*Contextual note – SESAR Solution description form for deployment planning*

*Purpose:*

*This contextual note introduces a SESAR Solution (for which maturity has been assessed as sufficient to support a decision for industrialization) with a summary of the results stemming from R&D activities contributing to deliver it. It 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 as well as additional activities to be conducted during the industrialization phase or as part of deployment. This contextual note complements the technical data pack comprising the SESAR deliverables required for further industrialization/deployment.*

## Improvements in Air Traffic Management (ATM)

The costs for performing Air Traffic Service (ATS) particularly at Other Airport Operating Environment (movements less than 15 000 annually) and Small Airport Operating Environment (movements greater or equal to 15000 and less than 40000) are high and need to be reduced/limited. It is very important to maintain this service at other airports to keep rural and remote regions vivid and interesting for people to inhabit and for local industry to remain or grow. Remote Tower Services (RTS) provide an opportunity for continued operations and integration of those airports into the global network.

The main driver for PJ.05.02 is increased cost efficiency, which cannot directly be validated in the exercises. Key element for validity of Remote Towers is safety which is highly influenced by the Human Machine Interface wherefore human performance is a key element to measure.

The objective for PJ.05-02 is to develop and validate a MRTM that allows the ATCO to maintain situational awareness for 2 or 3 airports simultaneously. The following traffic characteristics are just providing an indication of the traffic volumes regarding simultaneous movements (including mix of IFR and VFR, as well as aerodrome vehicles):

- 2 (small environment) airports with
    - 6 simultaneous movements in total
    - Up to 20 movements (ground and air) per hour in peak
    - 15.000 to 45.000 annual movements
- 3 (other environment) airports with
    - 4 simultaneous movements in total
    - Up to 15 movements (ground and air) per hour
    - 0 to 15.000 annual movements

The traffic volumes in specific situations might deviate from this indication depending on traffic complexity and other factors influencing task load for the controller. The traffic figures presented have been adapted to a peak hour scenario and are higher than what is expected to occur in operations. Less complex situations could increase the figures whilst more complex situations might decrease the levels.

In order to be able to allow more airports and/or higher traffic volumes to be controlled simultaneously from one MRTM compared to SESAR 1 solution #52 or #12, the solution validates advanced features of the visual reproduction as well as additional voice services integrated into the MRTM.

It is assumed that an ATCO can hold endorsements for up to 3 (single) different airports.

There is a fixed allocation of airports to a set of MRTMs. However, in case of high workload, due to e.g. emergency, high traffic volumes or degraded mode, the ATCO can split one airport into a spare MRTM if required.

The baseline for multiple remote tower operations is the single remote tower operations, SDM-0201 solution #12, and applies to both solutions PJ05-02 and PJ05-03. Transfer from conventional tower service local at the aerodrome to multiple Remote Tower is foreseen to take the step via Single Remotely controlled Air Traffic Service before a combination of more than one aerodrome in multiple mode is in place.

The environments for deployment of Multiple Remote Tower are aerodrome, with traffic figures described above, where runway complexity seldom consists of more than 4 taxiways. Solution 05.02 focuses on the Other or Small Airport Environments aerodromes where the total amount of traffic seldom exceeds above the total amount of 20 movements per hour.

Traffic can consist of a different mix of IFR and VFR as well as vehicles. The increased complexity with a more diverse mixture of traffic impacts the capacity and need for technical support tools.

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; ESNO-Örnsköldsvik, ENHD-Haugesund, ENBO-Bodö, LHDC-Debrecen,

## Operational Improvement Steps (OIs) & Enablers

- Aerodrome ATC-79 – Multiple Remote Tower Module
- Aerodrome ATC-81 – ATCO planning tool
- Aerodrome ATC-82 – Technical supervision of MRTM
- CTE C-14 – Advanced Voice Services

Applicable Integrated Roadmap Dataset is DS18.

Pre-requisite SESAR Solution is #71 and #12, SDM-0201 Single Remote Tower and development in Solution #52 Multiple Remote Tower (2 Other Environment Airports, less than 10 000 movements annually).

## Background and validation process

Solution PJ.05.02 has been validated through four Real Time Simulations on four different validation platforms focusing on the two different airport environments. One Shadow mode

trial took place. Two validations focusing on 2 Small environment airports and two validations focused on three Other environment airports (according to EATMA definition). Human Performance and Safety was validated through questionnaires in all four validation exercises and a common workshop for consolidation of results.

- Real Time Simulations for three other environment airports in multiple mode:
  - o FSP, Hungaro Control validation developing a digital flight strip system including airport control of three aerodromes and ATCO planning tool. Development of HMI for Advanced Voice Services. Also with a final PSM.
  - o Indra, validation delivering results on visual reproduction environment for control of 3 aerodromes simultaneously and technical support systems for the ATCOs in a MRTM.
- Real Time Simulation for two small environment airports in multiple mode:
  - o COOPANS, validation platform delivering results on visual reproduction and HMI for control of 2 airports simultaneously with a mix of IFR and VFR traffic. Development of technical tools for ATCO planning tool and HMI for technical supervision, e.g. ILS, NAV combined with Advanced Voice Com.
  - o ENAV, validation platform delivering results on mixed weather at the airports.
- HP and SAF workshop, was performed with ATCOs from all validation activities on PJ.05.02 together with PJ.05.03 to consolidate and develop requirements for Safety and Human Performance.

## Results and performance achievements

PJ.05.02 has the aim to increase efficiency per ATCO by introducing Multiple Remote Tower for aerodromes with larger amounts of traffic than in SESAR 1 and SDM-0205. The impact will lead to a possibility for more aerodromes suitable for Multiple Remote Tower. This while keeping safety. Target airports are those with a single ATCO in operations

The following benefits have been identified:

- A reduction of ATCOs of up to 25% compared to Single Remote Tower according to CBA

- Maintained traffic levels for the targeted aerodromes

- A mix of IFR and VFR traffic is possible

- Different types of aerodromes can be paired in Multiple mode
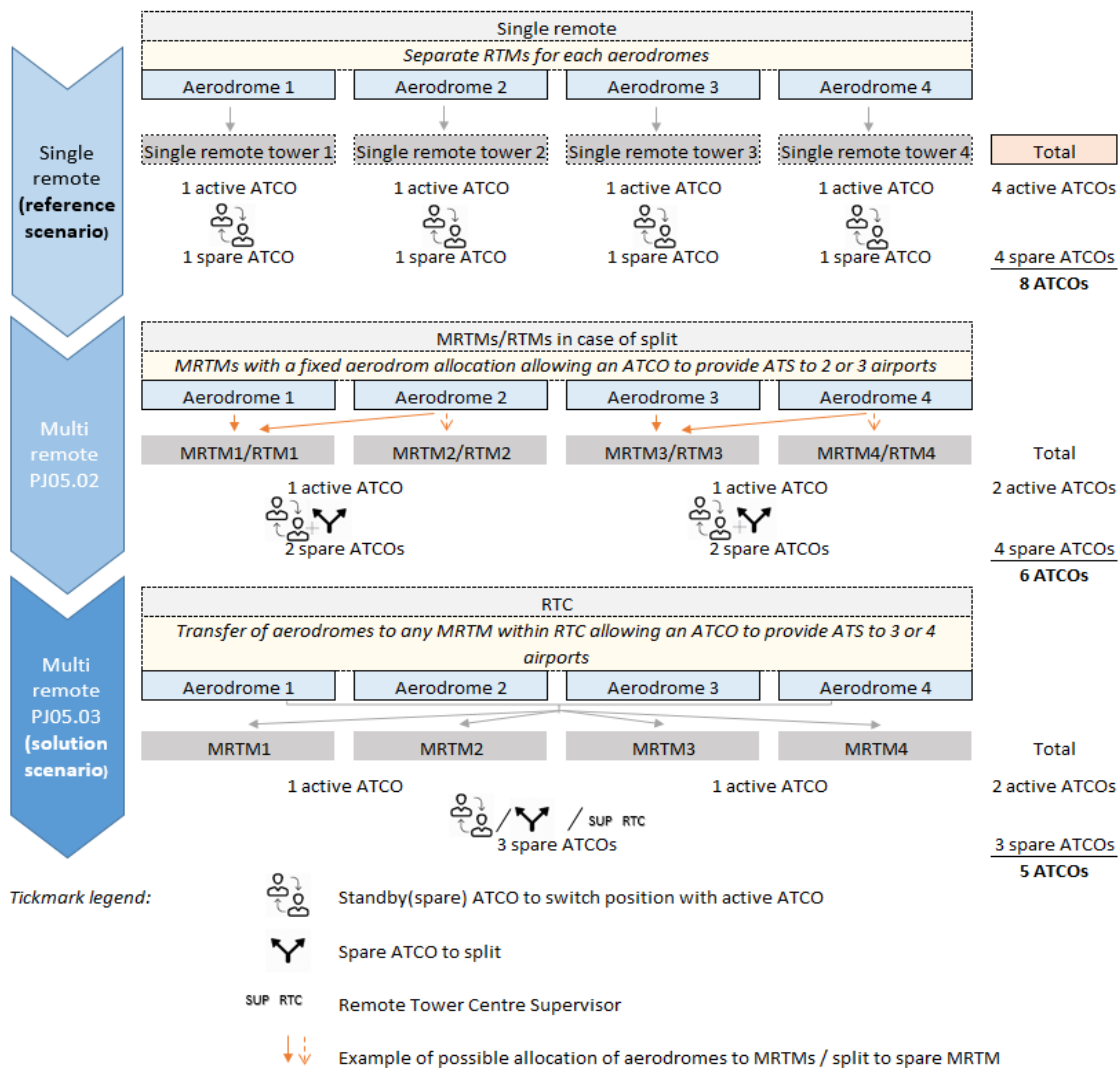


Main findings and results on Multiple Remote Tower can be summarized as follows:

- From Validation trial results:

  o 20 movements per hour, or slightly more, is possible for 2 simultaneous small environment airports

  o 15 movements per hour, or slightly more, is possible for 3 simultaneous other environment airports

  o Traffic complexity with mixed traffic has an impact on workload as well as individual aspects at each aerodrome.

  o Distribution of traffic is more related to capacity based on airport layout, e.g. parallel taxiway or single centred taxiway.

  o ATCOs were able to deal with normal and abnormal modes. Abnormal situations caused a request for split or similar to enable focus on the abnormal situation.

  o Different RWY conditions were possible such as rain or snow on one airport whilst not on the other.

  o RWY directions did not impact the ATCOs capability to handle traffic.

  o A difference in wind or visibility conditions was proven possible during the validations. Those results were also applicable for difference in daylight.

- From participating ATCO point of view:

  o Aerodrome layout complexity has an impact on capacity

  o Different HMI is possible, side by side or on top presentation

  o Airport name in communication adds situation awareness and there was no need to add a phrase stating Remote Control

  o Opening angle in the visual reproduction presenting the aerodromes is important for situational awareness and need to be considered.

## Recommendations and Additional activities

Additional activities to be considered during deployment are:

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:

- 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.

## Actors impacted by the SESAR Solution

Tower Controllers, ATCOs.

## Impact on Aircraft System

N/A

## Impact on Ground Systems

Single Remote Tower is the baseline and is therefore for solution PJ.05.02 already in place so there is no impact on the Remote Tower Systems already in place.

The MRTM can be a new Module in the RTC building even though existing modules can be transferred to a MRTM with the new features added for this solution.

## Regulatory Framework Considerations

Standardisation activities from SDM-0201 are already in place in the ED-240A and RMT.0624 together with STD-HNA-04 and -05.

## Standardization Framework Considerations

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 by the enabler REG-0525, linked to SDM-0205.
The above NPA recognised, at the time of publication, there was only one SESAR solution published related to multiple mode of operation (Solution #52 for 'two low density aerodromes'). Future research and validation activities (incl. SESAR 2020's PJ.05) as well as

EUROPEAN UNION    EUROCONTROL

development of technology might potentially extend the possible operational context of multiple mode of operation.

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.

This potential regulatory activity could be captured by a new REG-XXX enabler, linked to SDM-0207.

## Considerations of Regulatory Oversight and Certification Activities

None are considered, later activities are:

In general the impact on regulatory activities will primarily be to update policy, regulation and other working methods to include providing ATS from a remote location for multiple aerodromes simultaneously.

For Solution PJ.05.02 this regulation is related to development of requirements for the ATCO planning tool, supervision of the systems and HMI design for the MRTM also considering advanced Voice Services

## Solution Data pack

The Data pack for this Solution includes the following documents:

- PJ.05.02 D2.2.001 - OSED PJ05-02 V3 final
- SESAR PJ.05.02 V3 Human Performance Assessment Report (1.0)
- SESAR Solution PJ05-02 V3 - SAR (1.0)
- PJ.05.02 V3 Performance Assessment Report (1.0)
- PJ.05.02 D2.2.002 - VALP PJ05-02 V3 final
- PJ.05.02 D2.2.003 - VALR PJ05-02 V3 final
- PJ.05.02 D2.2.004 - TS PJ05-02 V3 final
- PJ.05.02 D2.2.005 - PJ.05-02: CBA (V3)

## Intellectual Property Rights (foreground)

The foreground is owned by the SJU.