution 35 are presented separately in the following appendixes:

Appendix B - "Baseline Requirements for Single Remote Tower (from SESAR 1)".

Appendix C - "Baseline Requirements for Multiple Remote Tower Module (from SESAR 2020 wave1, solution PJ05-02-V3).

During SESAR 2020 wave 1 several of the requirements were shared between solution PJ.05.02-V3 and solution PJ.05.03-V2. These shared requirements were indicated by a requirement identifier beginning with "REQ-05.00-..."

Solution PJ.05.03-V2 had specific requirements related to RTC functionality and these were indicated as "REQ-05.03-..." in the beginning of the requirement identifier. These requirements are further validated through Solution 35 at V3 maturity level.

Some new requirements also have been created for Solution 35 and these are indicated as "REQ-05.35-..."

### 4.1 Flexible Allocation (Transfer/Merging)

#### 4.1.1 General Requirements

[REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0001
Title	Transfer request by ATCO
Requirement	ATCO shall be able to request a 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 request it.
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0002
Title	ATCO responsibility during transfer
Requirement	The receiving ATCO shall be responsible to finalise the transfer of control and complete the handover procedure.
Status	<Validated>
Rationale	While RTC Supervisor role and ATCO can initiate the handover procedure, it's ATCO responsibility to establish when completing the transfer procedure and finalise the transfer.
Category	<Operational>,<Safety>,<Human Performance>,<Interoperability>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0003
Title	Coordination and responsibility for RTC supervisor role and ATCO during transfer
Requirement	Timing of the transfer procedure should be coordinated between RTC Supervisor role and ATCOs as its ATCO responsibility to manage the transfer.
Status	<Validated>
Rationale	It should be the ATCOs' responsibility to manage the transfers between themselves, thus the timing of the transfer should be coordinated between SUP role and ATCOs.
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0004
Title	Operational procedures and checklist regarding transfer in nominal conditions, abnormal and degraded mode
Requirement	Transfer operational procedures and checklists for nominal conditions, abnormal and degraded mode shall be locally established to support the RTC.
Status	<Validated>

Rationale	<p>Supporting the RTC with Transfer Operational procedures and checklists for nominal operational conditions, as well as under abnormal and degraded mode of operations, shall ensure a minimized impact on safe and effective provision of ATS under such conditions.</p> <p>In terms of abnormal and degraded mode of operations, transfer operational procedures and checklists should be presented as a Contingency Plan is presented in a conventional tower and will support the work in the RTC to safely provide ATS. E.g. unexpected situations, restrict/terminate ATS to one or more aerodrome, unavailable coordination within RTC or between RTC and external parties, inadequate transfer execution or aerodrome allocation etc.</p>
Category	<Operational>,<Safety>,<Human Performance>,<Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
<ALLOCATED_TO>	<Activity>	Simultaneous ATS with Flexible allocation
<ALLOCATED_TO>	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller RTC Supervisor
<ALLOCATED_TO>	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0005
Title	Operating procedures for transfer
Requirement	Operating procedure for the transfer should foresee a time period dedicated to a coordination between the ATCOs and the monitoring including frequency monitoring before the actual handover.
Status	<Validated>
Rationale	There is a need to dedicate a time period to building-up the situational awareness before finalising the split and merge procedure
Category	<Operational>,<Safety>,<Human Performance>



## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0006
Title	Single acceptance action by ATCO for completion of handover
Requirement	When transfer is completed, all systems and information that belongs to the same/transferred aerodrome shall be accepted in a single action.
Status	<Validated>
Rationale	To complete the handover one single action shall be performed and no additional activation click will be needed on the system's user interface.
Category	<Operational>, <Safety>, <Human Performance>, <Performance>, <Interoperability>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0007
Title	Display layout to be presented in a predefined way
Requirement	All ATCO displays shall retain the predefined ATCOs Set-up during transfer of the aerodromes.
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
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0008
Title	Consistent display layout for all aerodrome configurations
Requirement	Visual Presentation and head down displays shall have the same layout for all the possible aerodrome configurations.
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
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0009
Title	Pre-set aerodrome radar maps
Requirement	ATCO should be supported by 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
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0010
Title	Time monitoring for active aerodromes with focus on endorsement
Requirement	The time the ATCO works on each airport should be automatically monitored 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	<Operational>,<Safety>,<Human Performance>,<Interoperability>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0011
Title	Fatigue assessment
Requirement	Fatigue tends to accumulate toward the end of the shift and should be locally assessed before the deployment to establish proper shift length
Status	<Validated>
Rationale	Local assessment of fatigue is required to establish the shift length and active time in position.
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0012
Title	Actual traffic flows
Requirement	ATCOs and SUP tools shall use actual traffic.
Status	<Validated>
Rationale	The ATCOs and SUP tools data shall be updated according to the evolution of the traffic to provide the latest view and proper support for the allocation of aerodromes.
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TM01.0013
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Title	Single click aerodrome presentation in MRTM
Requirement	When an aerodrome is opened in an MRTM the video system shall automatically display it without the need for additional ATCOs manual actions.
Status	<Validated>
Rationale	When an aerodrome is opened in an MRTM, the video system shall automatically follow this, and no additional activation click shall be needed on the video system's user interface.
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.03-SPRINTEROP-TM02.0004
Title	Transfer of aerodrome between MRTMs – duplicated/shared view
Requirement	During Transfer of an aerodrome both ATCOs shall be presented with the same information on the aerodrome being transferred with all available technical systems as replicas until the transfer process is finished, readiness by overtaking ATCO is confirmed and the fully control over the new aerodrome is being reported established.
Status	<Validated>
Rationale	There is a need for both ATCOs to have a correct overview of aerodromes to be transferred between MRTMs in order to maintain a correct situational awareness. The overtaking ATCO shall confirm ready to take over the control of the transferred aerodrome and the fully control on it to be reported established.

	<p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-20.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-RTC3.0007</b></p>
Category	< Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.03-SPRINTEROP-TM02.0005
Title	Transfer of aerodromes – transfer procedures
Requirement	Transfer procedures (for the transfer of an aerodrome between MRTMs) shall be locally defined with a clear description of the associated roles and responsibilities and corresponding coordination procedures.
Status	<Validated>
Rationale	<p>To ensure all actors involved are aware of their responsibilities and associated tasks.</p> <p>This REQ originates from [HPAR] REQ.05.00_HPtraining_32.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-20.</p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	Safety Assessment Report
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.03-SPRINTEROP-TM03.0002
Title	Overview on MRTM traffic and operational status
Requirement	The RTC Supervisor role should be provided with a display presenting an overview of the RTC, including e.g. MRTM status, aerodromes allocated to MRTMs, traffic load, etc. to be able to transfer an airport.
Status	<Validated>
Rationale	The RTC Supervisor should have a clear overview of the RTC and all connected aerodromes in order to plan and manage resources and assist or initiate aerodrome transfers.  The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-27.
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Flexible Allocation
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other



## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD01.0075
Title	Monitoring of the present and upcoming traffic flow
Requirement	ATCO should continuously be monitoring the upcoming and present traffic flow for all active aerodromes dedicated to the MRTM to avoid overload.
Status	<Validated>
Rationale	ATCO should be provided with updated and reliable data regarding present and upcoming traffic flows on all aerodromes assigned to the particular MRTM. This will mitigate the overloading of a particular MRTM and thus improve the workload balance between MRTMs accommodated in the same RTC.
Category	<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	ATCO
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD01.0096
Title	Availability of proper information and functionality at receiving MRTM
Requirement	The ATCO at a receiving MRTM shall not take over control from the transferring MRTM if any critical system or information is not available.
Status	<Validated>
Rationale	All system tools and system functionalities available to receiving MRTM shall work properly; also all relevant information needed for

	safe and efficient ATS shall be presented for receiving ATCO, before the transfer being approved.
Category	<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	RTC Unit
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD01.0106
Title	Clear distinctions of aerodrome borders
Requirement	The border of each displayed aerodrome should be marked in the visual presentation and head-down displays with possible colour coding for the different positions or aerodromes.
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
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	MRTM
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller

< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other
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## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD01.0107
Title	Consistent indication of aerodrome borders
Requirement	In case of colour, coding, consistent indication shall be used for the different aerodromes on visual presentation and head down displays.
Status	<Validated>
Rationale	ATCOs situational awareness will be increased by applying of different colour for the different aerodromes. This colour coding shall be consistent for visual presentation and head down displays.
Category	<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	MRTM
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD01.0108
Title	ATCO in charge responsibility for Flexible Positioning
Requirement	Flexible positioning of aerodromes within the same MRTM shall be performed by the ATCO.
Status	<Validated>
Rationale	Aerodromes assigned to a particular MRTM may be positioned flexibly by the ATCO who operates that MRTM and is responsible for providing safe and efficient ATS, in accordance to their own preferences.

Category	<Safety>
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## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	MRTM
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD02.0093
Title	Spare ATCO endorsements
Requirement	The spare ATCOs shall have endorsement for all aerodromes within the RTC.
Status	<Validated>
Rationale	As multiple aerodromes might be handled by one MRTM it is important to quickly be able to call in other ATCOs to the position in case of an unexpected event.
Category	<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	ATCO
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD02.0094
Title	An extra spare MRTM
Requirement	A spare MRTM, which is not used in day-to-day operational service, should be available.
Status	<Validated>
Rationale	If all aerodromes connected to an RTC were needed to be placed on one MRTM each, then there should be a spare MRTM if MRTM were to malfunction.
Category	<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	ATCO
<ALLOCATED_TO>	<Activity>	Simultaneous ATS with Flexible allocation
<ALLOCATED_TO>	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller RTC Supervisor
<ALLOCATED_TO>	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD03.0099
Title	Determining the required number of MRTMs located at the same RTC
Requirement	The RTC should host a locally determined number of MRTMs to be able to split aerodromes.
Status	<Validated>
Rationale	RTC should determine number of MRTMs needed with focus on emergency, abnormal and degrade situations in order to sustain a safe ATS.
Category	<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## 4.1.2 Communications

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-CO01.0001
Title	Phraseology
Requirement	The airport name shall be integrated in the phraseology in order to increase the situational awareness
Status	<Validated>
Rationale	Airport name is to be used in the communication exchange to enhance situational awareness
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-CO01.0002
Title	Overlapping of air-ground communication
Requirement	The overlapping of air-ground communication must be minimized for the ATCO.
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
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-CO01.0003
Title	Training of personnel operating ground vehicles
Requirement	Ground vehicles should be properly trained to become familiar with the fact that the ATCO is communicating also with other aerodromes including ground vehicles
Status	<Validated>
Rationale	To avoid confusion on ground frequency, ground vehicles operators shall be aware that the ATCOs is communicating with different aerodromes vehicles. Also, ground frequency shall not be mixed with aircraft frequency

Category	<Operational>,<Safety>,<Human Performance>,<Performance>
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## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Vehicle Drives
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD01.0076
Title	Communication between the ATCOs working on different MRTMs
Requirement	ATCO shall be able to communicate with ATCOs in other MRTMs within the RTC in order to coordinate transfer procedure at each aerodrome allocated to the MRTM.
Status	<Validated>
Rationale	In order to accomplish an increased level of safety and efficiency during the transfer procedure, all uncertainties between the ATCOs involved in this transfer shall be coordinated via means of communication available to RTMs.
Category	<Operational>,<Safety>,<Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<High Level Operational Requirement>	S05-035-HLOR-01
<SATISFIES>	<Information Exchange>	Surf-G COMM (MRTMs)
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller



< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other
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## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD01.0089
Title	Communication between the RTC Supervisor role and all ATCOs working on MRTMs
Requirement	RTC Supervisor role shall be able to communicate with ATCOs in all MRTMs within the RTC in order to coordinate transfer procedures at each aerodrome allocated to the MRTM
Status	<Validated>
Rationale	An effective and well-coordinated flexible allocation will be achieved by regular and timely communication between RTC Supervisor role and all affected ATCOs. All factors that affect the capacity of the MRTMs, in order to provide relevant ATC services to concerned aerodromes need to be continuously monitored by RTC Supervisor role.
Category	<Operational>,<Safety>,<Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<High Level Operational Requirement>	S05-035-HLOR-01
<SATISFIES>	<Information Exchange>	Surf-G COMM (MRTMs)
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD01.0091
Title	Coordination between the RTC Supervisor role and all relevant external parties

Requirement	RTC Supervisor shall be able to coordinate with all relevant external parties.
Status	<Validated>
Rationale	RTC Supervisor role shall be able to coordinate with external parties in order to e.g. plan maintenance and solve problems quickly.
Category	<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	Surf-G COMM (External parties)
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

### 4.1.3 Alarms and Alerts

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-AL01.0001
Title	Support for ATCO to monitor runway
Requirement	The ATCO may be supported 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	<Operational>, <Safety>, <Human Performance>, <Performance>, <Interoperability>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-AL01.0002
Title	Implementation of existing Safety nets in RTC
Requirement	If any Safety net is available in current conventional tower environment (e.g. conflicting clearances alerts etc.) it shall be available in the RTC.
Status	<Validated>
Rationale	Safety net already in place in standard tower and in single remote tower environment are a pre-requisite of the RTC.
Category	<Operational>, <Safety>, <Human Performance>, <Performance>, <Interoperability>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD03.0110
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Title	Alert in case of failure of the transfer function
Requirement	An alert shall be provided to the controller 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
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SD03.0111
Title	Alert in case of corrupted data by any critical system
Requirement	An alert shall be provided to the supervisor in case of the Supervisor Planning 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>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35

<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

#### 4.1.4 ATCO Planning Tools

[REQ]

Identifier	REQ-05.35-SPRINTEROP-AP01.0001
Title	ATCO Planning tool to provide accurate and reliable information
Requirement	ATCO shall be provided with accurate and reliable traffic and planning information through the ATCO Planning tool.
Status	<Validated>
Rationale	ATCO planning tool shall support ATCOs with reliable and accurate information to efficiently and safely manage flexible allocation.
Category	<Operational>, <Safety>, <Human Performance>, <Performance>, <Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

[REQ]

Identifier	REQ-05.03-SPRINTEROP-AP01.0002
Title	Task Prioritisation

Requirement	The ATCO should be supported in prioritising tasks (e.g. providing landing clearance or taxi clearance) from a support tool in the tactical short term.
Status	<Validated>
Rationale	A task prioritisation tool can support ATCO in Human Performance working in a complex Multiple Remote Tower environment.
Category	<Operational>,<Human Performance>,<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Functional Block>	CHMIM Aerodrome ATC
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

#### 4.1.5 Automation Functionalities

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-AF01.0001
Title	Indication of Clearances to be given
Requirement	The ATCO may be supported by the system indicating 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 could be given. This helps if the ATCO is focussing on one aerodrome while a clearance can be given at another aerodrome.
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.03-SPRINTEROP-AF01.0002
Title	Conformance Monitoring Ground
Requirement	The ATCO may be supported in monitoring conformance to clearances on ground.
Status	<Validated>
Rationale	<p>Support in ground 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.</p> <p>REC.05.00_HPdesign13: In case stop bars and/or ground sensors are available, there should be a visual indication when stop bar overrun occurs. Rationale: REC.05.00_HPdesign13: Either The indication could be in the panorama and/or in the planning tool (e.g. the label could turn red or if possible, it could be linked to the electronic planning tool that blocks the occupied section).</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-36, SR-37.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-FN03.3006 &amp; REQ-06.09.03-OSED-FN03.3007.</b></p>
Category	< Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35

<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

Identifier	REQ-05.03-SPRINTEROP-AF01.0003
Title	Conformance Monitoring Air
Requirement	The ATCO may be supported in monitoring conformance to clearances for airborne movements
Status	<Validated>
Rationale	Support in air monitoring can support the ATCO in monitoring that given clearances are followed. An air 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	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Functional Block>	Conformance Monitoring
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.03-SPRINTEROP-AF01.0004
Title	Conflict Detection indicated by delivering contradictory (Incompatible) clearances



Requirement	The ATCO may be supported by the system, indicating situations when contradictory (incompatible) clearances are delivered.
Status	<Validated>
Rationale	Conflicting clearance alerts for controllers (CATC) can support the ATCO to be warned if contradictory (incompatible) clearances are given.
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## 4.1.6 Training

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TR01.0001
Title	Training of ATCO in RTC system and environment
Requirement	ATCOs shall be trained in order to achieve familiarity with the RTC systems and operational environment
Status	<Validated>
Rationale	Operational environment is intended to include all the aspects of the RTC, including teamwork, methods and procedures regarding prioritisation, transfers and regulations connected to number of movements allowed are also seen as a requirement in order to safely operate multiple aerodromes.
Category	<Operational>, <Safety>, <Human Performance>, <Performance>, <Interoperability>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-TR01.0002
Title	Training and additional skills
Requirement	Additional skills may be needed: <ul style="list-style-type: none"> <li>• Teamwork skills (TRM), depending on the context</li> <li>• RTC supervisor role should have a background in control tower</li> </ul>
Status	<In Progress>
Rationale	Working in a RTC with flexible allocation may be very different by working in a very small airport and this might require additional skills
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## 4.2 RTC Supervisor

### 4.2.1 RTC Supervisor Role

[REQ]

Identifier	REQ-05.35-SPRINTEROP-SR01.0001
Title	RTC Supervisor role -Assessing and balancing workload between modules
Requirement	RTC supervisor role shall assess and balance the workload between the modules
Status	<Validated>
Rationale	There is the need to always properly balance the workload in order to minimise the impact on situation awareness
Category	<Operational>,<Safety>,<Human Performance>,<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Flexible allocation
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

[REQ]

Identifier	REQ-05.35-SPRINTEROP-SR01.0002
Title	RTC Supervisor role - Responsibility for initiation of transfer
Requirement	The transfer procedure initiation should be responsibility of the RTC supervisor role.
Status	<Validated>
Rationale	RTC supervisor role should be responsible of initiating the transfer as he/she has the overview of the expected traffic load and workload expected at each aerodrome and the relevant information like status of the aerodromes,

	endorsements and ATCO availability. The ATCO can always request a handover.
Category	<Operational>, <Safety>, <Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Flexible allocation
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SR01.0003
Title	RTC Supervisor role - Support ATCO in emergency situation
Requirement	The RTC Supervisor role or similar role shall be able to support the ATCO in case of an emergency.
Status	<Validated>
Rationale	Emergency situations should be known by the role responsible of the allocation of aerodromes between modules in order to be able to support the ATCO affected by the emergency
Category	<Operational>, <Safety>, <Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Flexible allocation
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## 4.2.2 RTC Supervisor Planning Tools

[REQ]

Identifier	REQ-05.03-SPRINTEROP-SP01.0001
Title	RTC Supervisor Maintenance Coordination Tools
Requirement	The RTC Supervisor role shall access functions for communicating the status of RTC and aerodromes and coordinating maintenance (to be carried out by a qualified engineer/technician).
Status	<Validated>
Rationale	<b>Initially addressed in SESAR1 REQ-06.09.03-OSED-SUP3.0014</b>
Category	< Operational>,<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Flexible allocation
< ALLOCATED_TO >	<Functional Block>	Operational Supervision
< ALLOCATED_TO >	<Functional Block>	Technical Supervision
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

[REQ]

Identifier	REQ-05.35-SPRINTEROP-SP01.0002
Title	Status of the MRTM and the expected traffic load
Requirement	Supervisor tool HMI shall display the status of the MRTM and the traffic load expected at each single aerodrome under his/her supervision to properly establish the flexible allocation of aerodromes to the available RTC Modules
Status	<Validated>

Rationale	The supervisor is responsible of the allocation of the aerodromes between the modules. The allocation shall be established depending on the aerodromes and traffic conditions (e.g. meteo, load etc.).The HMI shall provide all the required information in order to establish the aerodrome allocation.
Category	< Operational>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Flexible allocation
< ALLOCATED_TO >	<Functional Block>	Operational Supervision
< ALLOCATED_TO >	<Functional Block>	Technical Supervision
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.03-SPRINTEROP-SP02.0003
Title	RTC Supervisor Airport Weather Monitoring Tools
Requirement	The RTC Supervisor role shall be able to access functions for the monitoring of weather conditions for all aerodromes.
Status	<Validated>
Rationale	The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-29.  <b>Initially addressed in SESAR1 REQ-06.09.03-OSED-SUP3.0013</b>
Category	< Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35

<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Flexible allocation
< ALLOCATED_TO >	<Functional Block>	Operational Supervision
< ALLOCATED_TO >	<Functional Block>	Technical Supervision
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.03-SPRINTEROP-SP02.0004
Title	RTC Technical Supervision
Requirement	The RTC Supervisor role should be provided with a technical overview of all systems e.g. the MRTM, camera functionality etc. in the RTC and of the aerodrome systems e.g. navigational aids, lights, emergency alerting functions, for all involved aerodromes part of the RTC
Status	<Validated>
Rationale	<p>There is a need for the RTC supervisor to have an overview over status of technical equipment to support to which ATCO and MRTM aerodromes can be allocated to.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-27.</p> <p><b>Initially addressed in SESAR1 &lt;&lt;partly&gt;&gt; REQ-06.09.03-OSED-SUP3.0012</b></p>
Category	< Operational>,<Safety> ,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	Flexible Allocation
< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Functional Block>	Operational Supervision
< ALLOCATED_TO >	<Functional Block>	Technical Supervision
< ALLOCATED_TO >	<Role>	RTC Supervisor

< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other
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## [REQ]

Identifier	REQ-05.03-SPRINTEROP-SP03.0002
Title	RTC Supervisor Planning tool - input data demand
Requirement	The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC.
Status	<Validated>
Rationale	<p>The supervisor planning tool aims to support the RTC Supervisor to balance workload and plan for e.g. work, such as maintenance at the aerodromes or the RTC.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-27.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-SUP3.0010</b></p>
Category	<Operational>,<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Flexible Allocation
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.03-SPRINTEROP SP03.0004
Title	RTC Supervisor Planning tool - input data ATCO availability and endorsements
Requirement	The RTC Supervisor role shall be provided with an overview of ATCO availability and their valid endorsements



Status	<Validated>
Rationale	<p>RTC Supervisor needs an overview of ATCO availability and their endorsements at the aerodromes connected to the RTC to enable the allocation of ATCOs.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-27.</p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Flexible Allocation
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.03-SPRINTEROP- TM03.0003
Title	RTC Supervisor Planning tool - for allocation of ATCOs and aerodromes to MRTMs
Requirement	The RTC Supervisor shall be provided with up-to date information to facilitate decisions regarding how to combine aerodromes in the MRTM.
Status	<Validated>
Rationale	<p>RTC supervisor needs an overview over capacity and demand at the connected aerodromes in order to find a suitable balance for the ATCOs in the different MRTMs.</p> <p>Considerations shall be done regarding e.g. traffic levels, traffic complexity, airport layout, geographical difference, daylight conditions, weather conditions, work in progress on the airport, etc.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-27.</p>
Category	<Operational>,<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Flexible Allocation
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.03-SPRINTEROP-TM03.0007
Title	Single Remote Tower Baseline - RTC Verifying Aerodrome Status
Requirement	The ATCO/RTC Supervisor shall be able to verify the status of an aerodrome and its related systems, before taking on responsibility for providing ATS to the aerodrome.
Status	<Validated>
Rationale	<p>In order to be sure about the airport and related system status before assuming the responsibility.</p> <p>Note: Indications from validation exercises performed so far indicates that some kind of system support such as a common handover/transfer area might be needed to enable this, when transferring aerodromes between RTMs within an RTC.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-21.</p> <p><b>Validated in SESAR1 REQ-06.09.03-OSED-RTC3.0008</b></p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.05.03
<SATISFIES>	<Information Exchange>	N/A

< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Functional Block>	Operational Supervision
< ALLOCATED_TO >	<Functional Block>	Technical Supervision
< ALLOCATED_TO >	<Role>	RTC Supervisor
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

### 4.3 Security Requirements

[REQ]

Identifier	REQ-05.35-SPRINTEROP-SC01.0001
Title	Physical protection of the airport shared area.
Requirement	Shared zone of the remote airport shall be physically protected.
Status	<In progress>
Rationale	Appropriate physical protection shall be in place based on the environment, threat actors and local regulations. Camera sensor damaging in open space shall be prevented e.g. with bigger area with restricted access to not reach the camera sensor (e.g. fence, CCTV). Other physical threat to be considered are e.g. vibration, strong light sources (laser), drone attacks.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<High Level Operational Requirement>	N/A
< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Role>	N/A
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

[REQ]

Identifier	REQ-05.35-SPRINTEROP-SC01.0002
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Title	Camera access control
Requirement	Camera shall provide access control for software / firmware updates.
Status	<In progress>
Rationale	Protection against software / firmware manipulation by unauthorised actors.
Category	<Security>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<High Level Operational Requirement>	N/A
< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Role>	N/A
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SC01.0003
Title	Camera software/firmware monitoring
Requirement	Camera software/firmware changes shall be monitored.
Status	<In progress>
Rationale	Detection of software/firmware manipulation by unauthorised actors.
Category	<Security>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<High Level Operational Requirement>	N/A
< ALLOCATED_TO >	<Activity>	N/A

< ALLOCATED_TO >	<Role>	N/A
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SC01.0004
Title	Wireless protection
Requirement	Wireless capabilities on camera or components connected to the LAN shall be disabled.
Status	<In progress>
Rationale	Wireless connection to the components shall be prohibited to avoid component manipulation.
Category	<Security>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<High Level Operational Requirement>	N/A
< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Role>	N/A
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SC01.0005
Title	Access control list
Requirement	Access control list shall be configured on the device connected to the LAN.
Status	<In progress>
Rationale	Access to camera interface and ports shall be protected.

Category	<Security>
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## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<High Level Operational Requirement>	N/A
< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Role>	N/A
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## [REQ]

Identifier	REQ-05.35-SPRINTEROP-SC01.0006
Title	Hardening
Requirement	Hardening according to the well-known industry best practices shall be provided on the components.
Status	<In progress>
Rationale	Access to camera interface and ports shall be protected.
Category	<Security>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<High Level Operational Requirement>	N/A
< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Role>	N/A
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## 4.4 Approach

Identifier	REQ-05.35-SPRINTEROP-TA01.0001
Title	Combined Tower and Approach Service
Requirement	When Tower and Approach services are combined within the same MRTM, the tools for each service shall be easily available.
Status	<Validated>
Rationale	<p>During specific periods (e.g. during low-traffic 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	<Operational>,<Safety>

### [REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ05-W2-35
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	Simultaneous ATS with Flexible allocation
< ALLOCATED_TO >	<Role>	Tower Clearance Delivery Controller Tower Ground Controller Tower Runway Controller Approach Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Small Airports Other

## 5 References and Applicable Documents

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### 5.1 Applicable Documents

#### Content Integration

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- [1] PJ19\_D5.11\_EATMA\_guidance\_material\_ (2019.0)
- [2] PJ19 Enablers Development and Usage Guidance (1.0)

#### Content Development

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- [3] D2.5 SESAR 2020 Concept Of Operations Edition 2019 v01.00.00 (1.0)

#### System and Service Development

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- [4] D3\_14 - RSIT - 2019 (1.0)

#### Performance Management

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- [5] SESAR Performance Framework ed. 01.00.01 - 2019 (1.0)
- [6] Validation Targets W2 (1.0)

#### Validation

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- [7] EOCVM V3 Volume 1 (1.0)
- [8] EOCVM V3 Volume 2 (1.0)
- [9] Validation Strategy VALS (2019.0)

#### System Engineering

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- [10] D3\_14 - RSIT - 2019 (1.0)

#### Safety

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- [11] SESAR2020 Safety Reference Material Ed 00.04.01\_1 (1.0)
- [12] Guidance to Apply the SESAR2020 Safety Reference Material Ed 00.03.01\_1 (1.0)

#### Human Performance

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- [13] SESAR Human Performance Assessment Process V1 to V3 – including VLD\_HP final version\_clean 4 (3.2)

#### Environment Assessment

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- [14] SESAR 2020 - Environment Impact Assessment Guidance (1.0)



## 5.2 Reference Documents

- [15]ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.<sup>1</sup>
- [16]SESAR 1 P06.08.04-D94-OSED Single Remote TWR Ph2 – Final Update, Edition 00.07.01, Dated 27/07/2016
- [17]SESAR 1 P06.09.03-D32 SAR for Multiple Remote Tower (two low density aerodromes), Edition 00.01.01, Dated 18/11/2015
- [18]SESAR 1 P06.09.03-D28 HP for Multiple Remote Tower (two low density aerodromes), Edition 00.01.01, Dated 01/09/2015
- [19]The Convention on International Civil Aviation, Annex 11, Air Traffic Services, Chapter 2.30 (Amendment 46)
- [20]ICAO Document 4444 “Procedures For Air Navigation Services - Air Traffic Management”, Sixteenth Edition, 2016 (Amendment 8, 08 November 2018)
- [21]ICAO Document 9426 “Air Traffic Services Planning Manual”, 1st Edition, December 1992
- [22] SESAR1 P06.09.03-D35 “OSED for Remote Provision of ATS to Aerodromes”, Edition 00.06.02, Dated 20/11/2015
- [23] LSD.02.03 D03 – RACoon Demonstration Report, Edition 01.01.00, Dated 19/12/2016
- [24] LSD.02.04 D03 – Remote Towers Demonstration Report, Edition 00.02.00, Dated 06/12/2016
- [25] LSD.02.05 D03 – RTO Demonstration Report, Edition 00.02.00, Dated 31/10/2016
- [26] LSD.02.10 D03 – Budapest 2.0 Demonstration Report, Edition 01.00.20, Dated 19/12/2016
- [27] PJ05\_D2.2\_Solution PJ.05.02\_V3 Data Pack, including: D.2.1.001 PJ05.02 V3 OSED-SPR-INTEROP (00.01.03) - final.docx; D2.1.001 PJ.05.02 V3 Human Performance Assessment Report (1\_1).docx; D2.1.001 PJ.05.02 V3 OSED part V - PAR (1.2).docx; D2.1.001 PJ05.02 V3 - SAR (1\_1).docx; D2.2.004 PJ05.02 V3 TS IRS (1\_1).docx; D2.2.005-PJ.05.02-V3 CBA (1.1).docx; SESAR Solution PJ.05.02 V3 Contextual Note 1.0.docx; SESAR Solution PJ05\_02-V3 VALR (3\_15).docx
- [28] PJ05\_D3.1\_Solution PJ.05.03\_V2 Data Pack, including: SESAR Solution PJ05\_03 - D3\_1\_003 - OSED (1\_1); SESAR Solution PJ05\_03 - D3\_1\_003 - SAR (1\_0); SESAR Solution PJ05\_03 - D3.1.003 - HPR (1\_1); SESAR Solution PJ05\_03 - D3\_1\_007 - VALR (2\_24); SESAR Solution PJ05\_03 - D3.1.010 - TS IRS (1\_0); SESAR Solution PJ05\_03 - D3\_1\_003 - PAR (1\_2); SESAR Solution PJ05-03 Contextual Note; SESAR Solution PJ05\_03 - D3\_1\_100 - VALP +Roadmap (1\_0)

[29]PJ05-W2-DTT Solution PJ.05-W2-35 Data Pack, including: SESAR Solution PJ.05-W2-35 SAR 00.00.02 (1.2); SESAR Solution PJ.05-W2-35 D2.1.020 HPAR 00.01.00 (4.9) SAR 00.00.02 (1.2); SESAR Solution PJ.05-W2-35 D2.1.060 VALR 00.01.01 (3.54)

## Appendix A Cost and Benefit Mechanisms

### A.1 Stakeholders identification and Expectations

Stakeholder	Involvement	Why it matters to stakeholder
ANS providers	ANSPs will be able to implement the systems	ANSPs expect a reduction of cost for running local air traffic service at aerodromes
Staff union and organisations	ATCOs will be the end user of the system	Staff working in a MRTM and RTC will be affected when working with more than one aerodrome at a time. Their expectations are that the technology will ensure that daily work can be performed safe and controlled.
ATM infrastructure and equipment suppliers	The technology set new demands on a reliable system for Multiple Remote Tower	Industries is affected by new requirements on multiple remote towers and the need for stable systems
Airspace users	Airspace users fly to and from aerodromes with RTC and Multi Remote Tower	Traffic to and from airports expect to continue to traffic aerodromes without impact on scheduled traffic with a kept availability for each of the aerodromes controlled in Multiple mode
Affected NSA	NSA will issue approval for any new ANS systems	NSA expect that any new technology is safe and stable for air traffic service and that methodology is properly adapted to the technology
Airport owners/providers	Airport owners are customers to ANS providers	Airports expect prices for ANS to be lowered with Multiple Remote Tower without a negative impact on their availability for flying customers.

Table 11: Stakeholder's expectations

[...]

## A.2 Benefits mechanisms

### A.2.1 Cost Efficiency

The main driver for Remote Provision of ATS for multiple aerodromes is Cost Effectiveness (the blue boxes in Figure below). However, this is not directly measured through the validation activities. Rather the validation activities are used to validate the assumption in the business case i.e. that it is operationally feasible to provide ATS from a remote location to multiple aerodromes. Proving the Operational Feasibility depends most on Safety, Human Performance and Capacity and so it is those areas that are further explored.

Figure below illustrates the above logic for how the project hopes to assess CEF through operational feasibility.

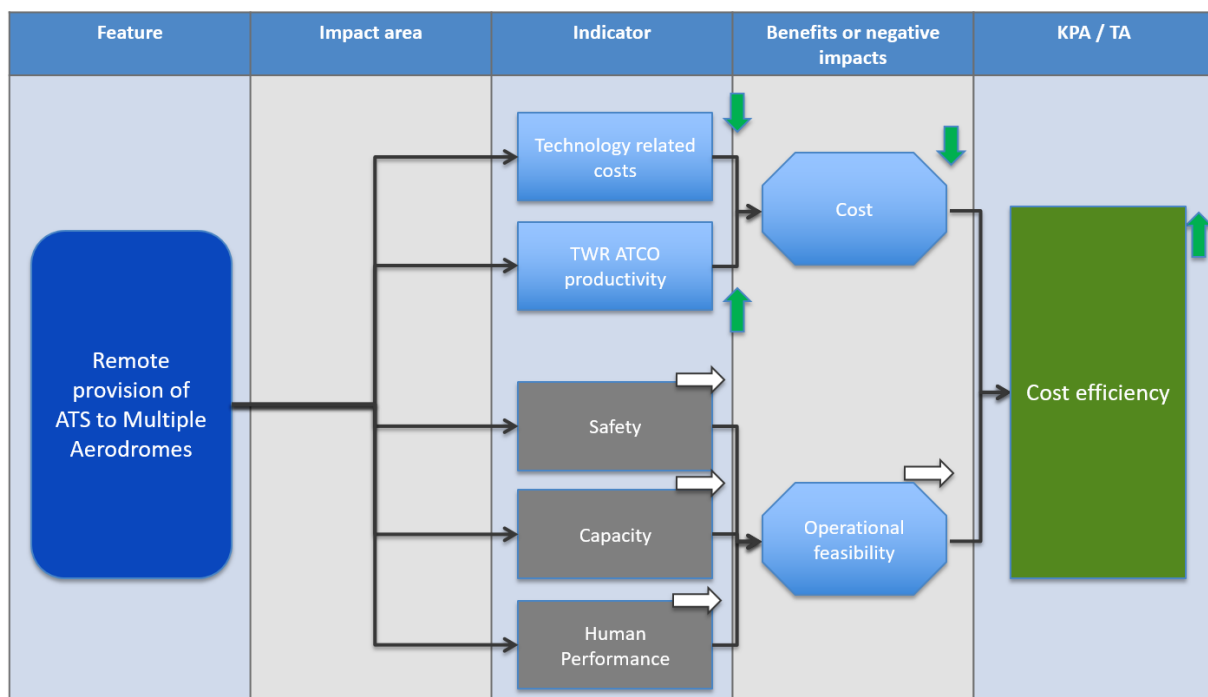


Figure 20: Benefit and Impact Mechanisms for Cost Effectiveness

Technology related TWR costs comprise of operational engineering staff costs, system-related capital and operating costs. It is envisaged that these costs will decrease due to the centralisation of resources and systems.

TWR Controller Productivity involves increasing safe throughput for a given level of operational resourcing. The remote provision of ATS for multiple aerodromes involves raising the number of flights that an individual controller can handle safely. The technical enablers within the RTM are designed to help the controller increase their situational awareness and decrease the workload.

In order to assess Cost Effectiveness, the Operational Feasibility of the Multiple Remote Tower concept shall be assessed (the grey boxes in Figure above). In order to prove the concept is operationally feasible the validation activities primarily assess the KPAs safety, human performance and capacity. The validation activities therefore look at these performance areas rather than cost effectiveness directly. These are detailed in the sections below.

## A.2.2 Safety

Multiple Remote Tower will keep safety levels for local Air Traffic Service. The new tools and features described as visual reproduction and advanced visual features aim to give the controller a level of situational awareness that is needed for service from the MRTM.

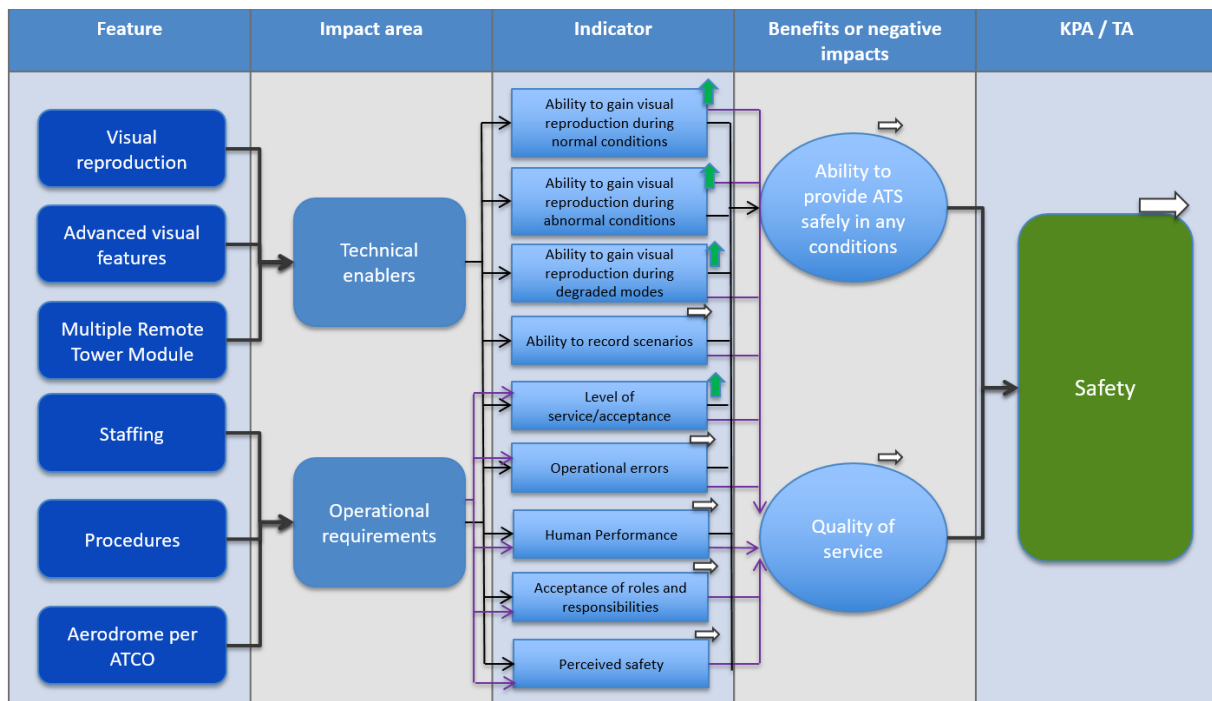


Figure 21: Benefit and Impact Mechanisms for Safety

Safety features already evolved for Single Remote will be baseline for Multiple Remote Towers and are already safe and implemented. A possibility to split aerodromes from MRTM to Single Remote Towers keep Multiple Remote Towers safe.

NOTE: The inclusion of Quality of Service in this Benefit Impact Mechanism is to indicate that in addition to gaining awareness of ability to provide **any** service in various modes a good quality of service can safely be provided e.g. a dramatic reduction in capacity or service quality is not the primary means by which safety is maintained.

Visual reproduction of the local aerodrome is a key part of the solution. A camera mast (or similar visual reproduction) will be placed at the airport relaying the visual reproduction to screen/screens in the MRTM in the RTC.

To enhance the visual reproduction, advanced visual features will be introduced such as; object bounding, radar tracking, IR and PTZ cameras.

Controllers will control from the MRTM which includes the screens for visual reproduction and the CWP with all the necessary ATS systems.

Staffing of the controllers will change with the introduction of the remote provision of ATS for multiple aerodromes. Endorsements will need to be considered as they may require change. The shift pattern and staffing levels may change.

Local procedures might change with the introduction of the remote provision of ATS for multiple aerodromes. New methods of operation during multiple control and detailed training will have to be included into the new procedures for operating all of the features in the MRTM.

The number and size of aerodromes per controller is new. This will largely relate to safety and how many aerodromes the controller can safely handle.

The ATCO must be able to gain sufficient information from the visual reproduction in order to make their decisions and provide their services during normal conditions. The advanced visual features will supplement the visual reproduction and give the controller access to more information.

The ability to provide visual reproduction during normal conditions will affect the ability to provide ATS services in any conditions. The airspace users should be provided with the same level of services as if the ATS were provided from a single RTM. The visual reproduction shall support the recognition task.

The visual reproduction during normal conditions should maintain the level of service provided in single Remote Towers. Alternative methods may be used in order to provide the service but the level of ATS should be the same. For example, the PTZ camera will use a functionality corresponding to (and being at least/equally easy and quick to use) as the binoculars in a conventional Tower, giving the possibility to zoom/enlarge specific areas and objects in the visual presentation.

The ATCO must be able to gain sufficient information from the visual reproduction in order to make their decisions and provide their services during non-nominal conditions. The advanced visual features will supplement the visual reproduction and give the controller access to more information.

The ability to gain visual reproduction during low visibility conditions should increase with the introduction of new AVF such as the IR camera.

The ATCO must be able to gain sufficient information from the visual reproduction in order to make their decisions and provide their services during degraded modes of operation. New technology such as electronic flight strips or advanced visual features could supplement the visual reproduction and give the controller access to more information.

The ability to gain visual reproduction during degraded modes of operation should increase with the introduction of new AVF such as the IR camera and electronic flight strips.

The concept will introduce the ability to record visual information; this will create enhanced and unique opportunities to support incident/accident investigators when working at aerodromes.

If better investigations are possible after certain scenarios/incidents then the result will be better safety systems. Controllers and airspace users will be able to learn from incidents/accidents and can put in place working methods to stop them from reoccurring.

The technical enabler system must provide the controller with sufficient information in order to maintain the level of service currently provided by the controller. The technical system must be accepted by the controller.

Any technical enabler system errors including malfunctions, bugs, error messages etc. will have a negative effect on human performance.

If there are too many errors (system and human) then this will affect the ATCO capacity and safety.

Errors will also affect the quality of service. If multiple errors are incurred then the quality of service provided will deteriorate.

The usability and utility of the technical enabler system with all the features involved will have an impact on human performance.

ATM is critically dependent on the day-to-day performance of front-line personnel, such as controllers, supervisors and other operational staff. Effective human performance at the front line enables the ATS service to be supplied safely and efficiently.

Human Performance is used to denote the human capability to successfully accomplish tasks and meet job requirements, maintaining/increasing the quality of service provided in Multiple Remote Towers, as per PJ05.

The controllers will have a perception of the safety of the technical enabler system. This includes how safe they believe each feature is.

The new roles and responsibilities will affect quality of ATS remotely to multiple aerodromes. The acceptance of transitioning between roles must be clearly understood, managed and accepted and will directly affect the quality of service provided.

The operational impacts of the concept including the staffing levels, procedures and the number of aerodromes per controller will affect the user acceptance (pilots and controllers) of the concept and the level of service that the controllers can safely provide. The airspace users should be provided with the same level of service as if the ATS were provided from a Single Remote Tower.

By identifying areas where the service users feel there are risks or lower levels of safety, the quality of the service can be improved. Perceived safety includes safety of the equipment as well as safety of the organisational factors such as resources, training, policies and procedures.

The new operating method may cause errors. Technical and operational errors will be recorded.

The number of aerodromes a controller has jurisdiction over will affect the human performance of the controller including the workload, situational awareness and trust in the concept.

There is a limit on the amount of endorsements that an ATCO can maintain due to needed practise at each airport, which has to be decided locally.

### **A.2.3 Capacity**

Aerodrome capacity will not change with Multiple Remote Tower Operations. The same procedures apply for providing aerodrome control service as with operations from a local tower. In general, traffic demand will be below aerodrome capacity at small to medium sized aerodromes.

As aerodromes can be transferred to a different MRTM the required capacity can always be met. The main question is about how many airports can be controlled at a time by one ATCO. That will affect

cost-effectiveness (but not airport capacity).

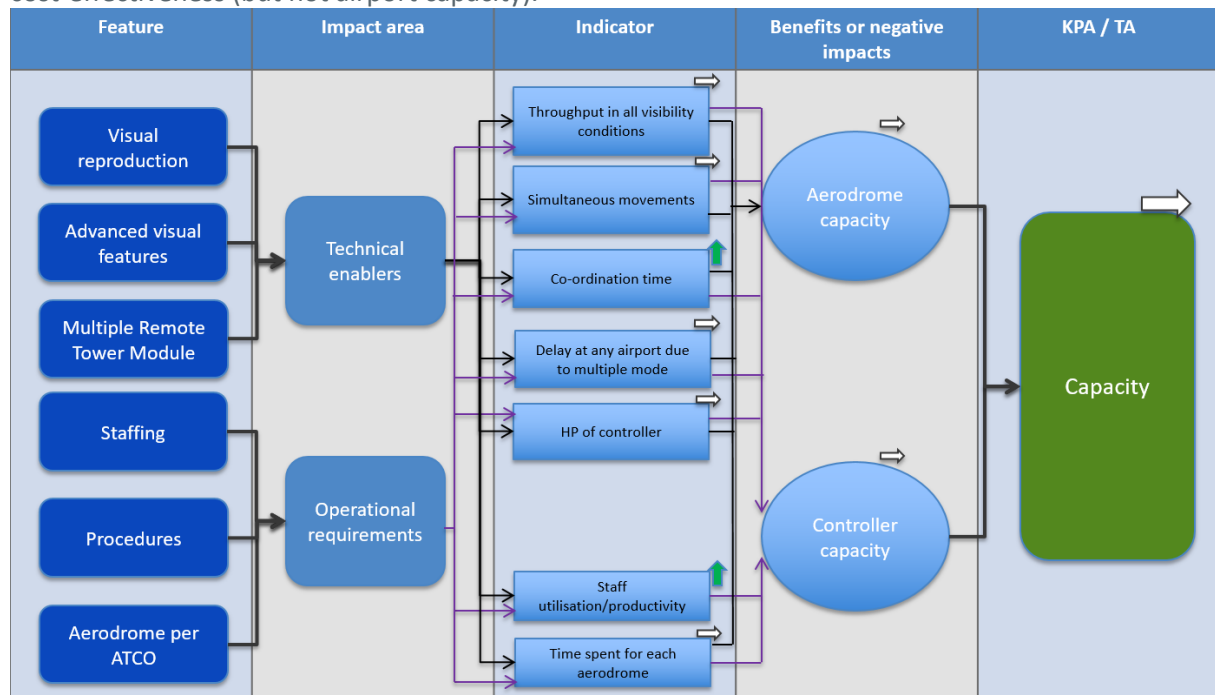


Figure 22: Benefit and Impact Mechanism for Capacity

In current operations, opening and closing ATCO positions at a local tower in order to balance traffic demand and ATCO workload is a standard procedure (which is now only extended to be applied over multiple aerodromes).

Nevertheless, the following aspects should be highlighted:

- Throughput in all weather conditions the visual presentation may include infrared images that enhance ATCO situation awareness in low visibility conditions. However, as the pilot still has to cope with low visibility conditions, no increase in capacity is to be expected.
- ATCO workload / human performance  
Increasing traffic volumes and other factors can increase ATCO workload while at the same time system design and support tools will increase human performance. ATCO and Supervisor planning tools aim to ensure that airports are transferred in time to a different MRTM if forecasted workload at a certain MRTM is too high.  
The impact will therefore be on cost-effectiveness rather than on capacity.
- Simultaneous runway operations at different airports  
It needs to be validated to what extent simultaneous runway operations (simultaneous landings and take-offs at different airports) are feasible.  
Procedures might be introduced in order to limit simultaneous runway operations (e.g. delay departure) that might impose some delay to certain flights. If there is a forecasted expected impact on capacity, airports can be transferred in time to a different MRTM.  
The impact will therefore be on cost-effectiveness rather than on capacity.
- Local procedures  
depending on specific local factors, local procedures might need to be adjusted to multiple remote tower operations (e.g. change in use of traffic patterns). Validations will show potential factors that need to be considered. It has already shown that this needs to be evaluated on a case-by-case basis.



ATCO “capacity” is not part of this KPI but addressed in Human Performance

Performance and operational conditions will directly affect what the ATCO in terms of the number of movements they are able to control. Controlling multiple aerodromes may reduce the human performance of the ATCO for one of the airports (comparing single remote tower), however the addition of advanced visual features should improve controller performance. Hence, the ATCOs ability to handle a certain number of movements per hour (capacity) should remain unchanged.

The level of support provided by the system through system tools or aids is expected to have an impact on the number of aerodromes or traffic level an ATCO can operate in parallel. Additional functionality such as monitoring aids, advanced controller tools and advanced visual features could all potentially increase the maximum number of aerodromes a single ATCO could operate in parallel.

## A.2.4 Human Performance

Human Performance is a key factor for Multiple Remote Towers and the goal is to keep all indicators on the same level as in single remote towers. Capacity and Safety are closely related to Human Performance affected of the outcome from the indicators.

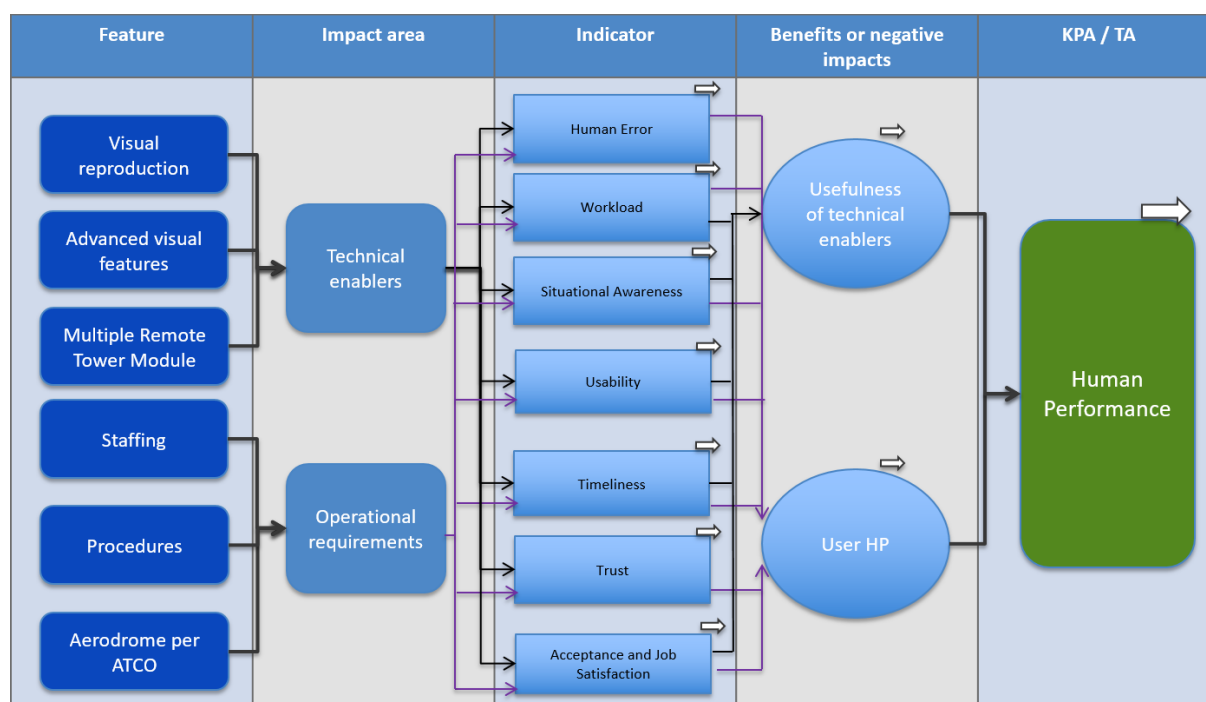


Figure 23: Benefit and Impact Mechanism for Human Performance

Visual reproduction of the local aerodrome is a key part of the solution.

To enhance the visual reproduction, advanced visual features will be introduced such as visual overlays, radar tracking, IR and PTZ cameras.

Controllers will control from the MRTM that includes the screens for visual reproduction and the CWP with all the necessary ATS systems.

Staffing of the controllers will change with the introduction of the remote provision of ATS for multiple aerodromes. Endorsements for each aerodrome will be needed. The shift pattern and staffing levels might change.

Local procedures might change with the introduction of the remote provision of ATS for multiple aerodromes. New local procedures might have to be introduced to cover how the switch is made from one MRTM to another during multiple control and has to be included into the new procedures for operating all of the features in the MRTM.

The number of aerodromes per controller is a new aspect. This is directly related to human performance and what the controller can safely handle.

The complexity of the technical enabler system will affect the number of errors the controller will make. The more usable and simple (harmonized) the system is, the less likely the controller is to make mistakes.

The number of operational errors a controller makes contributes to their human performance. The fewer the errors made, the greater the human performance.

The stability of the system will affect the confidence the controllers have that the system is providing them with the correct and accurate information. The controllers will have more confidence in the system if it is reliable and robust.

The confidence the controller has in the system depends on the technical capability of the system. The system must work accurately and be robust in difficult situations, which will lead to controller confidence.

The human actors' level of confidence in the new concept / new procedures must be appropriate, that is, neither too high nor too low.

The usability and operability of the Multiple Remote Provision platform must be acceptable, i.e. the system is user friendly.

The controller's view on the acceptance of the platform is related to the system's capability.

Acceptance and job satisfaction, changes in competence requirements, impact on staff levels and shift organisation, and the need for re-location of the work force will all affect controller's human performance.

Technical issues with the system will lower the controller trust. Functional Alarm systems and back-up systems will increase trust, which will increase human performance.

Trust of the system will depend on how accurate and reliable the output information is. Alarm systems and back-up systems will increase trust, which will increase human performance.

Trust relates to the level of confidence the human actors have in the new / changed tasks & procedures etc. The human actors' level of confidence in the new concept / new procedures must be appropriate, that is, neither too high nor too low.

Stress may be induced due to the complexity of the technical enabler system. A complex system may increase workload, which could have negative effects on stress.

Controller stress depends on how complex and usable the platform is. If the system is robust and provides the controller with all the information he requires (neither too much nor too little), this will lead to less stressful situations brought on by technology.

Stress has a direct relation to human performance. If a controller is excessively stressed this may negatively affect their performance.

The visual reproduction in conjunction with the AVF aim to improve the controller's situational awareness by providing them with enough, if not more, information compared to the conventional

tower. The system must be usable so that features do not take a long time to operate and situational awareness remains high.

Situational awareness depends on the system capability and robustness. The layout of the CWP and the usability of the HMI will also affect situational awareness so that the controllers have information readily available. As much “heads up” controlling as possible is necessary for the controller to maintain a solid traffic picture.

Situational awareness is a contributor to the human performance and safety of service the controller provides.

The ease of using the platform and the usability and utility of the technical enablers will directly impact workload.

The workload of the controller will be affected by how usable the system is and how much of the controller workload is removed by the system’s AVF.

The workload is directly related to the user human performance. If the workload is excessively high the human performance of the controller may be negatively impacted.

Confidence of the controllers will be impacted by the procedures, new roles and responsibilities and how comfortable they are.

The controllers and pilots must find the new concept acceptable from an operational point of view as this will affect the human performance of the controller. This includes the procedures, staffing, organisation and training.

The operational requirements will affect the trust of the controller. The controller must be able to trust the procedures and policies. If the controller is not content with the operational aspect of the concept, this will affect the human performance.

The operational requirements of the concept will affect the stress levels of the controller. Increasing the number of aerodromes will increase the stress levels of the controller as the workload and situational awareness will have to increase.

The operational requirements of the concept will affect the situational awareness of the controller. The increase in the number of aerodromes being controller by a single ATCO will require an increase in situational awareness.

The operational requirements of the concept will affect the workload of the controller. The more aerodromes a single controller has under his/her control, the higher the workload and larger need of buffer. The efficiency of procedures and the training will also affect controller workload.

## A.3 Costs mechanisms

### Technology related costs

Cost for deployment of Multiple Remote Tower Technology is related to:

- Installation, NSA Approval processes
- Maintenance
- Running the system

### **TWR ATCO productivity**

Tower ATCO productivity in Multiple Remote Tower is measured in comparison with a single ATCO in a conventional Tower situated at the aerodrome. A remote solution with one ATCO controlling 2 or 3 aerodromes from a Multiple Remote Tower working position has a possibility to reduce costs for staff. Different rostering is possible in an environment where several controllers are controlling several aerodromes.

### **Safety**

Safety is the most important objective for Multiple Remote Tower. It is closely interlinked with Human Performance. Building a functional Human Machine Interface will therefore impact safety.

### **Capacity**

Aerodromes in focus for validation need to maintain capacity wherefore measurements are made on the capability for one ATCO to maintain the requested capacity for 2 or 3 aerodromes simultaneously.

*Note: In situations with a higher request than normal, such as peak time or emergency situations, other precautions might be needed, e.g. closing of an aerodrome, split of the multiple service or slot allocation of movements.*

### **Human Performance**

Human Performance is measured in Human Machine Interface design. ATCO acceptance of tools and features in the Multiple Remote Tower Module will show the results.

### **Cost**

Cost can be reduced with new technology and a decrease in running cost for the ATM system. Added benefits are a possibility for new aerodromes to get ATS compared to with conventional towers.

### **Operational feasibility**

Safety and capacity can be kept with focus on Human Performance in design of the MRTM.

## Appendix B 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 OSED (OSED for Remote Provision of ATS to Aerodromes – D94 – Edition 00.07.01 – 15/07/2016), **unless specified by red text**. Cross-references in this Appendix are available in SESAR 1 OSED – D94.

### B.1 Overall Concept Requirements

Identifier	REQ-06.09.03-OSED-BC01.0008
Requirement	For each Remote & Virtual Tower application, minimum Security Management levels and applicable minimum-security measures <b>shall</b> be defined, in order to maintain airport operations at or above the current local operations level.
Title	KPA Security
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> <p>A Security Risk Assessment Report have been produced by WP16.06.02, under "06.03.01 Remote and Virtual Tower Security Risk Assessment", Edition 00.00.02, 09/12/2013.</p>
Category	<Design><Security>
Validation Method	<Expert Group (Judgement Analysis)><Analytical Modelling>
Verification Method	<Analysis>

Identifier	REQ-06.09.03-OSED-BC01.0009
Requirement	The Remote & Virtual Tower Concept <b>shall</b> contribute to the overall cost reduction of the European gate-to-gate ATM, by reducing costs for performing ATS at aerodromes.
Title	OFA06.03.01 KPA Cost Effectiveness, general
Status	<Validated>

Rationale	<p>Through progressive implementation of new systems and procedures, the European gate-to-gate ATM costs shall reduce, as stated in the Airport Detailed Operational Descriptions for Step 1 and Step 2, produced by P06.02.00.</p> <p>This requirement is refined in separate cost reduction figures for SESAR Step 1 (SDM-0201) and SESAR Step 2 (SDM-0204 &amp; SDM-0205) respectively, in accordance with the requirements given in WP6.2 DOD Step 1 &amp; Step 2; see the respective Single, Multiple &amp; Contingency Concept Requirements Sections below.</p> <p>Cost Effectiveness has not been assessed directly through the validation exercises, with the cost benefit analysis task being performed externally to P06.09.03 and P06.08.04. (P06.09.03 contributed to an Analysis of Costs and Benefits (ACB), which was used to provide input towards the P16.06.06 full Airport CBA, which in turn gave the figures as detailed in WP6.2 DOD requirements.) Instead, the focus of the validation exercises has been to validate the assumption in the business case i.e. that it is operationally feasible to provide ATS from a remote location. In addition, a cost benefit analysis will be dependent on the implementation environment and is something where a generic assessment may not prove to be useful. As the concept of Remote aerodrome ATS (within all the three concept applications of Single, Multiple and Contingency) has been proven feasible by P06.09.03, this requirement is considered being validated.</p>
Category	<Design>
Validation Method	<Expert Group (Judgement Analysis)><Analytical Modelling>
Verification Method	<Analysis>

Identifier	REQ-06.09.03-OSED-BC01.0010
Requirement	The Remote & Virtual Tower Concept <b>shall</b> contribute to the overall improvement of uniformity of ATM services.
Title	KPA Interoperability
Status	<Validated>
Rationale	Operate on the basis of uniformity throughout Europe Applying standards and uniform principles, and ensuring the technical and operational interoperability of aircraft and ATM systems.
Category	<Interoperability><Design>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	<Analysis>

## B.2 General Service Requirements

*This section presents applicable regulatory, operational and functional requirements that exist on the service in order to provide ATS for aerodromes, regardless of whether that service is performed locally or remotely, such as requirements originating from current ICAO regulations. Hence, all the requirements presented in this section apply for the RVT concept.*

## B.2.1 Communications

Identifier	REQ-06.09.03-OSED-CO02.1001
Requirement	The ATCO/AFISO <b>shall</b> use aeronautical mobile service (air-ground communications) in the area of responsibility, in accordance with ICAO Annex 11, Chapter 6.1.
Title	Aeronautical Mobile Service
Status	<Validated>
Rationale	ICAO Annex 11, Chapter 6.1  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR07.
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-CO02.1002
Requirement	The ATCO/AFISO <b>shall</b> use aeronautical fixed service (ground-ground communications) in accordance with ICAO Annex 11, Chapter 6.2.
Title	Aeronautical Fixed Service
Status	<Validated>
Rationale	ICAO Annex 11, Chapter 6.2  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR06, SR09, SR11, SR12.
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-CO02.1003
Requirement	The ATCO/AFISO <b>shall</b> use surface movement control service (communications for the control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes) for the aerodrome(s) under control, in accordance with ICAO Annex 11, Chapter 6.3.
Title	Surface Movement Control Service
Status	<Validated>
Rationale	ICAO Annex 11, Chapter 6.3  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR08, SR10.
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>



Identifier	REQ-06.09.03-OSED-CO02.1004
Requirement	The ATCO/AFISO <b>shall</b> be able to communicate via a signalling lamp with aircraft and vehicles at each aerodrome under responsibility, in case of radiotelephony or data link communication failure, in accordance with ICAO Annex 14 section 5.1.3 /Eurocontrol Manual for AFIS section 4.2.2.3.2.
Title	Signalling Light Gun Communication
Status	<Validated>
Rationale	<p>In accordance with ICAO Annex 14 section 5.1.3 / Eurocontrol Manual for AFIS section 4.2.2.3.2.</p> <p>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) Eurocontrol Manual for AFIS, 4.2.2.3.2 (4.2.2.3.2 When communications by a system of visual signals is deemed to be adequate, or in the case of radio-communication failure, the signals given hereunder shall have the meaning indicated therein :) Eurocontrol Manual for AFIS, Attachment A, 1.2 (1.2 The equipment in the AFIS unit should be the same as that required for an aerodrome control tower at an aerodrome with low traffic density.)</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR37.</p>
Category	<Operational><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-CO02.1005
Requirement	Visual communication from aircraft on and in the vicinity of the aerodrome <b>shall</b> be used when/as applicable, in accordance with ICAO Doc 4444 Chapter 12.3.4.
Title	Visual Communication
Status	<Validated>
Rationale	<p>The vicinity of an aerodrome is defined in Doc 4444 as "aircraft in, entering or leaving an aerodrome traffic circuit".</p> <p>ICAO Doc 4444 12.3.4 "Phraseologies for use on and in the vicinity of the aerodrome" defines; - showing landing lights as a possible means of "Identification of aircraft" (12.3.4.1) - And moving ailerons (or rudder), rocking wings or flashing landing lights as "acknowledgement by visual means (12.4.3.2).</p>
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>



## B.2.2 MET Functions & Procedures

Identifier	REQ-06.09.03-OSED-MT02.2001
Requirement	The ATCO/AFISO <b>shall</b> use relevant meteorological information, in accordance with ICAO Annex III, ICAO Annex 11 Chapter 7.1 and national regulations.
Title	Met Info
Status	<Validated>
Rationale	<p>ICAO Annex III, ICAO Annex 11 Chapter 7.1 and national regulations.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR23.</p> <p>The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_DESIGN_001.</p>
Category	<Operational><Safety><HMI>
Validation Method	<Live Trial><Shadow Mode><Expert Group (Judgement Analysis)>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-MT02.2002
Requirement	The current MET report, actual wind information, actual QNH and, if measured for the particular airport(s), RVR values <b>shall</b> continuously be presented to the ATCO/AFISO, in accordance with ICAO Doc 4444 Chapter 7.3.1.2 & ICAO Annex 11 Chapter 7.1.4.
Title	Met Info Presented
Status	<Validated>
Rationale	<p>ICAO Doc 4444 Chapter 7.3.1.2 &amp; ICAO Annex 11 Chapter 7.1.4.</p> <p>This is essential information used frequently by the ATCOs/AFISOs to inform pilots in real time.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR 24.</p> <p>The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_DESIGN_001.</p>
Category	<Operational><Functional><Safety><HMI>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-MT02.2003
Requirement	The ATCO/AFISO <b>shall</b> advise aircraft of significant meteorological conditions in the take-off and climb-out area, except when it is known that the information has already been received by the aircraft, in accordance with ICAO Doc 4444 Chapter 7.4.1.2.2.
Title	Advising of Significant Met Conditions

Status	<Validated>
Rationale	<p>ICAO Doc 4444 Chapter 7.4.1.2.2 states that prior to take-off aircraft shall be advised of significant meteorological conditions in the take-off and climb-out area, except when it is known that the information has already been received by the aircraft.</p> <p>Significant meteorological conditions in this context are defined in ICAO Doc 4444 Chapter 7.4.1.2.2.</p> <p>Significant meteorological conditions can be either visually observed by the ATCO/AFISO or reported to the same from pilots, met-offices etc.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR 26.</p>
Category	<Operational><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

## B.2.3 Visualisation

Identifier	REQ-06.09.03-OSED-VS02.3001
Requirement	<p>The ATCO <b>shall</b>, from the remote location, apply ICAO Doc 4444, Chapter 7.1.1.2 and 7.1.1.2.1.</p> <p>7.1.1.2: "Aerodrome controllers shall maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the manoeuvring area. Watch shall be maintained by visual observation, augmented when available, by an ATS surveillance system</p> <p>7.1.1.2.1: "Visual observation shall be achieved through direct out-of-the-window observation, or through indirect observation utilizing a visual surveillance system which is specifically approved for the purpose by the appropriate ATS authority."</p>
Title	Visual Observation Doc 4444
Status	<Validated>
Rationale	<p>ICAO Doc 4444, Chapter 7.1.1.2 and 7.1.1.2.1.</p> <p>The vicinity of an aerodrome is defined in Doc 4444 as "aircraft in, entering or leaving an aerodrome traffic circuit".</p> <p>The manoeuvring area is defined in Doc 4444 as "that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons".</p> <p>Requirement valid for ATC (TWR) only.</p>
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VS02.3002
Requirement	The AFISO <b>shall</b> , from the remote location, apply Eurocontrol Manual for AFIS Chapter 3.1.2: <i>“AFISOs shall maintain a continuous watch by visual observation and an ATS surveillance system when authorized by and subject to conditions prescribed by the appropriate authority (see Appendix A), on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the manoeuvring area.”</i>
Title	Visual Observation Eurocontrol Manual for AFIS
Status	<Validated>
Rationale	Eurocontrol Manual for AFIS Chapter 3.1.2  The vicinity of an aerodrome is defined in Doc 4444 as “aircraft in, entering or leaving an aerodrome traffic circuit”.  The manoeuvring area is defined in Doc 4444 as “that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons”.  Requirement valid for AFIS only.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VS02.3003
Requirement	The ATCO/AFISO <b>shall</b> issue information (TWR & AFIS) and clearances (TWR) with the object of preventing collisions (AFIS: assisting pilots in preventing collisions) between aircraft and obstructions on the manoeuvring area, in accordance with ICAO Doc 4444, Chapter 7.1.1.1, bullet point e) & Chapter 4.5.1.1, Eurocontrol Manual for AFIS, 3.1.1, bullet point e).
Title	Visual Observation Obstructions
Status	<Validated>

Rationale	<p>Doc 4444 – CHAPTER 7 – PROCEDURES FOR AERODROME CONTROL SERVICE</p> <p>Chapter 7.1.1.1: Aerodrome control towers shall issue information and clearances to aircraft under their control to achieve a safe, orderly and expeditious flow of air traffic on and in the vicinity of an aerodrome with the object of preventing collision(s) between: e) aircraft on the manoeuvring area and obstructions on that area.</p> <p>Doc 4444 - 4.5 AIR TRAFFIC CONTROL CLEARANCES</p> <p>Chapter 4.5.1.1: Clearances are issued solely for expediting and separating air traffic and are based on known traffic conditions that affect safety in aircraft operation. Such traffic conditions include not only aircraft in the air and on the manoeuvring area over which control is being exercised, but also any vehicular traffic or other obstructions not permanently installed on the manoeuvring area in use.</p> <p>EUROCONTROL MANUAL FOR AFIS – CHAPTER 3 – PROCEDURES FOR AFIS</p> <p>Chapter 3.1.1: AFIS units shall issue information to aircraft in its area of responsibility to achieve a safe, orderly and expeditious flow of air traffic on and in the vicinity of an aerodrome with the object of assisting pilots in preventing collision(s) between: e) aircraft on the manoeuvring area and obstructions on that area.</p> <p>The manoeuvring area is defined in Doc 4444 as “that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons”.</p>
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VS02.3004
Requirement	A functionality corresponding to the binoculars in a traditional Tower, giving the possibility to zoom/enlarge specific areas and objects in the visual presentation / Area of Responsibility shall be provided, in accordance with ICAO Doc 9426 (Planning manual), Appendix B, (Aerodrome Control Tower Equipment Checklist).
Title	Binocular Functionality
Status	<Validated>
Rationale	<p>ICAO Doc 9426 (Planning manual), Appendix B, (Aerodrome Control Tower Equipment Checklist) states binoculars as equipment.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR19.</p> <p>The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_DESIGN_012.</p>
Category	<Operational><Safety><HMI>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

## B.2.4 NAV Functions

Identifier	REQ-06.09.03-OSED-NV02.4001
Requirement	The ATCO/AFISO <b>shall</b> monitor and adjust intensity and on/off status of visual navigational aids, in accordance with ICAO Annex 11 Chapter 7.3 & ICAO Doc 4444 Chapter 7.15.
Title	Visual Nav Aids
Status	<Validated>
Rationale	<p>Visual navigational aids are; runway and field lighting systems as applicable to the aerodrome, such as approach, PAPI, runway, taxiway, RGL, stopway and obstacle lighting.</p> <p>ICAO Annex 11 Chapter 7.3 ICAO Doc 4444 Chapter 7.15</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR21.</p>
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-NV02.4002
Requirement	The ATCO/AFISO <b>shall</b> monitor and adjust the status of non-visual navigational aids, in accordance with ICAO Annex 11 Chapter 7.3.
Title	Non-Visual Nav Aids
Status	<Validated>
Rationale	<p>Non-visual navigational aids are; aerodrome NAV systems as applicable to the aerodrome, such as ILS LOC/GP, LO NDB, OM/MM/IM, VOR, DME).</p> <p>ICAO Annex 11 Chapter 7.3</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR22.</p>
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

## B.2.5 Other ATS Systems / Functions / Procedures

Identifier	REQ-06.09.03-OSED-FN02.5001
Requirement	The ATCO/AFISO <b>should</b> access surveillance data, such as radar presentation, when available for the particular airport(s), in accordance with ICAO Doc 4444, Chapter 7.1.1.2 / Eurocontrol Manual for AFIS Chapter 3.1.2.
Title	Surveillance Data
Status	<Validated>

Rationale	ICAO Doc 4444, Chapter 7.1.1.2 Eurocontrol Manual for AFIS Chapter 3.1.2  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR13.
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN02.5002
Requirement	The ATCO/AFISO <b>shall</b> access and handle ATS messages, in accordance with ICAO Doc 4444 Chapter 11.
Title	ATS Messages
Status	<Validated>
Rationale	ICAO Doc 4444 Chapter 11
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN02.5003
Requirement	The ATCO/AFISO <b>shall</b> 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.
Title	Flight Plan and Control Data
Status	<Validated>
Rationale	ICAO Doc 4444 Chapter 4.13  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR05.  The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: MRT_REQ_DS2.
Category	<Operational><Functional><Safety><HMI>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN02.5004
Requirement	The ATCO/AFISO <b>shall</b> monitor and manage accident, incident and distress alarms as applicable to the aerodrome(s), in accordance with ICAO Doc 4444 Chapter 7.1.2.
Title	Accident, Incident and Distress Alarms
Status	<Validated>

Rationale	ICAO Doc 4444 Chapter 7.1.2  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR38.
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN02.5005
Requirement	Correct time, in the format of hours, minutes and seconds in UTC, <b>shall</b> be continuously presented to the ATCO/AFISO), in accordance with ICAO Doc 4444 Chapter 7.3.1.2.
Title	UTC Time Presentation
Status	<Validated>
Rationale	ICAO Doc 4444 Chapter 7.3.1.2
Category	<Operational><Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN02.5006
Requirement	The ATCO/AFISO <b>shall</b> be notified about any technical status of systems that can affect the safety or efficiency of flight operations and/or the provision of air traffic service, in accordance with ICAO Doc 4444 Chapter 4.14 & Chapter 7.1.3.
Title	Technical Status
Status	<Validated>
Rationale	ICAO Doc 4444, Chapter 4.14 "Failure or irregularity of systems and equipment", states; "ATC units shall immediately report in accordance with local instructions any failure or irregularity of communication, navigation and surveillance systems or any other safety-significant or equipment which could adversely affect the safety or efficiency of flight operations and/or the provision of air traffic control service."  ICAO Doc 4444, Chapter 7.1.3 "Failure or irregularity of aids and equipment", states; "Aerodrome control towers shall immediately report in accordance with local instructions any failure or irregularity of operation in any equipment, light or other device established at an aerodrome for the guidance of aerodrome traffic and flight crews or required for the provision of air traffic control service."  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR46, SR48, SR57.
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode><Expert Group (Judgement Analysis)>
Verification Method	<Review of Design><Test>



Identifier	REQ-06.09.03-OSED-FN02.5007
Requirement	The ATCO/AFISO <b>shall</b> be provided with all relevant operational data (e.g. AIP information, NOTAMs, Manual of operations etc.) required for conducting the ATS tasks.
Title	AIP, NOTAMs and other relevant operational data.
Status	<Validated>
Rationale	The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR01, SR02, SR03.
Category	<Operational><Safety>
Validation Method	<Live Trial><Shadow Mode><Expert Group (Judgement Analysis)>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN02.5008
Requirement	The ATCO/AFISO <b>shall</b> alert the rescue and firefighting services in accordance with ICAO Doc 4444 Chapter 7.1.2.
Title	Alerting Service
Status	<Validated>
Rationale	ICAO Doc 4444 Chapter 7.1.2.1 states that; Aerodrome control towers are responsible for alerting the rescue and firefighting services whenever: a) an aircraft accident has occurred on or in the vicinity of the aerodrome; or b) information is received that the safety of an aircraft which is or will come under the jurisdiction of the aerodrome control tower may have or has been impaired; or c) requested by the flight crew; or d) when otherwise deemed necessary or desirable."
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode><Expert Group (Judgement Analysis)>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN02.5009
Requirement	The ATCO/AFISO <b>shall</b> advise aircraft about abnormal configurations or conditions, such as landing gear not extended or only partly extended or unusual smoke emissions from any part of the aircraft, if observed by or reported to the ATCO/AFISO, in accordance with ICAO Doc 4444 Chapter 7.4.1.7.
Title	AIP, NOTAMs and other relevant operational data.
Status	<Validated>
Rationale	ICAO Doc 4444 Chapter 7.4.1.7 states that; "Whenever an abnormal configuration or condition of an aircraft, including conditions such as landing gear not extended or only partly extended, or unusual smoke emissions from any part of the aircraft, is observed by or reported to the aerodrome controller, the aircraft concerned shall be advised without delay."
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode><Expert Group (Judgement Analysis)>
Verification Method	<Review of Design><Test>



## B.2.6 Voice and Data Recording

Identifier	REQ-06.09.03-OSED-DR02.6001
Requirement	Necessary communications and data <b>shall</b> be recorded (in order being available e.g. for accident and incident investigation purposes), to be retained for a period of at least thirty days (or longer if pertinent to accident and incident investigations), in accordance with ICAO Annex 11 Chapter 6.
Title	Voice & Data Recording
Status	<Validated>
Rationale	<p>ICAO Annex 11 Chapter 6 states that;</p> <ul style="list-style-type: none"> <li>- For aeronautical mobile service (air-ground communications), two-way radiotelephony or data link communications used for the provision of air traffic control service, recording facilities shall be provided on all such air-ground communication channels, and such recordings shall be retained for a period of at least thirty days. (6.1.1.3 &amp; 6.1.1.4)</li> <li>- For aeronautical fixed service (ground-ground communications), in all cases where automatic transfer of data to and/or from air traffic services computers is required, suitable facilities for automatic recording shall be provided, and all facilities for direct-speech or data link communications between air traffic service units and between air traffic service units and other units (described under 6.2.2.2.1 and 6.2.2.2.2) shall be provided with automatic recording. Recordings of data and communications described shall be retained for a period of at least thirty days. (6.2.2.3.3, 6.2.2.3.7 &amp; 6.2.2.3.8)</li> <li>- For surface movement control service, when conditions warrant separate channels to be provided for the control of vehicles on the manoeuvring area, automatic recording facilities shall be provided on all such channels, and such recordings shall be retained for a period of at least thirty days. (6.3.1.2 &amp; 6.3.1.3)</li> <li>- For aeronautical radio navigation service, surveillance data (from primary and secondary radar equipment or other systems (e.g. ADS-B, ADS-C)) used as an aid to air traffic services shall be automatically recorded for use in accident and incident investigations, search and rescue, air traffic control and surveillance systems evaluation and training. Such automatic recordings shall be retained for a period of at least thirty days. When the recordings are pertinent to accident and incident investigations, they shall be retained for longer periods until it is evident that they will no longer be required. (6.4.1.1 &amp; 6.4.1.2)</li> </ul>
Category	<Operational><Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

## B.3 Remote Operations Requirements

*The requirements that are listed under B.2 “General Service Requirements” above originate from the fact that the aim of the RVT concept is to provide the same set of services as from conventional towers, meaning that the regulatory, operational and functional requirements on a conventional tower also apply for a remote tower.*

Stopping there, however, one would fail to answer how these requirements are applicable to the RVT concept and most requirements would end up in the unanswered question of how this requirement should be handled in the “remote” environment.

This section is therefore dedicated to facilitating the advancement of the concept, by providing a set of operational, functional and performance requirements that apply specifically to the remote and virtual component of operations, explaining how to fulfil the service requirements in a “remote” context.

### B.3.1 RTC Level Requirements

Requirements in this section are applicable when operations are performed from an RTC connected to several aerodromes and consisting of several RTMs.

Identifier	REQ-06.09.03-OSED-RTC3.0004
Requirement	The ATCO/AFISO <b>should</b> use unified operating methods and procedures for all airports connected to a RTM/RTC (in order to contribute to the overall improvement of uniformity of ATM services).
Title	KPA Interoperability – RTC Operating Methods and Procedures
Status	<Validated>
Rationale	Operate on the basis of uniformity throughout Europe Applying standards and uniform principles, and ensuring the technical and operational interoperability of aircraft and ATM systems. Operating methods and procedures are today sometimes different in between aerodromes.
Category	<Interoperability><Operational><Design>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	<Analysis>

Identifier	REQ-06.09.03-OSED-RTC3.0005
Requirement	All RTMs in a RTC <b>should</b> be unified in terms of HMI and equipment (in order to contribute to the overall improvement of uniformity of ATM services).
Title	KPA Interoperability – RTC HMI & Equipment
Status	<Validated>
Rationale	Operate on the basis of uniformity throughout Europe Applying standards and uniform principles, and ensuring the technical and operational interoperability of aircraft and ATM systems. In today's operation there is often a lack of standardisation of systems and equipment between different aerodromes. CWP and HMI are often different from one ATS tower to another. This requirement also aims to ensure flexibility within an RTC regarding airport and CWP allocation, as well as to simplify ATCO/AFISO licensing & training issues.
Category	<Functional><Interoperability><Design>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	<Analysis>

Identifier	REQ-06.09.03-OSED-RTC3.0006
Requirement	RTC <b>should</b> enable transfer of responsibility of ATS for aerodromes between RTMs within an RTC.
Title	RTC Transfer of Responsibility
Status	<Validated>
Rationale	To ensure flexibility of staff and CWP/airport allocation.  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR-27M02,
Category	<Design><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-RTC3.0007
Requirement	If compliant with REQ-06.09.03-OSED-RTC3.0006, RTC <b>shall</b> enable the service provision to be uninterrupted during transfer of responsibility between RTMs.
Title	RTC Transfer of Responsibility, Uninterrupted Service Provision
Status	<Validated>
Rationale	This includes functional supporting of a handover sequence.  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR-27M02.
Category	<Design><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

### B.3.2 RTC Supervisor

*Requirements in this section are applicable when operations are performed from an RTC connected to several aerodromes and consisting of several RTMs. The requirements are specifically targeting the RTC Supervisor Role and its needed functionalities, if such a role is put in place.*

Identifier	REQ-06.09.03-OSED-SUP3.0009
Requirement	When RTC enables transfer of responsibility of ATS for aerodromes between RTMs within the RTC, RTC <b>should</b> enable a RTC Supervisor role for the RTC. Note: The RTC Supervisor role may be performed either from a separate stand-alone working position (where no ATS is performed in combination) or combined from a CWP/RTM (where ATS is performed in combination).
Title	RTC Supervisor Role
Status	<Validated>
Rationale	The role of the RTC Supervisor is defined in the OSED.
Category	<Operational><Design>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-SUP3.0010
Requirement	If implemented, the RTC Supervisor role <b>shall</b> access functions for the planning, coordination and monitoring of the upcoming and present traffic flow, in the purpose of tactical opening and closure of RTMs and allocation of airports to them.
Title	RTC Supervisor Flow Planning Tools
Status	<Validated>
Rationale	As an example, available tools could include e.g. flight plans, slot coordination, communications and surveillance data. The role of the RTC Supervisor is defined in the OSED.  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR34.  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR-34M01, SR-35M01.
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-SUP3.0011
Requirement	If implemented, the RTC Supervisor role <b>shall</b> access functions for the monitoring and coordination of responsibilities between different RTMs within the RTC.
Title	RTC Supervisor RTM Coordination Tools
Status	<Validated>
Rationale	The role of the RTC Supervisor is defined in the OSED.  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR-34M02.
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-SUP3.0012
Requirement	If implemented, the RTC Supervisor role <b>should</b> access functions for the monitoring of airport systems status for all aerodromes and all RTC systems.
Title	RTC Supervisor Airport System Monitoring Tools
Status	<Validated>
Rationale	The role of the RTC Supervisor is defined in the OSED.  Monitoring of system status could also be allocated to technical staff (who need to inform the RTC Supervisor.)  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR-35M01.
Category	<Operational><Functional><Safety>

Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-SUP3.0013
Requirement	If implemented, the RTC Supervisor role <b>shall</b> access functions for the monitoring of weather conditions for all aerodromes.
Title	RTC Supervisor Airport Weather Monitoring Tools
Status	<Validated>
Rationale	<p>The role of the RTC Supervisor is defined in the OSED.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR35.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR-35M01.</p>
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-SUP3.0014
Requirement	If implemented, the RTC Supervisor role <b>shall</b> access functions for communicating the status of RTC and aerodromes and coordinating maintenance (to be carried out by a qualified engineer/technician).
Title	RTC Supervisor Maintenance Coordination Tools
Status	<Validated>
Rationale	The role of the RTC Supervisor is defined in the OSED.
Category	<Operational><Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

### B.3.3 Procedures Related to Remote Operations

Identifier	REQ-06.09.03-OSED-RTC3.0008
Requirement	The ATCO/AFISO/RTC Supervisor (if implemented) <b>shall</b> verify the status of an aerodrome, in terms of traffic, weather etc. and its related systems, before assuming responsibility for providing ATS to the aerodrome.
Title	RTC Verifying Aerodrome Status
Status	<Validated>

Rationale	<p>In order to be sure about the airport and related system status before assuming the responsibility.</p> <p>Note: Indications from validation exercises performed so far indicates that some kind of system support such as a common handover/transfer area might be needed to enable this, when transferring aerodromes between RTMs within an RTC.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSD requirement: SR28.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSD requirement: SR-27M02.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSD requirement: SR-C3.</p>
Category	<Operational><Safety>
Validation Method	<Live Trial><Shadow Mode><Real Time Simulation>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSD-RTC3.0015
Requirement	Airspace users <b>should</b> be informed about the remote provision of ATS, e.g. through AIP or NOTAMs.
Title	Information to airspace users about remote operations.
Status	<Validated>
Rationale	The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSD requirement: SR04.
Category	<Operational><Safety>
Validation Method	<Live Trial><Shadow Mode><Real Time Simulation>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSD-RTC3.0016
Requirement	A Letter of Agreement for the communication and coordination between the remote ATS unit and the airport <b>shall</b> be developed and agreed.
Title	LoA between the remote ATS unit and the airport.
Status	<Validated>
Rationale	The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSD requirement: SR29, SR39.
Category	<Operational><Safety>
Validation Method	<Live Trial><Shadow Mode><Real Time Simulation>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-RTC3.0017
Requirement	If service is provided alternately from the local tower and from the RTM, coordination and transfer of control of operational systems <b>shall</b> take place between the local tower and the RTM prior to transfer of ATS provision from one to the other.
Title	Transfer of ATS between local tower and RTM.
Status	<Validated>
Rationale	<p>This coordination must include transfer of control of operational systems</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR40.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR-C4, SR-C5, SR-C6.</p>
Category	<Operational><Safety>
Validation Method	<Live Trial><Shadow Mode><Real Time Simulation>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-RTC3.0018
Requirement	For (new) system elements (specific to remote tower operations) where existing procedures are not already in place, new operational procedures <b>shall</b> be developed.
Title	Operational procedures for new systems introduced by remoter tower operations.
Status	<Validated>
Rationale	<p>System elements targeted by this requirement can e.g. be tracking and labels, infrared cameras etc.</p> <p>The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_PROCEDURE_002.</p>
Category	<Operational><HMI>
Validation Method	<Live Trial><Shadow Mode><Real Time Simulation>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-RTC3.0019
Requirement	Degraded mode procedures for all systems, including new system elements (such as the visual presentation) <b>shall</b> be developed for every local implementation.
Title	Operational procedures for new systems introduced by remoter tower operations.
Status	<Validated>



Rationale	<p>Degraded mode procedures needs to cover full as well as partial system failures (e.g. loss of all visual presentation screens, loss of only one screen and loss of more than one but less than all).</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR64, SR67.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR-61M01, SR-64M01, SR-67M01.</p> <p>The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_PROCEDURE_003.</p>
Category	<Operational><Safety><HMI>
Validation Method	<Live Trial><Shadow Mode><Real Time Simulation>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-RTC3.0020
Requirement	ATCO/AFISOs <b>shall</b> be provided with a specific training incorporating knowledge about local airport conditions - such as local geography, local weather conditions, traffic type & mix, etc. – as part of the endorsement training for the aerodromes to which remote services are to be provided.
Title	ATCO/AFISO local knowledge training
Status	<Validated>
Rationale	<p>To better keep, the 'local' knowledge of the operational environment even if the service is provided remotely. Such training may include study visits to the concerned aerodrome(s) on a regularly basis.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR-69M01.</p>
Category	<Operational><Safety>
Validation Method	<Expert Group (Judgement Analysis)><Analytical Modelling>
Verification Method	<Analysis>

### B.3.4 Visualisation

#### Visualisation – General

Identifier	REQ-06.09.03-OSED-VG03.1001
Requirement	A visual presentation of the aerodrome (SINGLE)/ all aerodromes (MULTIPLE) under responsibility, covering the manoeuvring area(s) and the vicinity of the aerodrome(s), <b>shall</b> be provided.
Title	Visual Presentation
Status	<Validated>



Rationale	<p>For details on what the operator needs to be able to see with help of the visual presentation, see the lower level requirements under section “Visualisation – Quality”.</p> <p>The vicinity of an aerodrome is defined in Doc 4444 as “aircraft in, entering or leaving an aerodrome traffic circuit”.</p> <p>The manoeuvring area is defined in Doc 4444 as “that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons”.</p> <p>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/AFISO 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.</p> <p>This requirement is valid in both daylight and darkness, however dependent on the visibility conditions at the aerodrome and its vicinity. (Note: Personnel /objects without its own light source may be difficult to detect during darkness.)</p> <p>This requirement is also valid in all weather conditions (the most common except for the very extreme/unusual weather phenomena) existing at the particular aerodrome.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR14, SR15, SR16, SR18.</p> <p>The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_DESIGN_005, RT_REQ_DESIGN_014.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR-14M01, SR-16M01, SR-68M01.</p>
Category	<Functional><Safety><HMI>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-VG03.1002
Requirement	The visual presentation <b>should</b> incorporate enhancements that improve the visual range compared to unaided viewing, to provide the ATCO/AFISO a greater level of situational awareness.
Title	Visual Presentation Image Processing Enhancements
Status	<Validated>
Rationale	<p>The enhancements considered in this requirement may utilize image processing, high-dynamic-range imaging and other techniques to improve the “raw” picture.</p> <p>The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_DESIGN_005.</p>
Category	<Functional><HMI>

Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-VG03.1004
Requirement	<p>The visual presentation <b>should</b> incorporate additional sensors that improve the visual range compared to unaided viewing, to provide the ATCO/AFISO a greater level of situational awareness.</p> <p>Note: Such sensors would be particularly helpful in darkness and low visibility conditions.</p>
Title	Visual Presentation Additional Sensors
Status	<Validated>
Rationale	<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> <p>The purpose of such sensors would e.g. be to assist the ATCO/AFISO to;</p> <ul style="list-style-type: none"> <li>- Detect 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> <p>The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_DESIGN_005.</p>
Category	<Functional><HMI>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

### Visualisation – Characteristics

Identifier	REQ-06.09.03-OSED-VC03.1101
Requirement	The visual presentation <b>shall</b> be designed to avoid unnecessary discontinuities or non-uniformities of the presented view.
Title	Visual Presentation Characteristics of Design/Setup
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>Validation experiences have showed this to be an essential requirement.</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/AFISO to get an undivided/unbroken/unobscured presentation of these “hot spot” areas.</p> <p>The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_DESIGN_011.</p>

Category	<Functional><Performance><HMI>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VC03.1104
Requirement	The visual presentation, including any additional sensors and the binocular functionality, <b>shall</b> provide a smooth and regular impression of moving objects to the human eye.
Title	Visual Presentation Characteristics of Moving Objects
Status	<Validated>
Rationale	<p>Moving objects must not give a "jumping" impression to the operator.</p> <p>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/AFISO to be able to see/judge if a light is flashing or not, e.g. confirm on/off status of RGL.</p> <p>Validation experiences have showed this to be an essential requirement.</p>
Category	<Functional><Performance>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VC03.1105
Requirement	The time delay between occurrences - at the aerodrome or its vicinity - and their presentation to the ATCO/AFISO <b>shall</b> not negatively affect the ability to perform the ATS service.
Title	Visual Presentation Characteristics Time Delay
Status	<Validated>
Rationale	The ATCO/AFISO must be able to trust the information presented. Time delay must be small enough (negligible) and fairly constant in order to be able to perform the service. Validation results have given a recommended maximum latency of 1 second.
Category	<Functional><Performance>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-VC03.1106
Requirement	If there is a difference in the perception of daylight / darkness conditions between the visual presentation and the reality, the ATCO/AFISO <b>shall</b> have 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.
Title	Difference in daylight / darkness perception.
Status	<Validated>

Rationale	<p>Validation experiences have showed that the visual presentation of some technical platforms presents the remote operating environment brighter than the conditions in the real world (prolonging the experience of daylight to some extent), thus allowing the operator to see better than in reality, but with the drawback making it difficult for the operator to judge when darkness has occurred (e.g. not knowing when needed to turn on landing lights). If this is the case for a particular implementation, some kind of mitigation would be needed (which in its simplest form could be a basic table of the sunrise / sunset times, but could also be a technical solution that provide and support the ATCO/AFISO with this kind of information and decision support.)</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR18, SR20.</p>
Category	<Operational><Functional><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

### Visualisation – 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/glider/ 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))

Identifier	REQ-06.09.03-OSED-VQ03.1201
Requirement	During CAVOK conditions, the ATCO/AFISO <b>shall</b> be able to visually <b>detect</b> an aircraft of type A320, ATR72 or similar size on 2NM final, by using the visual presentation (excluding the binocular functionality).
Title	Visual Presentation – Quality; traffic on final, visual presentation only

Status	<Validated>
Rationale	<p>Fulfilment of this requirement is to be achieved by using the visual presentation (excluding the binocular functionality).</p> <p>CAVOK stands for Ceiling and visibility OK and shall for the purpose of this requirement have the following meaning: visibility &gt; 10 km, no clouds &lt; 5000 feet, no cumulonimbus or towering cumulus and no significant weather (such as precipitation, thunderstorms, dust storm, shallow fog, low drifting dust, sand or snow) at or in the vicinity of the aerodrome.</p> <p>Detect in this context means that something in the image raises the observer's attention: "There is something!"</p> <p>This requirement is valid in daylight and darkness (in darkness only when the aircraft has its own light source).</p> <p>The purpose of this requirement is to define a quantifiable minimum standard for the quality of the visual presentation, where a gradual degradation of performance is expected in less favourable conditions. The purpose is not to define operator responsibilities.</p>
Category	<Operational><Performance>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VQ03.1220
Requirement	During CAVOK conditions, the ATCO/AFISO <b>should</b> be able to visually <b>detect</b> an aircraft of type A320, ATR72 or similar size on 4NM final, by using the visual presentation (excluding the binocular functionality).
Title	Visual Presentation – Quality; traffic on final, visual presentation only
Status	<Validated>
Rationale	<p>Fulfilment of this requirement is to be achieved by using the visual presentation (excluding the binocular functionality).</p> <p>CAVOK stands for Ceiling and visibility OK and shall for the purpose of this requirement have the following meaning: visibility &gt; 10 km, no clouds &lt; 5000 feet, no cumulonimbus or towering cumulus and no significant weather (such as precipitation, thunderstorms, dust storm, shallow fog, low drifting dust, sand or snow) at or in the vicinity of the aerodrome.</p> <p>Detect in this context means that something in the image raises the observer's attention: "There is something!"</p> <p>This requirement is valid in daylight and darkness (in darkness only when the aircraft has its own light source).</p> <p>The purpose of this requirement is to define a quantifiable minimum standard for the quality of the visual presentation, where a gradual degradation of performance is expected in less favourable conditions. The purpose is not to define operator responsibilities.</p>
Category	<Operational><Performance>
Validation Method	<Live Trial><Shadow Mode>

Verification Method	<Test>
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Identifier	REQ-06.09.03-OSED-VQ03.1207
Requirement	During daylight CAVOK conditions, the ATCO/AFISO <b>shall</b> be able to visually <b>recognise</b> an aircraft of type A320, ATR72 or similar size on 4NM final, by using the visual presentation in combination with the binocular functionality.
Title	Visual Presentation – Quality; traffic on final, visual presentation in combination with binocular functionality
Status	<Validated>
Rationale	<p>Fulfilment of this requirement is to be achieved by using the visual presentation, in combination with the binocular functionality when needed.</p> <p>CAVOK stands for Ceiling and visibility OK and shall for the purpose of this requirement have the following meaning: visibility &gt; 10 km, no clouds &lt; 5000 feet, no cumulonimbus or towering cumulus and no significant weather (such as precipitation, thunderstorms, dust storm, shallow fog, low drifting dust, sand or snow) at or in the vicinity of the aerodrome.</p> <p>The intent with this requirement is not to be able to identify the aircraft but rather to judge/estimate that the aircraft in sight is an aircraft of the same class/category/configuration.</p> <p>This requirement is valid in daylight conditions only.</p> <p>The purpose of this requirement is to define a quantifiable minimum standard for the quality of the visual presentation in combination with the binocular functionality, where a gradual degradation of performance is expected in less favourable conditions. The purpose is not to define operator responsibilities.</p>
Category	<Operational><Performance>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VQ03.1202
Requirement	During CAVOK conditions and when the topography of the surrounding terrain so permits, the ATCO/AFISO <b>should</b> be able to visually judge the position of a light aircraft (e.g. C172 or P28A) in the traffic circuit, by using the visual presentation, in combination with the binocular functionality.
Title	Visual Presentation – Quality; small aircraft in traffic circuit
Status	<Validated>



Rationale	<p>Fulfilment of this requirement is to be achieved by using the visual presentation, in combination with the binocular functionality when needed.</p> <p>CAVOK stands for Ceiling and visibility OK and shall for the purpose of this requirement have the following meaning: visibility &gt; 10 km, no clouds &lt; 5000 feet, no cumulonimbus or towering cumulus and no significant weather (such as precipitation, thunderstorms, dust storm, shallow fog, low drifting dust, sand or snow) at or in the vicinity of the aerodrome.</p> <p>Aerodrome traffic circuit is defined in Doc 4444 as "the specified path to be flown by aircraft operating in the vicinity of an aerodrome". (The vicinity of an aerodrome is defined in Doc 4444 as "aircraft in, entering or leaving an aerodrome traffic circuit".)</p> <p>This requirement is valid in daylight and darkness (in darkness only when the aircraft has its own light source).</p> <p>The intent behind this requirement is to define parameters that enable the use of reduction of separation minima in the vicinity of aerodromes, when two aircraft are continuously visible to the ATCO, according to ICAO Doc 4444 chapter 6.1.</p> <p>Also in today's ordinary towers it is hard to achieve this (judge the position of a light aircraft in the traffic circuit) at all times, e.g. when the traffic circuit is extended or if the light aircraft is in front of low standing sunlight, etc. The nature of a traffic circuit is that it can vary a lot in size and distance to aerodrome depending on many various factors, such as the aircraft type and the type of approach. Thus, in order for this requirement to be a "shall", a specific distance to aerodrome would need to be defined at the same time as a lot of other factors would need to be fixed (e.g. no strong sun backlight, contrast values between the aircraft painting and the sky, etc.). In addition to that, for some airports today the view from the tower can be obscured in a direction for various reasons (e.g. by forests, buildings, mountains). If this requirement would be a "shall", then it would ultimately disqualify some of the existing towers at some airports.</p> <p>The purpose of this requirement is to define a quantifiable minimum standard for the quality of the visual presentation in combination with the binocular functionality, where a gradual degradation of performance is expected in less favourable conditions. The purpose is not to define operator responsibilities.</p>
Category	<Operational><Performance>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VQ03.1203
Requirement	During daylight CAVOK conditions, the ATCO/AFISO <b>should</b> be able to visually recognise aircraft abnormal configurations or conditions, such as landing gear not or only partly extended or unusual smoke emissions from any part of the aircraft, by using the visual presentation in combination with the binocular functionality.
Title	Visual Presentation – Quality; aircraft abnormal configurations or conditions.
Status	<Validated>

Rationale	<p>Fulfilment of this requirement is to be achieved by using the visual presentation, in combination with the binocular functionality when needed.</p> <p>The reasoning for having this requirement as a "should (important) requirement" only (and not a "shall (mandatory) requirement") is that this requirement is primarily based on ICAO Doc 4444 Chapter 7.4.1.7 (see REQ-06.09.03-OSED-FN02.5009), which states "is observed by or reported to the aerodrome controller". Hence, regulations imply that "abnormal configuration or condition of an aircraft" must not necessarily be observed by the controller at all times, it could likewise be reported to the ATCO/AFISO. In addition to that, "abnormal configuration or condition of an aircraft" can be a vast variety of different things, thus in order for this requirement to be a "shall", a specific situation / occurrence / object size would need to be defined as well as a distance to the same.</p> <p>CAVOK stands for Ceiling and visibility OK and shall for the purpose of this requirement have the following meaning: visibility &gt; 10 km, no clouds &lt; 5000 feet, no cumulonimbus or towering cumulus and no significant weather (such as precipitation, thunderstorms, dust storm, shallow fog, low drifting dust, sand or snow) at or in the vicinity of the aerodrome.</p> <p>This requirement is valid in daylight conditions only.</p> <p>The purpose of this requirement is to define a quantifiable minimum standard for the quality of the visual presentation in combination with the binocular functionality, where a gradual degradation of performance is expected in less favourable conditions. The purpose is not to define operator responsibilities.</p>
Category	<Operational><Performance>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VQ03.1208
Requirement	During CAVOK conditions, the ATCO/AFISO <b>shall</b> be able to visually <b>detect</b> all flight operations and vehicles on the manoeuvring area, by using the visual presentation (excluding the binocular functionality).
Title	Visual presentation – Quality; traffic on manoeuvring area, visual presentation only
Status	<Validated>



Rationale	<p>Fulfilment of this requirement is to be achieved by using the visual presentation (excluding the binocular functionality).</p> <p>CAVOK stands for Ceiling and visibility OK and shall for the purpose of this requirement have the following meaning: visibility &gt; 10 km, no clouds &lt; 5000 feet, no cumulonimbus or towering cumulus and no significant weather (such as precipitation, thunderstorms, dust storm, shallow fog, low drifting dust, sand or snow) at or in the vicinity of the aerodrome.</p> <p>The manoeuvring area is defined in Doc 4444 as "that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons".</p> <p>Detect in this context means that something in the image raises the observer's attention: "There is something!"</p> <p>This requirement is valid in daylight and darkness (in darkness only when the aircraft/vehicle has its own light source).</p> <p>The purpose of this requirement is to define a quantifiable minimum standard for the quality of the visual presentation, where a gradual degradation of performance is expected in less favourable conditions. The purpose is not to define operator responsibilities.</p>
Category	<Operational><Performance>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VQ03.1209
Requirement	During CAVOK conditions, the ATCO/AFISO <b>shall</b> be able to visually <b>recognise</b> all flight operations and vehicles on the manoeuvring area, by using the visual presentation in combination with the binocular functionality.
Title	Visual presentation – Quality; traffic on manoeuvring area, visual presentation in combination with binocular functionality
Status	<Validated>

Rationale	<p>Fulfilment of this requirement is to be achieved by using the visual presentation, in combination with the binocular functionality when needed.</p> <p>CAVOK stands for Ceiling and visibility OK and shall for the purpose of this requirement have the following meaning: visibility &gt; 10 km, no clouds &lt; 5000 feet, no cumulonimbus or towering cumulus and no significant weather (such as precipitation, thunderstorms, dust storm, shallow fog, low drifting dust, sand or snow) at or in the vicinity of the aerodrome.</p> <p>The manoeuvring area is defined in Doc 4444 as “that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons”.</p> <p>The intent with this requirement is not to be able to identify the aircraft/vehicle but rather to judge/estimate the type/category/configuration/class.</p> <p>This requirement is valid in daylight and darkness (in darkness only when the aircraft/vehicle has its own light source).</p> <p>The purpose of this requirement is to define a quantifiable minimum standard for the quality of the visual presentation in combination with the binocular functionality, where a gradual degradation of performance is expected in less favourable conditions. The purpose is not to define operator responsibilities.</p>
Category	<Operational><Performance>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VQ03.1205
Requirement	During daylight CAVOK conditions, the ATCO/AFISO <b>should</b> be able to visually <b>detect</b> obstructions on the manoeuvring area, by using the visual presentation in combination with the binocular functionality.
Title	Visual presentation – Quality; obstructions on manoeuvring area
Status	<Validated>

Rationale	<p>Fulfilment of this requirement is to be achieved by using the visual presentation, in combination with the binocular functionality when needed.</p> <p>CAVOK stands for Ceiling and visibility OK and shall for the purpose of this requirement have the following meaning: visibility &gt; 10 km, no clouds &lt; 5000 feet, no cumulonimbus or towering cumulus and no significant weather (such as precipitation, thunderstorms, dust storm, shallow fog, low drifting dust, sand or snow) at or in the vicinity of the aerodrome.</p> <p>The manoeuvring area is defined in Doc 4444 as "that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons".</p> <p>Detect in this context means that something in the image raises the observer's attention: "There is something!"</p> <p>This requirement is valid in daylight conditions only.</p> <p>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.</p> <p>The reasoning for having this requirement as a "should (important) requirement" only (and not a "shall (mandatory) requirement") is that regulations only states that ATCOs shall prevent collisions between aircraft and obstructions (AFISOs to assist pilots for the same) but nowhere states that the ATCO/AFISO needs to visually see/detect the obstruction, hence implying that the existence of an obstruction can likewise be reported to the ATCO/AFISO. In addition to that, the size of an obstruction can vary widely from a very small object to a large. Thus, if having this requirement as a "shall (mandatory) requirement" a minimum target size of the obstruction would need to be defined.</p> <p>The purpose of this requirement is to define a quantifiable minimum standard for the quality of the visual presentation in combination with the binocular functionality, where a gradual degradation of performance is expected in less favourable conditions. The purpose is not to define operator responsibilities.</p>
Category	<Operational><Performance>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VQ03.1210
Requirement	During daylight CAVOK conditions, the ATCO/AFISO <b>shall</b> be able to visually <b>recognise</b> personnel on the manoeuvring area, by using the visual presentation in combination with the binocular functionality.
Title	Visual presentation – Quality; personnel on manoeuvring area
Status	<Validated>

Rationale	<p>Fulfilment of this requirement is to be achieved by using the visual presentation, in combination with the binocular functionality when needed.</p> <p>CAVOK stands for Ceiling and visibility OK and shall for the purpose of this requirement have the following meaning: visibility &gt; 10 km, no clouds &lt; 5000 feet, no cumulonimbus or towering cumulus and no significant weather (such as precipitation, thunderstorms, dust storm, shallow fog, low drifting dust, sand or snow) at or in the vicinity of the aerodrome.</p> <p>The manoeuvring area is defined in Doc 4444 as "that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons".</p> <p>Recognise in this context means being able to see/distinguish a person (not just being able to see "there is something").</p> <p>This requirement is valid in daylight conditions only.</p> <p>The fulfilment of this requirement will be dependent on distance to and size of the person as well as on meteorological conditions - as already implicit in current ICAO regulations.</p> <p>The purpose of this requirement is to define a quantifiable minimum standard for the quality of the visual presentation in combination with the binocular functionality, where a gradual degradation of performance is expected in less favourable conditions. The purpose is not to define operator responsibilities.</p>
Category	<Operational><Performance>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VQ03.1206
Requirement	Depending on visibility and daylight/darkness conditions, the ATCO/AFISO <b>may</b> be able to visually observe significant meteorological conditions in the take-off and climb-out area, by using the visual presentation in combination with the binocular functionality.
Title	Visual Presentation Quality Significant Met Conditions
Status	<Validated>

Rationale	<p>Fulfilment of this requirement is to be achieved by using the visual presentation, in combination with the binocular functionality when needed.</p> <p>ICAO Doc 4444 Chapter 7.4.1.2.2 states that aircraft shall be advised of significant meteorological conditions in the take-off and climb-out area, except when it is known that the information has already been received by the aircraft.</p> <p>Significant meteorological conditions in this context are defined in ICAO Doc 4444 Chapter 7.4.1.2.2.</p> <p>Significant meteorological conditions can be either visually observed by the ATCO/AFISO or reported to the same from pilots, met-offices etc. In addition, "significant meteorological conditions" can be a variety of different weather phenomena's, many of them impossible to observe visually, some difficult to observe visually. In conclusion this is not a mandatory requirement to be able to observe all significant met conditions at all times even in today's regulations / today's traditional towers.</p> <p>The fulfilment of this requirement will be dependent on the type of and distance to the significant weather, the daylight/darkness conditions as well as the meteorological visibility - as already implicit in current ICAO regulations.</p> <p>The purpose of this requirement is to define a quantifiable minimum standard for the quality of the visual presentation in combination with the binocular functionality, where a gradual degradation of performance is expected in less favourable conditions. The purpose is not to define operator responsibilities.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR18.</p>
Category	<Operational><Performance><Safety>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-VQ03.1211
Requirement	<p>The ATCO/AFISO <b>may</b> be able to visually observe visual communication from aircraft that are within the ATCO/AFISO's visual range on and in the vicinity of the aerodrome, by using the visual presentation in combination with the binocular functionality, i.e.:</p> <ul style="list-style-type: none"> <li>- Aircraft flashing or showing landing lights (in darkness).</li> <li>- Moving ailerons (or rudder). (in daylight)</li> <li>- Aircraft repeatedly changing its bank angle - "rocking wings" (in daylight).</li> </ul>
Title	Visual Communication from Aircraft in Aerodrome Vicinity
Status	<Validated>

Rationale	<p>Fulfilment of this requirement is to be achieved by using the visual presentation, in combination with the binocular functionality when needed.</p> <p>The vicinity of an aerodrome is defined in Doc 4444 as “aircraft in, entering or leaving an aerodrome traffic circuit”.</p> <p>ICAO Doc 4444 12.3.4 “Phraseologies for use on and in the vicinity of the aerodrome” defines;</p> <ul style="list-style-type: none"> <li>- Showing landing lights as a possible means of "Identification of aircraft" (12.3.4.1)</li> <li>- And moving ailerons (or rudder), rocking wings or flashing landing lights as acknowledgement by visual means (12.4.3.2).</li> </ul> <p>Regulations nowhere state this being a mandatory requirement at all times. E.g. an aircraft at the RWY threshold moving its ailerons is difficult to spot even from a conventional tower today.</p> <p>The fulfilment of this requirement will be dependent on distance to aircraft and meteorological conditions - as already implicit in current ICAO regulations.</p> <p>The purpose of this requirement is to define a quantifiable minimum standard for the quality of the visual presentation in combination with the binocular functionality, where a gradual degradation of performance is expected in less favourable conditions. The purpose is not to define operator responsibilities.</p>
Category	<Operational><Performance>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

### Visualisation – Binocular Functionality

Identifier	REQ-06.09.03-OSED-BF03.1501
Requirement	The binocular functionality <b>shall</b> be simple, quick and easy to use.
Title	Binocular Functionality Ease of Use
Status	<Validated>
Rationale	<p>Compare with traditional binoculars, as used in normal towers.</p> <p>The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_DESIGN_012.</p>
Category	<Operational><Functional><HMI>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-BF03.1502
Requirement	The visual presentation provided by the binocular functionality <b>shall</b> be of sufficient quality (image sharpness, magnification, contrast) to support the related ATCO/AFISO tasks.
Title	Binocular Functionality Performance
Status	<Validated>

Rationale	<p>For details on the required quality/performance in order to support the ATCO/AFISO tasks, see the related requirements under section “Visualisation – Quality” (which details what the operator needs to be able to see with help of the binocular functionality.)</p> <p>The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_DESIGN_012.</p>
Category	<Functional><HMI>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-BF03.1503
Requirement	The binocular functionality <b>shall</b> include a adjustable zoom feature with a visual indication of the direction of bore sight.
Title	Binocular Functionality Zoom Feature
Status	<Validated>
Rationale	In order for the binocular functionality to be simple, quick and easy to use, this forms an essential feature.
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-BF03.1504
Requirement	The binocular functionality <b>should</b> include predefined and user-definable positions (where a position is based on automatic (predefined / user-definable) zoom, pan-tilt and focus).
Title	Binocular Functionality Fixed Positions
Status	<Validated>
Rationale	<p>Assisting the ATCO/AFISO quickly scanning commonly hot spots or areas of particular interest.</p> <p>In order for the binocular functionality to be simple, quick and easy to use, this forms an important feature.</p>
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-BF03.1505
Requirement	The binocular functionality <b>should</b> include predefined and user-definable automatic scanning patterns, such as runway sweeps.
Title	Binocular Functionality Automatic Scanning Sweeps
Status	<Validated>

Rationale	Assisting the ATCO/AFISO performing e.g. runway sweeps or sweeps of any of other area of interest within the area of responsibility. In order for the binocular functionality to be simple, quick and easy to use, this forms an important feature.
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-BF03.1506
Requirement	The binocular functionality <b>should</b> include automatic tracking of moving aircraft, vehicles or obstructions (e.g. personnel or large animals).
Title	Binocular Functionality Automatic Tracking
Status	<Validated>
Rationale	Assisting the ATCO/AFIS to follow moving targets. In order for the binocular functionality to be simple, quick and easy to use, this forms an important feature.
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-BF03.1507
Requirement	The means of directing the signalling lamp towards the applicable aircraft <b>may</b> be combined with the binocular functionality.
Title	Signal Light Gun combined with Binocular Functionality
Status	<Validated>
Rationale	This solution has been tested successfully in validations.
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

### B.3.5 Airport Sound

Identifier	REQ-06.09.03-OSED-AS03.2001
Requirement	In order to increase situational awareness and compensate for being placed remote the ATCO/AFISO <b>may</b> access the actual outdoor sound from the remote airport.
Title	Airport Sound Single
Status	<Validated>
Rationale	Requirement applicable to the SINGLE aerodrome environment only.  Requirement is likely to be more important for small aerodromes (to attract ATCO/AFISOs attention of arising occurrences at the aerodrome) where sound plays an important role in the ATCOAFISO's job. Requirement can also increase situational awareness in low visibility conditions.



Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-AS03.2002
Requirement	If a function for actual outdoor sound reproduction is implemented (REQ-06.09.03-OSED-AS03.2001), the volume <b>shall</b> be adjustable and possible to be turned off by the operator.
Title	Airport Sound Adjustments
Status	<Validated>
Rationale	In order to meet individual ATCO/AFISO needs and to be able to minimise disturbing background noise in some circumstances.
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

### B.3.6 Other ATS Systems / Functions

Identifier	REQ-06.09.03-OSED-FN03.3001
Requirement	The ATCO/AFISO <b>should</b> access an electronic system for the presentation and updating of flight plan and control data (in accordance with ICAO Doc 4444 Chapter 4.13).
Title	E-Strip System Baseline Requirement
Status	<Validated>
Rationale	ICAO Doc 4444 Chapter 4.13
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN03.3002
Requirement	When RTC enables transfer of responsibility of ATS for aerodromes between RTMs within the RTC, the ATCO/AFISO <b>shall</b> access an electronic system for the presentation and updating of flight plan and control data (in accordance with ICAO Doc 4444 Chapter 4.13).
Title	E-Strip System for Transfer of Responsibility Between RTMs
Status	<Validated>
Rationale	ICAO Doc 4444 Chapter 4.13  To facilitate the transfer of aerodromes between RTMs within the RTC, the importance of this requirement has been raised to a higher level compared to when ATS is provided to a fixed aerodrome only from a RTM.
Category	<Functional>

Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN03.3003
Requirement	If the RTM is equipped with an electronic system for the presentation and updating of flight plan and control data, the ATCO/AFISO <b>should</b> use pre-set functions for the most common actions, e.g. creating a new strip for a pop up VFR flight.
Title	E-Strip System Pre Set Functions
Status	<Validated>
Rationale	This requirement is based on validation feedback overall, but particularly from EXE-060.
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN03.3004
Requirement	Updates for flight plan and control data (in accordance with Doc 4444 4.13.2) to other ATS units <b>may</b> be done automatically (if not being performed by manual coordination by the ATCO/AFISO).
Title	Automatic Flight Plan and Control Data Updates, Single
Status	<Validated>
Rationale	Requirement applicable to the SINGLE aerodrome environment only  ICAO Doc 4444 Chapter 4.13
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN03.3005
Requirement	In low visibility conditions, the ATCO/AFISO <b>may</b> be notified about an aircraft or vehicle entering or vacating the runway. Note: Such notifications can be particularly helpful in low visibility conditions.
Title	RWY Entry/Exit Notification
Status	<Validated>
Rationale	Such notifications may be utilized by cameras / laser beams monitoring specific parts of the manoeuvring area, such as runway entry/exits.  To assist ATCO/AFISOs identifying aircraft/vehicle entering/vacating RWY.
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN03.3006
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Requirement	The ATCO/AFISO <b>may</b> be warned about an aircraft or vehicle entering the runway without clearance.
Title	RWY Entry/Exit Warning
Status	<Validated>
Rationale	To assist in identifying/avoiding RWY incursions.
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN03.3007
Requirement	The ATCO/AFISO <b>may</b> be warned about an aircraft or vehicle entering the manoeuvring area without clearance.
Title	Manoeuvring Area Entry/Exit Warning
Status	<Validated>
Rationale	To assist in identifying/avoiding manoeuvring area incursions.
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-FN03.3008
Requirement	Notifications about any technical status of systems that can affect the safety or efficiency of flight operations and/or the provision of air traffic service <b>shall</b> be extended to include systems and/or data that are specific to remote tower operations, such as detecting corrupt/delayed/frozen visual presentation.
Title	Technical Status
Status	<Validated>
Rationale	ICAO Doc 4444, Chapter 4.14, ICAO Doc 4444, Chapter 7.1.3  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR54.  The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_DESIGN_003.
Category	<Functional><Safety><HMI>
Validation Method	<Live Trial><Shadow Mode><Expert Group (Judgement Analysis)>
Verification Method	<Review of Design><Test>

### B.3.7 Voice and Data Recording

Identifier	REQ-06.09.03-OSED-DR03.4001
Requirement	<p>Recording of necessary communications and data shall be extended to include recording of systems and/or surveillance data that are specific to remote tower operations, such as recording of the visual presentation (or other surveillance data used as an aid for ATS provision).</p> <p><b>Note:</b> Note 1 to ICAO Doc 4444 Chapter 7.1.1.2.1 now clarifies that “For the purposes of automatic recording of visual surveillance system data, Annex 11, 6.4.1 applies”. See also the guidance provided in Chapter 5.6 of Annex 1 to EASA ED Decision 2019/004/R.</p> <p><b>Note:</b> Requirement text adjusted compared to its appearance in S1 OSED in order to reflect the latest amendments of ICAO Doc 4444 (Amendment 8 to the Sixteenth Edition 2016, applicable as of 08 November 2018).</p>
Title	Voice & Data Recording expanded for remote.
Status	<Validated>
Rationale	<p>ICAO Annex 11 Chapter 6.4.1.1 &amp; 6.4.1.2.</p> <p>ICAO Doc 4444 Chapter 7.1.1.2.1.</p> <p>Annex 1 to EASA ED Decision 2019/004/R ('Guidance Material on remote aerodrome air traffic services' — Issue 2), Chapter 5.6.</p>
Category	<Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

### B.3.8 Work Environment

Identifier	REQ-06.09.03-OSED-WE03.5001
Requirement	Working Environment <b>should</b> permit day light conditions equal to ordinary office establishments.
Title	Working Environment General Lighting Conditions
Status	<Validated>
Rationale	ATCOs/AFISOs are used to work in a daylight environment. Compare with modern ACCs, which are also designed to allow for daylight conditions to avoid fatigue etc.
Category	<Design><Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-WE03.5002
Requirement	Working Environment (noise, temperature etc.) <b>shall</b> be according national regulations for normal office establishments.
Title	Working Environment Noise & Temperature Conditions
Status	<Validated>
Rationale	In order to ensure good working environment to avoid fatigue etc.
Category	<Design><Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test>

Identifier	REQ-06.09.03-OSED-WE03.5003
Requirement	Working Environment <b>shall</b> enable the ATCO/AFISO to adjust the lighting conditions in the RTM in order to adapt to the conditions at the remote airport(s).
Title	Working Environment Lighting Adaptable to Remote Airport
Status	<Validated>
Rationale	E.g., during darkness at the remote aerodrome, the room/RTM is likely needed to be darker. Based on validation feedback.
Category	<Design><Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test><Review of Design>

Identifier	REQ-06.09.03-OSED-WE03.5004
Requirement	If several RTMs are collocated in a RTC, the ATCO/AFISO <b>should</b> be able to control the lights individually for each RTM in a RTC.
Title	Working Environment Lights Adjustable on RTM Level
Status	<Validated>
Rationale	It can be daylight conditions (at the remote airport) in one RTM, and darkness (at the remote airport) in the RTM next beside.
Category	<Design><Functional>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-WE03.5005
Requirement	Working Environment <b>shall</b> enable sufficient writing space in the CWP for the ATCO/AFISO to make manual notes.
Title	Working Environment Space for Writing
Status	<Validated>

Rationale	Based on validation feedback, particularly from VP-058. The space shall be properly lit as required, minding the difference in daylight/night-time operations.  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 fallback procedure if all technical systems would stop functioning. Using paper strips may satisfactory fulfil this need, hence if using paper strips no additional separate space for making notes may be needed.
Category	<Design><Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test><Review of Design>

Identifier	REQ-06.09.03-OSED-WE03.5006
Requirement	The CWP <b>should</b> be designed according to good ergonomical design principles and allow for a degree of flexibility for user adaption.
Title	Working Environment - good ergonomics and user adaptation
Status	<Validated>
Rationale	Adaption for left/right handed persons, height adjustable worktable, number of input and output devices limited to a minimum, etc.  The following human performance requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: RT_REQ_DESIGN_007, RT_REQ_DESIGN_009.
Category	<Design><Functional><HMI>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Test><Review of Design>

### B.3.9 Reliability & Integrity

Identifier	REQ-06.09.03-OSED-RI03.6001
Requirement	The likelihood of failure or degradation of systems not specific to remote tower operations <b>shall</b> be operationally acceptable as per local implementation and as per applicable regulations.
Title	Reliability & integrity of non-remote tower specific systems.
Status	<Validated>
Rationale	Systems not specific to remote tower operations refers to systems that are used already in today's local operations, e.g. radio communication, radar surveillance etc.  The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR42, SR43, SR44, SR45, SR47, SR49 SR51, SR56, SR58, SR59, SR60.
Category	<Safety><Reliability><Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

Identifier	REQ-06.09.03-OSED-RI03.6002
Requirement	The likelihood of failure or degradation of systems that are specific to remote tower operations, such as the visual presentation, shall be defined on local implementation level in order to be operationally acceptable.
Title	Reliability & integrity of remote tower specific systems.
Status	<Validated>
Rationale	<p>These decisions and figures will likely be based on e.g. Regularity, Cost Benefit and Safety analysis for every airport and local implementation.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR52.</p> <p>The following safety requirement(s) of <b>Fehler! Verweisquelle konnte nicht gefunden werden.</b> comply with this OSED requirement: SR-52M01.</p>
Category	<Safety><Reliability><Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	<Review of Design><Test>

## Appendix C Baseline 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.

### C.1 Performance Requirements

[REQ]

Identifier	REQ-05.00-SPRINTEROP-PR01.0003
Title	KPA Cost Effectiveness, Multiple
Requirement	The Multiple Aerodrome Application part of the Remote Tower Concept shall reduce the direct cost of gate-to-gate ATM by 1, 33%.
Status	<Validated>
Rationale	<p>Through progressive implementation of new systems and procedures the European gate-to-gate ATM costs shall reduce.</p> <p>Validation Targets for PJ.05-03 published in D4.8 PJ19: Validation Targets (2019). It means that CEF2 Validation target for PJ.05-02 and PJ.05-03 is 1.33 % and CEF3 Validation target for PJ.05-03 is 1.745 %.</p> <p>Cost Effectiveness has not been assessed directly through the validation exercises. Instead the focus of the validation exercises has been to validate the assumption in the business case i.e. that it is operationally feasible to provide ATS from a remote location for multiple aerodromes.</p>
Category	<Performance>

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.05.02
< ALLOCATED_TO >	<SESAR Solution>	PJ.05.03
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Functional Block>	N/A
< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout



## C.2 Multiple handling/procedures

[REQ]

Identifier	REQ-05.00-SPRINTEROP-MP01.0001
Title	Handling high workload situations in Multiple
Requirement	<p>In case of an high workload situations, such as an emergency situation, at one of the airports - significantly increasing the ATCO/AFISO workload and affecting her/his capability to continue to provide ATS to all airports under responsibility - the ATCO may perform one of the following actions in order to be able to manage the high workload situation,:</p> <ul style="list-style-type: none"> <li>• Temporarily stop/delay traffic at the other/all airport(s),</li> <li>• Transfer the provision of ATS for the airport(s) not experiencing the unexpected event to another MRTM,</li> <li>• Request the support of another ATCO, to be able to continue the service provision for all aerodromes from the existing RTM.</li> </ul> <p>Note: The RTC Supervisor, if implemented in solution 03, may support the controller to apply these procedures.</p>
Status	<Validated>
Rationale	<p>Based on experiences gained during validation exercises and workshops.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-17.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-MP04.0001</b></p>
Category	<Operational>,<Safety>,<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Functional Block>	N/A
< ALLOCATED_TO >	<Role>	Tower Runway Controller

< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout
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## [REQ]

Identifier	REQ-05.00-SPRINTEROP-MP01.0002
Title	Airport clustering considerations in Multiple mode of operation.
Requirement	The clustering of aerodromes in an MRTM shall be done taking into account factors such as traffic levels and complexity, aerodrome layout, geographical specificities, runway orientations/directions, operational procedures/conditions, weather patterns.
Status	<Validated>
Rationale	<p>Based on experiences gained during validation exercises and workshops.</p> <p>In order to identify/avoid any potential interactions that could potentially create confusions for ATCOs.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-26.</p> <p>This REQ originates partly from REQ.05.00_HPOps_16 of [HPAR].</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-MP04.0002</b></p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Functional Block>	N/A
< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-TM01.0002
Title	Spare controller
Requirement	The simultaneous control of 3 aerodromes shall ensure the availability of a spare controller or an assistant, in case the termination of service is not locally acceptable.
Status	<Validated>
Rationale	<p>The spare ATCO or assistant could assist the TWR ATCO in order to manage workload and prevent overload by supporting with communication and coordination tasks or by adding delays in traffic or reducing capacity for emergency or complex situations.</p> <p>This REQ originates from [HPAR] REQ.05.00_HPOps_11.</p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Functional Block>	N/A
< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-TM01.0003
Title	Spare controller – local definition of roles, responsibilities and coordination
Requirement	If an additional spare ATCO or assistant is required, the corresponding roles and responsibilities and the coordination procedures shall be locally defined.
Status	<Validated>

Rationale	<p>In order to ensure all actors understand and accept their roles and responsibilities as well as the corresponding tasks/ coordination.</p> <p>This REQ originates from [HPAR] REQ.05.00_HPops_12.</p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Functional Block>	N/A
< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-TM01.0004
Title	Spare controller – local definition of availability
Requirement	In case a back-up ATCO or an assistant is needed, the availability of the additional ATCO/assistant needs to be locally defined.
Status	<Validated>
Rationale	<p>Local assessment shall define the availability of the spare ATCO or assistant in order to ensure an appropriate response time in case of emergency/ complex situations.</p> <p>This REQ originates from [HPAR] REQ.05.00_HPops_13.</p> <p>REC.05.00_HPops9: Local guidelines with regard to when the support from an additional ATCO or assistant shall be asked for, shall be locally defined</p> <p>Rationale: REC.05.00_HPops9: The local guidelines are meant to support the ATCOs in making the right decision (avoiding reaching an overload). However, it is recommended that the decision remains with the ATCO, as inter-subject variabilities will influence the way an ATCO perceives workload as compared to another.</p>

Category	<Operational>,<Safety>,<Human Performance>
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## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Functional Block>	N/A
< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## C.3 Multiple Remote Tower Module (MRTM)

### C.3.1 General Requirements

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-CO01.0005
Title	Spare MRTMs
Requirement	The RTC should host enough MRTMs to be able to split all aerodromes, i.e. each aerodrome can be allocated to a single MRTM.
Status	<Validated>
Rationale	Splitting all 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.
Category	<Operational>,<Safety>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Functional Block>	A/G Voice Communication
< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## C.3.2 Communications

### C.3.2.1 Voice Communication System (VCS)

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-CO03.0003
Title	Aeronautical Mobile Service in Multiple mode of operation.
Requirement	When ATS is performed to more than one aerodrome simultaneously from one MRTM, the standard practise should be to cross couple the aeronautical mobile service (air-ground communications) frequencies for all aerodromes being served from that MRTM.
Status	<Validated>
Rationale	<p>This is to avoid simultaneous transmissions on the different frequencies /aerodromes under the responsibility of one RTM.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-05, SR-07, SR-08.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-MC04.2001, REQ-06.09.03-OSED-MC04.2002 &amp; REQ-06.09.03-OSED-MC04.2003</b></p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Functional Block>	A/G Voice Communication
< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-CO03.0004
Title	Aeronautical Fixed Service in Multiple mode of operation.
Requirement	When ATS is performed to more than one aerodrome simultaneously from one MRTM, aeronautical fixed service (ground-ground communications) shall be extended to cover communications with all units relevant for all aerodromes being served.
Status	<Validated>
Rationale	<p>The ATCO must be able to communicate with all units relevant for all aerodromes being provided with ATS from the MRTM, in accordance with ICAO Annex 11, Chapter 6.2.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-08, SR-12, SR-13, SR-14.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-MC04.2004</b></p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Functional Block>	G/G Communication Aerodrome ATC
< ALLOCATED_TO >	<Role>	Tower Runway Controller

< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout
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## [REQ]

Identifier	REQ-05.00-SPRINTEROP-CO03.0006
Title	Surface Movement Control Service in Multiple mode of operation.
Requirement	When ATS is performed to more than one aerodrome simultaneously from one MRTM, the standard practise for the surface movement control service (communications for the control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes) should be to transmit to aerodromes/frequencies individually (frequencies not to be cross-coupled).
Status	<Validated>
Rationale	<p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-08, SR-10, SR-11.</p> <p>REQ.05.00_HPdesign_9: Most ATCOs confirm that by having un-coupled frequencies on the ground, the risk of vehicle drivers assuming a wrong clearance (from another aerodrome) will significantly lower. The conclusion is attributed to the fact that vehicle drivers are less experienced with coupled frequencies, as opposed to pilots that have an appropriate training and practice, e.g. En-route).</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-MC04.2005 &amp; REQ-06.09.03-OSED-MC04.2006</b></p>
Category	< Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Functional Block>	G/G Communication Aerodrome ATC
< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout



[REQ]

Identifier	REQ-05.00-SPRINTEROP-CO03.0007
Title	Surface Movement Control Service, “push buttons symmetry in Multiple”
Requirement	The transmit push buttons for the ground frequencies (surface movement control service) shall be integrated in the CWP in a way that they are easily distinguishable between airports (e.g. if airports are represented side by side the push buttons shall be respectively located on each side).
Status	<Validated>
Rationale	With a multiple remote tower display, symmetry is considered a strong supporting barrier in helping ATCOs distinguish the input/ output devices per each aerodrome.  This REQ originates from REQ.05.00_HPdesign_10 of the [HPAR].
Category	<Operational>,<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
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<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Functional Block>	G/G Communication Aerodrome ATC
< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

### C.3.3 Visualisation

#### C.3.3.1 General

[REQ]

Identifier	REQ-05.00-SPRINTEROP-VS01.0002
Title	Visual Presentation in Multiple mode of operation.

Requirement	<p>The ATCO shall have access to a visual presentation of all aerodromes under responsibility, covering (at least) the manoeuvring area and the aerodrome vicinity of each aerodrome.</p> <p>The visual presentations might either be placed side-by-side or on top of each other or in a combination of both.</p>
Status	<Validated>
Rationale	<p>In case the ATS unit is also responsible for the provision of apron management services, the visual presentation would also need to cover the respective aprons. Even if the ATS unit is not providing apron management services, there could be an operational need/benefit to access a view of the aprons.</p> <p>For details on what the operator needs to be able to see with help of the visual presentation, see the lower level requirements under section "Visualisation – Quality".</p> <p>The vicinity of an aerodrome is defined in Doc 4444 as "aircraft in, entering or leaving an aerodrome traffic circuit".</p> <p>The manoeuvring area is defined in Doc 4444 as "that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons".</p> <p>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/AFISO 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.</p> <p>This requirement is valid in both daylight and darkness, however dependent on the visibility conditions at the aerodrome and its vicinity. (Note: personnel/objects without its own light source may be difficult to detect during darkness.)</p> <p>This requirement is also valid in all weather conditions (the most common except for the very extreme/unusual weather phenomena) existing at the particular aerodrome.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-VG03.1001</b></p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<SESAR Solution>	PJ.05.03
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Activity>	N/A
< ALLOCATED_TO >	<Functional Block>	CHMIM Aerodrome ATC
< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-VS02.0008
Title	Possibility to scan/view all parts of the CTR
Requirement	The binocular functionality or the Visual Presentation (the latter by enabling a possibility to turn/pan the view) shall allow the ATCO to scan the remaining part of the CTR (in case not a 360-degree view is provided by default).
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 of the [HPAR].</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. (REC.05.00_HPdesign16)</p> <p>In order to avoid having the ATCO "look" for a location. (Rationale:REC.05.00_HPdesign16)</p>
Category	<Operational>,<Human Performance>

## [REQ Trace]

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

< ALLOCATED_TO >	<SESAR Solution>	PJ.05.03
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< ALLOCATED_TO >	<Functional Block>	Out of the Window
< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

### C.3.3.2 Quality

#### C.3.3.2.1 Augmentation

[REQ]

Identifier	REQ-05.00-SPRINTEROP-VG01.0002
Title	Overlay: Visual Presentation Digital Overlays in Multiple mode of operation.
Requirement	The visual presentation should include digitally overlaid additional information to provide the ATCO a greater level of situational awareness and minimise head down time (as further detailed in requirements REQ-05.00-SPRINTEROP-VG01.0004, REQ-05.00-SPRINTEROP-VG01.0005, REQ-05.00-SPRINTEROP-VG01.0006, REQ-05.00-SPRINTEROP-VG01.0007 and REQ-05.00-SPRINTEROP-VG01.0009).
Status	<Validated>
Rationale	<p>To facilitate provision of ATS to multiple aerodromes, the importance of this requirement has been raised to a higher level compared to when ATS is provided to a single aerodrome only.</p> <p>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/AFISO head down time (as further detailed in requirements REQ-05.00-SPRINTEROP-VG01.0004, REQ-05.00-SPRINTEROP-VG01.0005, REQ-05.00-SPRINTEROP-VG01.0006, REQ-05.00-SPRINTEROP-VG01.0007 and REQ-05.00-SPRINTEROP-VG01.0009).</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-33, SR-35, SR-36, SR-37.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-MV04.3001</b></p>
Category	< Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	Out of the Window
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-VG01.0004
Title	Overlay: Visual and radar tracking in Multiple mode of operation.
Requirement	The visual presentation should include overlaid symbols/boxes/labels facilitating detection and identification of objects capable of movement and relevant for the service provision.
Status	<Validated>
Rationale	<p>To facilitate provision of ATS to multiple aerodromes, the importance of this requirement has been raised to a higher level compared to when ATS is provided to a single aerodrome only.</p> <p>This requirement targets objects such as aircraft, vehicles, personnel, obstructions, birds etc. on the manoeuvring area and in the vicinity of the aerodrome.</p> <p>Objects not relevant for the service provision would include e.g. vehicles outside of the manoeuvring area / outside the aerodrome premises.</p> <p>Such symbols and labels can be based on;</p> <ul style="list-style-type: none"> <li>• surveillance information (from radars, ADS-B etc.), targeting cooperative targets (commonly referred to as “radar tracking” or “radar labels”),</li> <li>• visual information (system detection of moving objects in the visual presentation), targeting all moving objects, including also non-cooperative targets in the visual field of view (commonly referred to as “visual tracking” or “box and follow”),</li> <li>• or a combination of the two above.</li> </ul> <p>In order to only present relevant targets for the service provision (i.e. to not</p>

	<p>present disturbing information), there may be a need to mask some areas in the visual field, e.g. aprons, roads or other areas outside of the aerodrome premises, airspace/sky outside CTR etc.</p> <p>The exact configuration of these overlays is to be determined in the scope of local implementations.</p> <p>The importance of this requirement is dependent on total traffic density and ATCO workload and is likely to be more advantageous in a high-density environment.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-36.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-MV04.3101</b></p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	Out of the Window
<ALLOCATED_TO>	<Role>	Tower Runway Controller
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-VG01.0005
Title	Overlay: RWY/TWY/apron designators/markings in Multiple mode of operation.
Requirement	The visual presentation should include overlaid information to indicate / high light runways, taxiways and aprons.
Status	<Validated>

Rationale	<p>To facilitate provision of ATS to multiple aerodromes, the importance of this requirement has been raised to a higher level compared to when ATS is provided to a single aerodrome only.</p> <p>This requirement primarily targets runway (in relation to the RWY direction in use or to all RWY directions), taxiway and apron <b>designators</b> to support the ATCO in a multiple environment.</p> <p><b>Framing</b> of runways, taxiways and aprons could be useful during darkness and low visibility conditions (but are not specifically related to Multiple).</p> <p>The exact configuration of these overlays is to be determined in the scope of local implementations.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-MV04.3102</b></p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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<ALLOCATED_TO>	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-VG01.0006
Title	Overlay: Meteorological and other operationally relevant information in Multiple mode of operation.
Requirement	The visual presentation should include meteorological and other operationally relevant overlaid information.
Status	<Validated>

Rationale	<p>To facilitate provision of ATS to multiple aerodromes, the importance of this requirement has been raised to a higher level compared to when ATS is provided to a single aerodrome only.</p> <p>Information types/classes may e.g. include:</p> <ul style="list-style-type: none"> <li>- Meteorological: current wind, QNH and RVR values (in relation to the RWY direction in use or to all RWY directions), met reports.</li> <li>- Operational: UTC clock, airport names/designators, cardinal/compass directions.</li> </ul> <p>During landing or departure the ATCO provide correct wind information (according to doc 4444) to aircrafts. Easy access to wind information support ATCOs in heads up time and enables focus in departure/touch down area.</p> <p>The ATCO must be able to access correct UTC time without a loss of situation awareness while searching for the information.</p> <p>The ATCO must be able to have support information presenting which aerodrome the ATCO has under control at each time. Validation results have shown that that information support ATCOs.</p> <p><b>REC.05.00_HPdesign3:</b> The full airport name should be displayed in both the Visual Presentation (VP) and the radar display in order to easily link OTW view, radar display and EFSS info.</p> <p><b>Rationale: REC.05.00_HPdesign3:</b> To allow the ATCOs to easily associated the display of information to the corresponding aerodrome.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-42.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-MV04.3103</b></p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

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<ALLOCATED_TO>	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout



## [REQ]

Identifier	REQ-05.00-SPRINTEROP-VG01.0007
Title	Overlay: Digital Intensity and On/Off Status Adjustments
Requirement	It shall be possible for the ATCO to toggle on/off as well as adjust light intensity of any overlaid information in the visual presentation, for each overlay type/category and each aerodrome separately.
Status	<Validated>
Rationale	Based on validation feedback. It is particularly important to be able to dim such overlays during darkness so as not to dazzle the operator  <b>Initially addressed in SESAR1 REQ-06.09.03-OSED-MV04.3001</b>
Category	< Operational>

## [REQ Trace]

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< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-VG01.0009
Title	Overlay HF design principles.
Requirement	The overlay options shall be embedded on the VP using HF design principles.
Status	<Validated>
Rationale	The overlay options shall be embedded ensuring an appropriate location of the information, no clutter on the screens, harmonised displays between the aerodromes etc.

	This REQ originates from REQ.05.00_HPdesign_23 of [HPAR].
Category	<Human Performance>

## [REQ Trace]

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< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

**C.3.3.2.2 Binocular Functionality**

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-BF01.0001
Title	Binocular Functionality in Multiple mode of operation.
Requirement	A binocular functionality, giving the possibility to zoom/enlarge specific areas and objects in the visual presentation / area of responsibility, shall be provided for each aerodrome under responsibility.
Status	<Validated>
Rationale	<p>ICAO Doc 9426 (Planning manual), Appendix B, (Aerodrome Control Tower Equipment Checklist) states binoculars as equipment.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-41.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-VS02.3004</b></p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

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< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## C.3.4 Other ATS Functions/Systems

### C.3.4.1 Surveillance

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-FN01.0001
Title	Surveillance Data in Multiple mode of operation.
Requirement	Surveillance data shall be provided to ATCO to support tasks for all aerodromes. Air surveillance data is mandatory while ground surveillance is optional.
Status	<Validated>
Rationale	<p>This requirement originates from SR-31 of [SAR] and is applicable for the environment that was validated within PJ05. Local assessment might confirm that no surveillance data is required.</p> <p>ICAO Doc 4444, Chapter 7.1.1.2</p> <p>Eurocontrol Manual for AFIS Chapter 3.1.2</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-FN02.5001</b></p>
Category	< Operational>,<Safety> ,<Human Performance>

## [REQ Trace]

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< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

### 5.2.1.1 E-strip System

[REQ]

Identifier	REQ-05.00-SPRINTEROP-FN02.0001
Title	Systems - Electronic Flight Strips integration
Requirement	The ATCO should be provided with an integrated presentation of the electronic flight strips for all aerodromes controlled from the MRTM.
Status	<Validated>
Rationale	ICAO Doc 4444 Chapter 4.13  E-strip is a supportive tool in the Multiple environment.  <b>Initially addressed in SESAR1 REQ-06.09.03-OSED-FN03.3001</b>
Category	< Operational>

[REQ Trace]

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< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

### 5.2.1.2 ATIS

[REQ]

Identifier	REQ-05.00-SPRINTEROP-FN03.0001
Title	Systems - ATIS
Requirement	The ATCO workload should be reduced by availability of an automated ATIS for all aerodromes being controlled from the MRTM
Status	<Validated>
Rationale	Automated ATIS will support and reduce workload in a Multiple environment.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## C.3.5 Technical Supervision

[REQ]

Identifier	REQ-05.00-SPRINTEROP-TS01.0002
Title	Alarms and alerts – HF design principles
Requirement	Alarms and alerts shall be developed in line with HF design principles.
Status	<Validated>

Rationale	To ensure appropriate visibility and user friendliness, without confusions.  This REQ originates from REQ.05.00_HPdesign_25 of the [HPAR].
Category	<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-TS01.0003
Title	Alarms and alerts in Multiple
Requirement	The same type of alarms and alerts used shall be available on all aerodromes clustered for multiple remote tower operations.
Status	<Validated>
Rationale	The symmetry of information between the aerodromes would help the ATCO easily identify the relevant information.  This REQ originates from REQ.05.00_HPdesign_26 of the [HPAR].
Category	<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

### C.3.6 ATCO Planning Tools

[REQ]

Identifier	REQ-05.00-SPRINTEROP-AP01.0001
Title	ATCO Planning tool
Requirement	<p>The ATCO shall be presented with planning information (e.g. forecasted traffic, forecasted weather, etc.) in order to adjust/plan traffic to any constraints or foresee the need for a split of the merged aerodromes.</p> <p>At the same time the planning information also allows the ATCO to foresee the possibility for a merge of aerodromes in one MRTM.</p>
Status	<Validated>
Rationale	<p>SESAR 1 results delivered a need of a tool to support the ATCO with a forecast of e.g. traffic, weather, airport work that affect the workload in situations when serving more than two low density aerodromes simultaneous.</p> <p>The need for this tool is to cover a more complex Multiple Remote Tower environment.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-46.</p>
Category	<Operational>,<Human Performance>,<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

### C.3.7 Automation Functionalities

[REQ]

Identifier	REQ-05.00-SPRINTEROP-AF01.0001
Title	Search Airport
Requirement	The ATCO should be provided with an indication of a radio transmission related to an aerodrome, e.g. either in the visual presentation or the flight strip system
Status	<Validated>
Rationale	<p>Human Machine Interface design can support ATCO in situational awareness by presenting visual and/or sound to enhance Voice Com transmissions from the aerodromes connected to the MRTM.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-06.</p> <p>REQ.05.00_HPdesign_8: As for the visual input, the ATCOs shall be able to easily distinguish the information associated to each of the aerodromes they are controlling.</p>
Category	<Operational>,<Human Performance>,<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Role>	Tower Runway Controller



< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout
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## C.3.8 Transfer/Merging

### C.3.8.1 General

[REQ]

Identifier	REQ-05.00-SPRINTEROP-TM02.0001
Title	Transfer of aerodromes - Split (or close MRTM)
Requirement	The ATCO shall be able to transfer one of the controlled aerodromes to another MRTM.
Status	<Validated>
Rationale	<p>There is a need to split aerodromes in case of high workload due to e.g. increased traffic load, emergency situations.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-20.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-RTC3.0006</b></p>
Category	< Operational>,<Safety>,<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

[REQ]

Identifier	REQ-05.00-SPRINTEROP-TM02.0002
Title	Transfer of aerodromes - Merge (or open MRTM)

Requirement	The ATCO shall be able to take over an aerodrome to one MRTM.
Status	<Validated>
Rationale	<p>There is a need to be able to merge aerodromes when work load permit's.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-20.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-RTC3.0006</b></p>
Category	< Operational>,<Safety>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.02-SPRINTEROP-TM02.0004
Title	Transfer of aerodrome between MRTMs – duplicated/shared view
Requirement	During Transfer of an aerodrome both ATCOs shall be presented with the same information on the aerodrome being transferred with all available technical systems as replicas until the transfer is performed.
Status	<Validated>
Rationale	<p>There is a need for both ATOs to have a correct overview of aerodromes to be merged or split in order to maintain a correct situational awareness.</p> <p>The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-20.</p> <p><b>Initially addressed in SESAR1 REQ-06.09.03-OSED-RTC3.0007</b></p>

Category	< Operational>,<Safety>,<Human Performance>
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## [REQ Trace]

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< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.02-SPRINTEROP-TM02.0005
Title	Transfer of aerodromes – transfer procedures
Requirement	Transfer procedures (for the transfer of an aerodrome between MRTMs) shall be locally defined with a clear description of the associated roles and responsibilities and corresponding coordination procedures.
Status	<Validated>
Rationale	<p>To ensure all actors involved are aware of their responsibilities and associated tasks.</p> <p>This REQ originates from [HPAR] REQ.05.00_HPtraining_32.</p> <p>The following safety requirement(s) of [SAR] comply with this OSD requirement: SR-20.</p>
Category	<Operational>,<Safety>,<Human Performance>

## [REQ Trace]

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< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

## [REQ]

Identifier	REQ-05.00-SPRINTEROP-TM02.0006
Title	Dimming/removing inactive aerodromes
Requirement	<p>The ATCO shall be able to visually distinguish which aerodromes are active or inactive (e.g. grey out, removing the inactive one).</p> <p>NOTE: For PJ05.03, the possibility to grey out information is not an option – only the "removal" from the screen of the inactive aerodrome.</p>
Status	<Validated>
Rationale	<p>The possibility to grey out the inactive aerodrome or to remove it from the display would remove the non-relevant information from the ATCOs visual range, allowing the focus on the active aerodromes.</p> <p>This REQ originates from REQ.05.00_HPdesign_2 of [HPAR].</p>
Category	<Operational>,<Human Performance>

## [REQ Trace]

Relationship	Linked Element Type	Identifier
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< ALLOCATED_TO >	<Role>	Tower Runway Controller
< ALLOCATED_TO >	<Sub-Operating Environment>	Airport Low Utilisation Simple/Complex Layout

### C.3.9 RTC Supervisor

[REQ]

Identifier	REQ-05.00-SPRINTEROP-RC02.0002
Title	Single Remote Tower Baseline – KPA Interoperability – RTC HMI & Equipment
Requirement	All MRTMs in a RTC shall be harmonised in terms of HMI and equipment (in order to contribute to the overall improvement of uniformity of ATM services).
Status	<Validated>
Rationale	<p>Operate on the basis of uniformity throughout Europe</p> <p>Applying standards and uniform principles, and ensuring the technical and operational interoperability of aircraft and ATM systems.</p> <p>In today's operation, there is often a lack of standardisation of systems and equipment between different aerodromes. CWP and HMI are often different from one ATS tower to another.</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 REQ-06.09.03-OSED-RTC3.0005</b></p>
Category	<Operational>, <Interoperability>,<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
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