

# SESAR SOLUTION PJ.05- W2-35 CONTEXTUAL NOTE V3

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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 Purpose

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*This contextual note provides to any interested reader (external and internal to the SESAR programme) an introduction to the SESAR Solution in terms of scope, main operational and performance benefits, relevant system impacts.*

*When Solution is at V3 level it contains as well additional activities to be conducted during the industrialization phase or as part of deployment.*

*It introduces the technical data pack comprising the SESAR JU deliverables (for V3, they are proposed to support industrialization/deployment).*

## 2 Improvements in Air Traffic Management (ATM)

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### 2.1 Description

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 through a flexible allocation of grouped aerodromes in dedicated MRTMs.

This allocation 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, this compared to a fixed presentation of 2 or 3 aerodromes.

The flexible allocation can also imply that the ATCO should handle higher traffic levels. 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).

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 is to be considered:

- 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.
- Possibility for ATCOs in charge to self-decide the positioning of the aerodromes within the particular MRTM.
- Additional automation support could support the ATCO in workload balance.

The task of flexible allocation of grouped aerodromes to dedicated MRTMs can be supported by a controller with a specific role (e.g. RTC supervisor), who can be aided by a support tool 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. The planning tool might include a what-if functionality to allow the RTC supervisor to compare different parameters.

*Note: One of the ATCOs available in the RTC can carry out the RTC Supervisor role can.*

An assumption for the solution is that an ATCO can hold endorsements for four aerodromes. Nevertheless, having four endorsements is not a requirement to implement the concept, but local considerations within each RTC is depending on aspects such as harmonised procedures, airspace class, and type of traffic. Allocation of these four aerodromes grouped together can be flexible to the MRTMs. Nevertheless, the concept could also be valid for a higher number of grouped aerodromes if

the ATCO can hold endorsements for more aerodromes. Results address in general a setup with two MRTMs, each providing the capability to allocate 3 aerodromes at a time.

### 2.1.1 Operating environment

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 will also be 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. This solution will address any recommended change, compared to the baseline, if the project find a need for a change.

Consideration of training and endorsement aspects is a natural part of the deployment phase.

### 2.1.2 Example airports

Example airports for deployment are for 2 Small airport environment; ESMS, Malmö-Sturup, ESSV-Visby, EDDR-Saarbrücken, EDDC-Dresden, EHTW-Twente, EICK-Cork.

Example airports for deployment are for 3 Other environment airports; ESNQ-Kiruna, ENHD-Haugesund, ENBO-Bodö, LHDC-Debrecen.



### 3 Operational Improvement Steps (OIs) & 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
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
				Aerodromes ATC - 84	Multiple Remote Tower allowing dynamic allocation of aerodromes
				Aerodromes ATC - 85	Provide the MRTM with automation functionalities to reduce controller workload
				SVC-072	Aerodrome Transfer service
				CTE – S10	Multiple Remote Tower Control - Surveillance
				REG-0537	EPAS – 7.11 RMT.0624  Technical and operational requirements for remote tower operation
				HUM-066	RTC Supervisor Role
				STD-162	ED-240A MASPS for Remote Tower Optical Systems Ch. 1

Table 1: OI-steps

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 moment while avoiding clutter of information</li> <li>applying handover procedures for a flexible transfer of aerodromes between MRTM</li> </ul>	Chapter 3.2.4

Table 2: CONOPS

## 4 Background and validation process

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Real Time simulations together with one shadow mode trial was used to validation Solution PJ.05.35. This on different validation platforms focusing on the two different airport environments. Validations focused on Small environment airports and Other environment airports (according to EATMA definition).

A consolidated workshop for Human Performance and Safety validated found results on requirements for Safety and Human Performance. This with ATCOS participating in all different exercises.

- Real Time Simulations for three other environment airports in multiple mode:
  - DLR validation developing a Multiple Remote Tower Module and Remote Tower Centre functionality.
  - INDRA, delivering results on visual reproduction environment for control of 3 aerodromes simultaneously and technical support systems for the ATCOs in a MRTM including approach for all airports.
  - COOPANS, validation platform delivering results on visual reproduction and HMI for control of 3 airports simultaneously with a mix of IFR and VFR traffic. Development of handover functionality for a flexible allocation of aerodromes.
  - ENAV, validation platform delivering results on mixed weather at the airports in a Multiple Remote Tower Module.
  - DFS, validation of a Multiple Remote Tower Module for 3 airports simultaneously.
- HP and SAF workshop. With ATCOs from all validation activities on PJ.05.35.

## 5 Results and performance achievements

The objective of PJ05 Solution 35 is to increase the scope of the Multiple Remote Tower solutions within an RTC and including traffic volumes and airports simultaneously controlled by one ATCO.

A flexible allocation of aerodromes within the RTC will ensure efficiency by serving multiple aerodromes within a MRTM together with RTC supervisor functionality. The Normal conditions, Abnormal conditions and Degraded modes are described in the SESAR Safety Reference Material, where details are listed.

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.

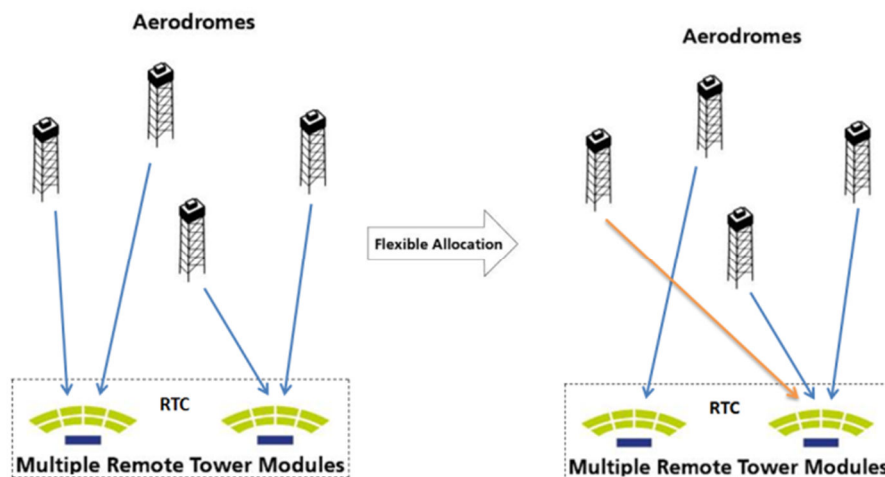


Figure 1: Flexible allocation of aerodromes between MRTMs

Items below present impacting factors on the number of simultaneous movements each Multiple Remote Tower Module can handle: A local assessment of influencing factors is necessary during the safety assessment performed during deployment:

- Number of aerodromes
- Increased traffic complexity
- Aerodrome complexity (e.g. backtracking, hot spots)
- Weather conditions
- Number of tasks (e.g. met reporting, coordination tasks)

## 6 Recommendations and Additional activities

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The platforms used for the validations included all systems needed at V3 level. A refinement of layout and manoeuvring of systems is needed at a local deployment related to systems used. Specific details for system failure and back up as well as local procedures and harmonisation need to be considered:

Additional activities during deployment are:

- Local procedures at the different aerodromes should be harmonized as much as possible
- Coordination needs with other sectors depending on APP/ACC sectors and airport coordination should be reduced as far as possible by using system support
- Alerts and alarms should be harmonised. The same alerts and alarms should be available at the aerodromes that are controlled by one ATCO. The alerts and alarms should be displayed to the ATCO in the same way. The same interaction with the alerts and alarms should be provided to the ATCO for the alarms and alerts of the different aerodromes

Depending on chosen technical system and layout, the deployment needs a Safety Assessment on the system for deployment. This to find proper mitigations for degradation where a split in to Single Remote Tower has the lowest impact on airport capacity and termination of service has the highest cost reduction in staffing.

- The procedures for degraded modes along with the minimum system performance should be considered as they impact traffic levels and required mitigations.

### 6.1 Training

ATCO licensing and endorsements can be kept with the aspect that an ATCO need a local endorsement for each aerodrome which the ATCO will work with in a flexible RTC.

Future deployment can find similarities between airports within a cluster to enable a common endorsement for all aerodromes within such a cluster.

Each deployment need a training plan for the functionalities available in the flexible allocation of aerodromes within the MRTM.

## 7 Actors impacted by the SESAR Solution

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Tower Controllers, ATCOs.

## 8 Impact on Aircraft System

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N/A

## 9 Impact on Ground Systems

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Single Remote Tower is the baseline and is therefore for solution PJ.05.35 already in place so there is no impact on the Remote Tower Systems already in place.

It can be possible to convert existing modules (RTMs or MRTMs) in the RTC building to fit this solution. This with new software, and if needed hardware according to requirements.



## 10 Regulatory Framework Considerations

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EASA and EUROCAE have developed the following Guidance Material for regulatory, operational and technical issues for Remote Tower solutions:

- EASA Guidance Material on remote aerodrome air traffic services, Decision 2019/004/R, Issue 2 still valid, Issue 3 published as NPA.
- ED-240A, MINIMUM AVIATION SYSTEM PERFORMANCE STANDARD FOR REMOTE TOWER OPTICAL SYSTEMS, ED-240B in preparation.

Conclusions and recommendations from PJ05 solutions to be considered by those initiatives.

# 11 Standardization Framework Considerations

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Regulatory support and guidance is available to facilitate safe implementation of multiple remote tower control and to provide a basis for its further development and industrialisation. This regulatory activity is captured in:

- EASA Guidance Material on remote aerodrome air traffic services, Decision 2019/004/R, Issue 2 still valid, Issue3 published as NPA
- ED-240A, MINIMUM AVIATION SYSTEM PERFORMANCE STANDARD FOR REMOTE TOWER OPTICAL SYSTEMS, ED-240B in preparation

The above NPA recognised, at the time of publication, there was two SESAR solution published related to multiple mode of operation (Solution #52 for ‘two low density aerodromes’) together with SDM-0207-Multiple Remote Tower Module.

It can therefore be expected that, subject to the validation of PJ.05 solutions, EASA further update its regulatory material to soften some recommended limitations as well as mitigation measures for how to handle related risks, in multiple mode of operation, taking into account the increased level of maturity.

A new REG-XXX enabler, linked to SDM-0210, could capture this potential regulatory activity.

## 12 Solution Data pack

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The Data pack for this Solution includes the following documents:

- D2.1.020 PJ05-W2-35-V3 SPR-INTEROP-OSED - Part I
- D2.1.020 PJ05-W2-35-V3 SPR-INTEROP-OSED - Part II – SAR
- D2.1.020 PJ05-W2-35-V3 SPR-INTEROP-OSED - Part IV – HPAR
- D2.1.020 PJ05-W2-35-V3 SPR-INTEROP-OSED - Part V – PAR
- D2.1.040 PJ05-W2-35-V3 TS
- D2.1.050 PJ05-W2-35-V3 CBA
- D2.1.060 PJ05-W2-35-V3 VALR