SESAR 2020 Solution 05-35 SPR-INTEROP/OSED V3 - Part IV - Human Performance Assessment Report

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DIGITAL TECHNOLOGIES FOR TOWER

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Abstract

This document contains the Human Performance (HP) assessment report for the solution 35 which consists of the HP assessment plan, the results of the HP activities conducted according to the HP assessment process, newly identified issues and the HP recommendations & requirements. It corresponds to the completion of the four steps of the Human Performance assessment process, namely: Step 1 – Understand the concept: Baseline, Solution and Assumptions, Step 2 – Understand the Human Performance Implications, Step 3 – Improve and Validate the concept and Step4 – Collate findings & conclude on V3 phase-4.

The HP V3 phase is considered closed for the solution 35.

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1 Executive Summary

This document describes the results of the activities conducted to date according to the Human Performance assessment process to derive the Human Performance Report for the Solution PJ05.35 ''Multiple Remote Tower and Remote Tower Centre''.

It is based on PJ05-35 HPAP. It corresponds to the completion of the 4 steps of the Human Performance assessment process, namely: Step 1 – Understand the concept: Reference, Solution and Assumptions and Step 2 – Understand the Human Performance Implications Step 3 – Improve and Validate the concept and Step4 – Collate findings & conclude on V3 phase. The outputs of the 4 steps are described and used to derive Human Performance requirements and demonstrate the V3 maturity achievement of ''Multiple Remote Tower and Remote Tower Centre'. The following activities have been conducted to mature the solution:

- Workshops
  - Workshop 1
    - HP and Safety workshop executed in Q4 2020
  - Workshop 2
    - HP and Safety workshop executed in Q2 2021
  - Workshop 3
    - Final HP and Safety workshop executed in Q3 2022
- Validation Exercises:
  - EXE-PJ05-W2-35-V3-2.1
    - EXE-PJ05-W2-35-V3-2.1. PSM (ATCO) DLR / FRQ Comsoft
    - EXE-PJ05-W2-35-V3-2.1.1 RTS (ATCO and SUP) DLR / FRQ/ON / PANSA
  - EXE-PJ05-W2-35-V3-2.2 RTS (ATCO) NATMIG/COOPANS
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  - EXE-PJ05-W2-35-V3-2.5 RTS (ATCO) DFS / FRQ / THALES

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The results collected have been used to draft requirements and recommendations to mitigate the identified issues or to ensure the identified benefits. Most of the identified requirements and recommendations are then also included in the Part I of SPR-INTEROP/OSED.

Recommendations and requirements validated at V3 level in previous phase have not been included in this HPAR.

The V3 phase is considered closed for the solution 35.

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2 Introduction

2.1 Purpose of the document

The purpose of this document is to describe the HP issues, mitigations, HP objectives, the HP activities and derived HP recommendations and requirements according to the Human Performance (HP) assessment process [1] . This document forms the V3 HP report for solution PJ05.35.

2.2 Intended readership

The intended audience and readership for this document is primarily all the partners involved in SESAR 2020, PJ05 addressing solution 35.

Stakeholders are to be found among:

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

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2.3 Structure of the document

The document includes the following sections:

- Executive Summary
- Introduction
- The Human Performance Assessment
- Appendix B – HP Recommendations Register
- Appendix C – HP Requirements Register

2.4 Acronyms and Terminology

Term	Description
Human Factors (HF)	HF is used to denote aspects that influence a human's capability to accomplish tasks and meet job requirements. These can be external to the human (e.g. light & noise conditions at the work place) or internal (e.g. fatigue). In this way, "Human Factors" can be considered as *focussing on the variables that determine Human Performance*.
Human Performance (HP)	HP is used to denote the human capability to successfully accomplish tasks and meet job requirements. In this way, "Human Performance" can be considered *as focussing on the observable result of human activity in a work context*. Human Performance is a function of Human Factors (see above). It also depends on aspects related to Recruitment, Training, Competence, and Staffing (RTCS) as well as Social Factors and Change Management.
HP activity	An HP activity is an evidence-gathering activity carried out as part of Step 3 of the HP assessment process. An HP activity can relate to, among others, task analyses, cognitive walkthroughs, and experimental studies.
HP argument	An HP argument is an HP claim that needs to be proven through the HP Assessment Process.
HP assessment	An HP assessment is the documented result of applying the HP assessment process to the SESAR Solution-level. HP assessments provide the input for the HP case.
HP assessment process	The HP assessment process is the process by which HP aspects related to the proposed changes in SESAR are identified and addressed. The development of this process constitutes the scope of Project 16.04.01. It covers the conduct of HP assessments on the Solution-level as well as the HP case building over larger clusters of Solutions.
HP benefit	An HP benefit relates to those aspects of the proposed ATM concept that are likely to have a positive impact on human performance.

HP case	An HP case is the documented result of combining HP assessments from Solutions into larger clusters (SESAR Projects, deployment packages) in SESAR.
HP issue	An HP issue relates to those aspects in the ATM concept that need to be resolved before the proposed change can deliver the intended positive effects on Human Performance.
HP impact	An HP impact relates to the effect of the proposed solution on the human operator. Impacts can be positive (i.e. leading to an increase in Human Performance) or negative (leading to a decrease in Human Performance).
HP recommendations	HP recommendations propose means for mitigating HP issues related to a specific operational or technical change. HF recommendations are proposals that require additional analysis (i.e. refinement and validation). Once this additional analysis is performed, HF recommendations may be transformed into HF requirements.
HP requirements	HP requirements are statements that specify required characteristics of a solution from an HF point of view. HP requirements should be integrated into the DOD, OSED, SPR, or specifications. HF requirements can be seen as the stable result of the HF contribution to the Solution, leading to a redefinition of the operational concept or the specification of the technical solution.

Table 1: Acronyms and terminology

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3 The Human Performance Assessment Process: Objective and Approach

The purpose of the HP assessment process described in detail in [1] is to ensure that HP aspects related to SESAR technical and operational developments are systematically identified and managed. The SESAR HP assessment process uses an 'argument' and 'evidence' approach. An HP argument is an 'HP claim that needs to be proven'. The aim of the HP assessment is to provide the necessary 'evidence' to show that the HP arguments impacted have been considered and satisfied by the HP assessment process. This includes the identification of HP requirements and recommendations to support the design and development of the concept.

The HP assessment process is a four-step process. Figure 1 provides an overview of these four steps with the tasks to be carried out and the two main outputs (i.e. HP plan and HP assessment report).

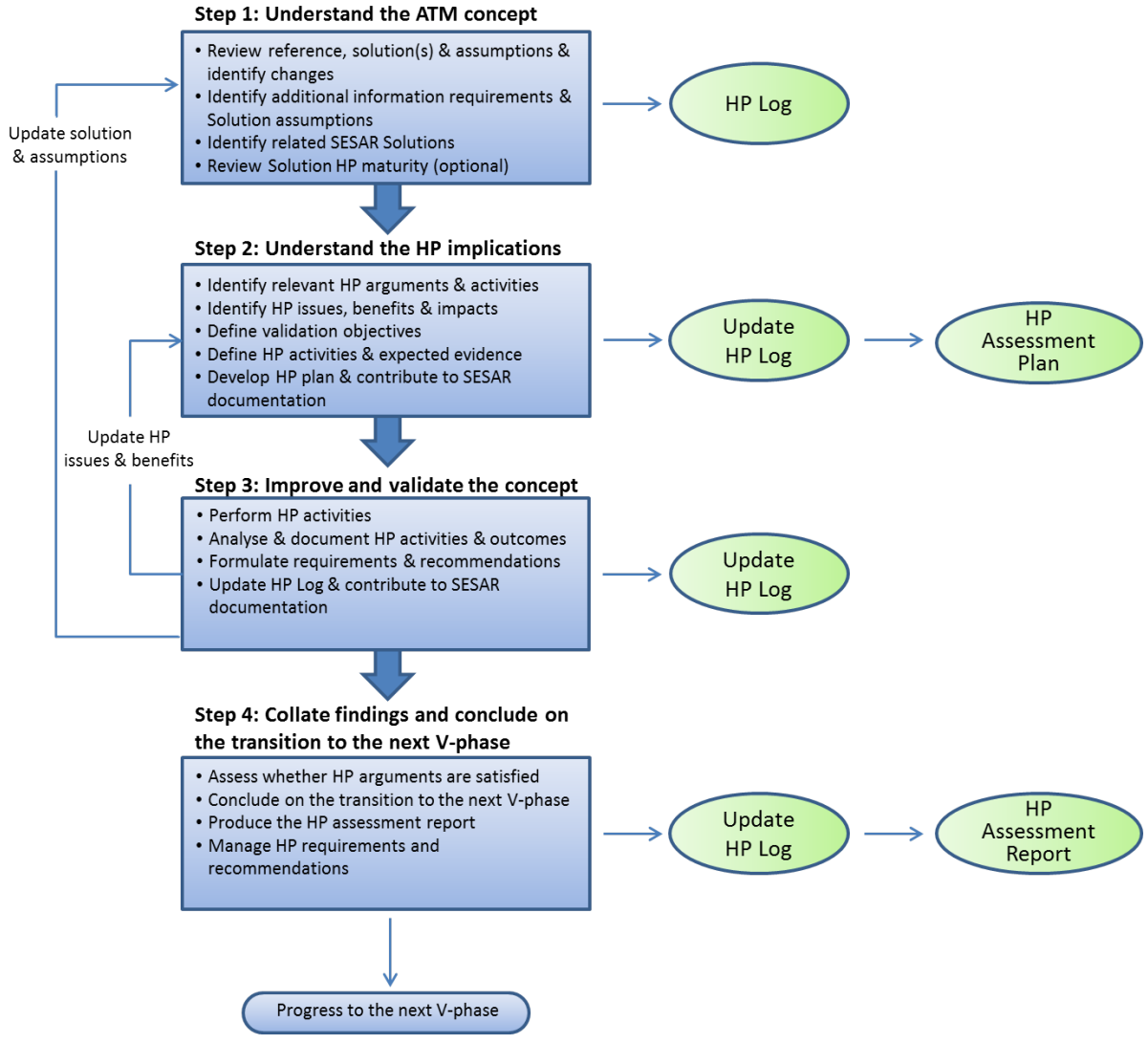

Figure 1: Steps of the HP assessment process

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Throughout the HP assessment process, the HP experts collaborate with the other Transversal Areas (TAs) in order to ensure that there is no overlap between the objectives defined or that there are no issues/benefits that have not been considered. Safety is one of the TAs with whom the HP experts interact the most, from identifying the list of changes and activities that will be included in the HP Plan to conducting joint workshops following the validation exercises. A detailed overview of the synergies with other TAs can be found in the HP reference Material [1].

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4 Human Performance Assessment

4.1 Step 1 Understand the ATM concept

4.1.1 Description of reference scenario

The reference scenario is described in the PJ05.35 W2 OSED and is the Remotely Provided Air Traffic Service for Multiple Aerodromes validated at V3 maturity level in SESAR 2020 W1 PJ05.02.

PJ.05-02 has validated a MRTM with a fixed allocation that allows the ATCO to maintain situational awareness for 2 or 3 airports simultaneously with the following traffic characteristics (including mix of IFR and VFR):

- 2 small airports (corresponding to the PJ.20 Operation environment description for a 'Small Airport Operating Environment') with up to 20 movements/hour in total for all airports.
- 3 other airports (corresponding to the PJ.20 Operation environment description for an 'Other Airport Operating Environment') with up to 15 movements/hour in total for all airports.

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

Providing ATS to more than one airport by one AFISO/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.

When providing ATS to multiple aerodromes from an MRTM requirements to share or duplicate features required for the provision of ATS to more than one aerodrome are to be taken into consideration.

Technical enablers, AVFs, communications, radar displays and other features/function to assist with the provision of ATS should be integrated and shared between aerodromes when possible. Other required key features such as the strip bay etc. require duplication 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 for the constant monitoring of each aerodrome. The screens will display each aerodrome simultaneously and continue to do so even when the AFISO/ATCO is managing traffic to one specific aerodrome. It is vitally important that the operator is, at all times, able to distinguish which aerodrome they are currently operating and which aerodrome any single set of displays or peripherals are linked to.

EATMA defined roles involved in the reference scenarios are:

- Tower Clearance Delivery Controller
- Tower Ground Controller
- Tower Runway Controller

These roles are combined in one single role assigned to the AFISO/ATCO providing ATS at the MRTM.

Figure below provides some examples of aerodrome distribution for Remotely Provided Air Traffic Service for Multiple Aerodromes in normal conditions or in high workload conditions. Once the MRTM configuration has been set, it cannot be dynamically changed.

There is a fixed allocation of airports to a set of MRTMs. However, in case of ATCO 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.

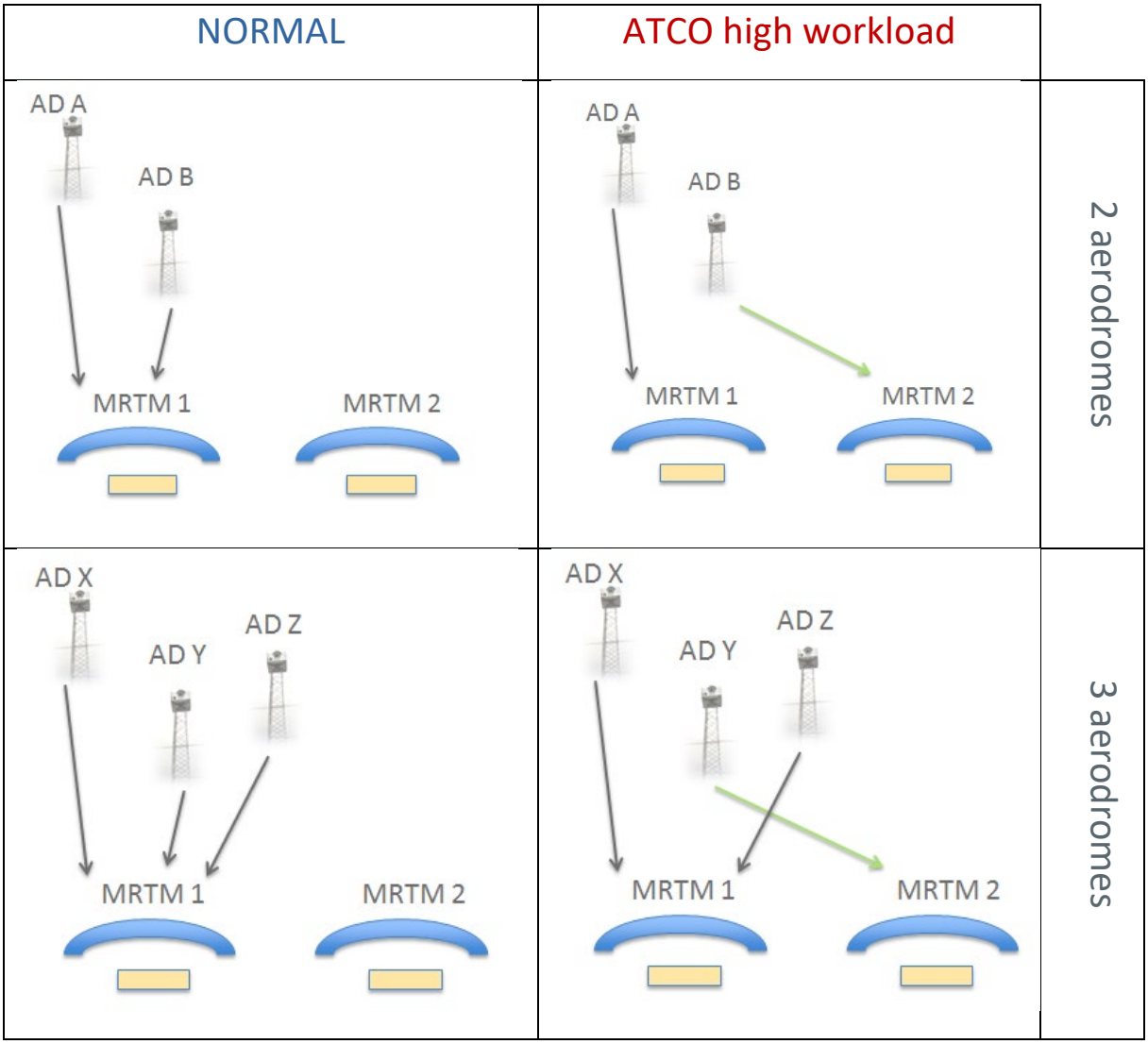

Figure 2 Example image of aerodrome distribution for ATCO high workload for 2 or 3 aerodromes

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4.1.2 Description of solution scenario

The solution scenario is the Multiple Remote Tower and Remote Tower Centre that is described in the PJ05.35 W2 OSED [3] and aims at providing remote tower control for multiple aerodromes simultaneously and by one ATCO.

The objective of solution 35 is to increase ATCO productivity (i.e. reduce the number of ATCOs required) by better balancing the workload between different MRTMs within a Remote Tower Centre. This will be achieved by a flexible allocation of grouped aerodromes to dedicated MRTMs supported by a Remote Tower Centre Supervisor role (RTC supervisor) and a Supervisor Planning Tool.

Such a flexible allocation of aerodromes in the MRTM implies that one aerodrome can take different display slots/positions within MRTMs (e.g. aerodrome A is at the left position of the MRTM (1) in the morning and after a transfer to another MRTM (2) is received back at the right part of the MRTM (1)).

All issues that could impact 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 to be kept at the level defined in the scope of the solution 35 while taking into account other factors such as traffic complexity and required efforts for providing simultaneous ATS caused by the aerodrome layouts complexity, (e.g. backtracking vs taxi ways).

- The workload could be reduced by extended automation support.

The full range of ATS should be offered in such a way that the possible 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.

As for the reference scenario, technical enablers, AVFs, communications, radar displays and other features/function to assist with the provision of ATS shall have varying degrees of integration and sharing between aerodromes. Features that are required continuously (such as the strip bay etc.) require duplication 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.

As for the reference scenario, the provision of ATS to more than one aerodrome will be made possible by the provision of visual presentations that allow for the constant monitoring of each aerodrome. The screens will display each aerodrome simultaneously and continue to do so even when the ATCO is managing flights to one specific aerodrome while no traffic or no movements are on the other aerodromes. It is vitally important that the operator is, at all times, able to distinguish which aerodrome they are currently operating and which aerodrome any single set of displays or peripherals are linked to.

As for the reference scenario, EATMA defined roles involved in the solution scenarios are:

- Tower Clearance Delivery Controller
- Tower Ground Controller
- Tower Runway Controller

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- Optional (including combined TWR/APP) Approach Controller

These roles are combined in one single role assigned to the air traffic controller providing ATS at the MRTS.

In addition to these roles, a new role is introduced for PJ05.35: the RTC supervisor role the task of the flexible allocation of grouped aerodromes to dedicated MRTMs should be assigned to a specific role, depending on the complexity of the flexible allocation.

RTC Supervisor is responsible for the operational supervision of the remote tower center. This role may be filled by an ATCO with dedicated license and training or alternatively may be a distinct position with an endorsement for the task.

In order to enable an efficient allocation, it is assumed that the RTC supervisor will be supported with a support tool (Supervisor Planning Tool) that incorporates data like traffic volume/complexity and weather conditions at the different airports as well as ATCO endorsements and availability.

The balance of traffic load for the ATCO can be assured in time with the support of ATCO planning tools and RTC planning tools for the supervisor. It will help in the decision making on when to transfer airports between MRTMs. It will also help in the decision on which airports to combine when there is a choice in doing so, taking into consideration suitable airport combinations and ATCO endorsements or other priorities depending on local specifications.

The number of endorsements an ATCO can keep sets the limit of how airports can be 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 below shows feasible grouping of different aerodromes in two separate clusters (up to 4 aerodromes on each) within one RTC.

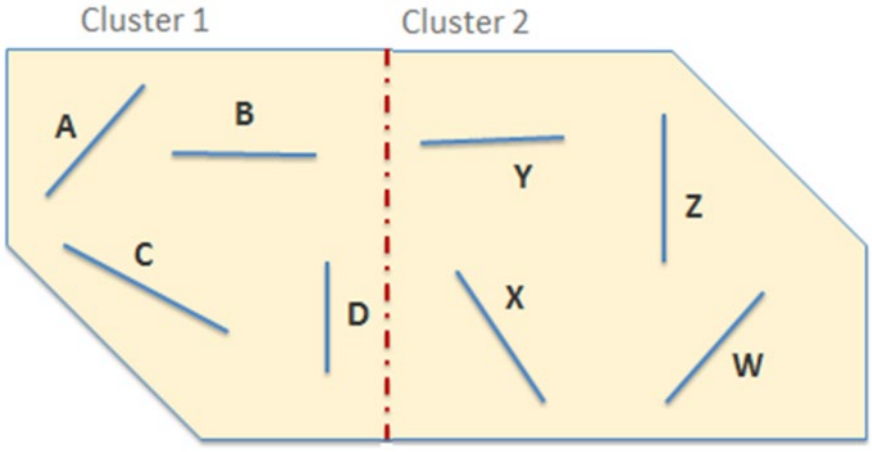

Figure 3 Airport cluster configurations in a RTC (see OSED)

Images below adds view on how an RTC with a flexible allocation of aerodromes could work:

- Four different aerodromes are flexibly allocated between two MRTMs in the one RTC

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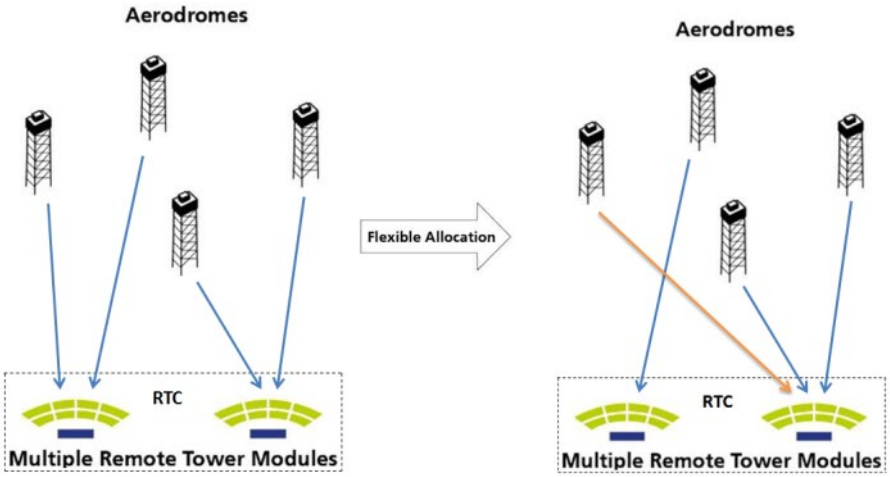

Figure 4 Flexible allocation of aerodromes to MRTM´s in RTC (see OSED)

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

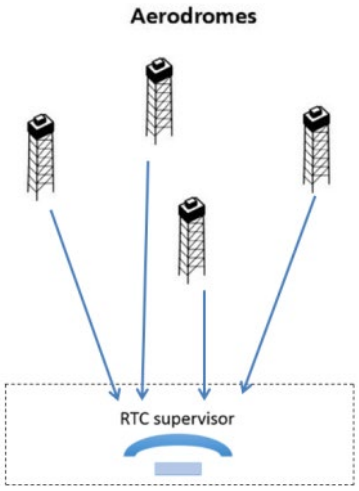

Figure 5 RTC Supervisor role with data from all connected airports (see OSED)

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

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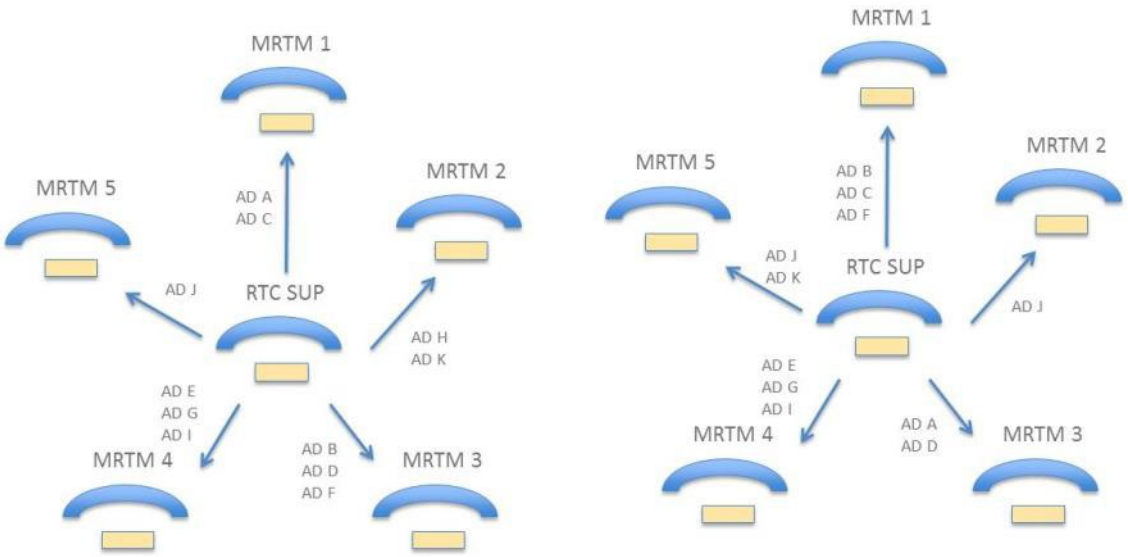

Figure 6 Aerodrome allocation examples within an RTC (see OSED)

The Real Time Simulations address in PJ05.35, in general, a setup with two MRTMs, each providing the capability to allocate 3 aerodromes at a time within each MRTM. Taking this into account, aerodromes could be allocated as follows:

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

HPAP will consider the capability to allocate:

- Up to 3 aerodromes at a time within each MRTM in line with RTS validation exercises' scope (3 simultaneous aerodromes managed by one single ATCO)
- Up to 4 aerodrome endorsements for a single ATCO. This also states the limit of the number of aerodromes that can be flexibly allocated within a cluster (a group of 4 aerodromes can be flexibly relocated for each cluster)
- Up to 2 clusters of aerodromes assigned to the remote tower centre in the validation exercises: even if this number is not the limit for the RTC, validation exercises will test up to this limit (up to 8 aerodromes simultaneously supervised by one single RTC supervisor)
- Up to 4 clusters of aerodromes considered by the RTC supervisor tool (up to 16 simultaneous aerodromes considered by the RTC supervisor tool).

4.1.3 Consolidated list of assumptions

The following table summarises the consolidated assumptions agreed in PJ05.03 [4] and reviewed for PJ05.35

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Assumptions Title and Description	Source
PJ05.35 W2 Remotely Provided Air Traffic Service for Multiple Aerodromes as reference scenario	
• Provision of remote ATS for a single aerodrome and for Multiple Aerodromes without flexible allocation is already available, i.e. ATCOs are used to providing ATS from a MRTM	W1-PJ05-02 W1-PJ05-03
Operating Methods / Traffic Characteristics	
• The remote provision of ATS for multiple aerodromes is applicable to aerodromes with simultaneous traffic at the different airports	W1-PJ05-02 W1-PJ05-03
• Different airport layout usage configurations at the controlled airports (e.g. different runway configuration, different views on the runway) are possible	W1-PJ05-02 W1-PJ05-03
• The operational procedure/protocol for transfer of one airport between two ATCOs is developed	
Weather Conditions	
• Different visibility conditions might occur at the controlled airports (resulting in different operational procedures e.g. different CAT/VIS conditions, night and daytime)	W1-PJ05-02 W1-PJ05-03
• Different wind conditions might occur at the controlled airports	W1-PJ05-02 W1-PJ05-03
Remote Tower Modules within an RTC	
• A unified Multiple Remote Tower Module (MRTM) solution will be developed and implemented (rather than different or even bespoke solutions) within an RTC.	W1-PJ05-02 W1-PJ05-03
• The minimum set of same systems are available at all controlled airports (i.e. air surveillance, electronic flight strips) and the HMIs of the systems of the controlled airports are harmonised	W1-PJ05-02 W1-PJ05-03
Allocation of airports to one MRTM can be:	
• fixed to MRTM, i.e. no change, and is already available	W1-PJ05-02
• flexible to MRTM, i.e. changing at certain times (short term planning) or due to emergencies and is already available	W1-PJ05-02 W1-PJ05-03
• dynamic, i.e. changing depending on traffic demand (long term planning), which requires a supervisor role	W1-PJ05-03

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Human actors are:	
• ATCO: one single ATCO for one MRTM, i.e. no workshare between two MRTMs	W1-PJ05-02 W1-PJ05-03
• RTC Supervisor	W1-PJ05-03
Training/ Licensing:	
• Controllers are familiar with the operating environment and tools	W1-PJ05-02 W1-PJ05-03
• ATCO can hold endorsements for up to 4(single) different airports harmonised in terms of systems and procedures	W1-PJ05-02 W1-PJ05-03

Table 2 Consolidated list of assumptions

4.1.4 List of related SESAR Solutions to be considered in the HP assessment

PJ05.35 W2 takes into account the work performed in SESAR 2020 W1 PJ5.02 [7] and PJ05.03 [4] (based on SESAR 1 in Project 06.09.03 [5]). This HP assessment plan documents the human performance activities planned for the solution PJ05-35 to address the maturity phase V3.

The PJ5.02 [7] and PJ05.03 [4][10] HP assessment plans [4]and the PJ05.02 (for V3) [8] and PJ05.03 (for V2) [9] Validation Reports are taken into account, including recommendations and requirements.

4.1.5 Identification of the nature of the change

The following table collects the changes on Human Performance Arguments areas (Roles and Responsibilities, Human and Systems, Teams & Communication, HP Related Transition Factors) introduced by PJ05.35. The changes were identified in V2 PJ05.03[10] and carried forward into the V3 current phase.

HP argument branch	Change & affected actors
1. ROLES & RESPONSIBILITIES	
1.1 ROLES & RESPONSIBILITIES	EATMA defined roles involved in the solution scenarios are: • Tower Clearance Delivery Controller • Tower Ground Controller • Tower Runway Controller These roles are combined in one single role assigned to the air traffic controller providing ATS at the MRTS. In addition to these roles, a new role is introduced for PJ05.35: the RTC supervisor role as the task of the flexible allocation of grouped aerodromes to dedicated MRTMs must be allocated to a specific role, depending on the complexity of the flexible

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	allocation. This role can also be held by one of the ATCOs responsible of one of the MRTMs in the RTC, depending on the complexity of the operational environment. ATCO will be responsible for providing ATS to more than one aerodrome in parallel and up to 3 aerodromes simultaneously. RTC supervisor will be responsible to supervise the clusters of aerodromes assigned to the RTC. The number of aerodromes a supervisor can be responsible for depends on how the role is locally defined (i.e., which tasks is the supervisor responsible for): In certain centres / countries the supervisor might have a more active supporting role (in which case he also needs the licences of the airports) whereas in others centres the supervisor role might be a more "administrative" role. However, the supervisor is anyway responsible for the flexible allocation of aerodromes between modules and for initiating the transfer procedure. Any tasks that have to be performed at the aerodrome will be performed by personnel located on-site at the aerodrome. The supervisor is responsible for planning resource and aerodrome allocation and the supervisor will facilitate the transition of aerodromes to different MRTMs, monitoring all conditions (e.g. weather conditions, status of RTC and aerodromes, responsibilities between different MRTMs within RTC etc.). An ATCO should also be able to request a transfer (even if he/she is not holding the RTC supervisor role). ATCO should have the final decision in when/whether the handover takes place. Spare ATCOs should be available at the remote-control centre. The number of spare ATCOs depends on the number of endorsements.
1.2 OPERATING METHODS	The operating methods as such do not change for each airport, however an ATCO might work simultaneously on different airport with different operational modes (e.g. LVP at only one airport). New operating methods are expected to be locally established to define the operational procedure to transfer the aerodromes between the different MRTMs available at the RTC: • the RTC supervisor, supported by the supervisor planning tool, needs to plan the allocation of aerodromes during the day and need to initiate a transfer of an aerodrome from an MRTM to another ahead when an increase of requested movements on one/or several aerodromes for an ATCO in a MRTM is expected • The ATCO is expected to receive instructions from the RTC supervisor about the changes in the allocation of aerodromes and is expected to initiate the transfer to

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	another MRTM, passing the control of the aerodrome to another ATCO. ATCO can also request for a transfer of aerodrome in case of need The operational methods for the Supervisor related to transition period (shifting an airport to another MRTM) and to the support tool (planning tool) have to be locally defined. In nominal conditions the transfer procedure should be initiated in low load period. In case of an emergency, the airport with the emergency shall be isolated if feasible. Operating procedure for the handover should foresee a period dedicated to the monitoring (also of the frequency) before the actual handover and a coordination between the ATCOs: the receiving ATCO should describe the situation and sending ATCO should confirm the acceptance. This operating procedure is expected to be supported by dedicated checklist locally defined.
1.3 TASKS	The ATCOs will be providing ATS for one or more aerodromes in parallel, so the individual tasks may not change significantly compared to static allocation of aerodromes to MRTM (PJ05.02) RTO. However, the number of tasks an ATCO will have to perform and the working methods will change, e.g. transfer of aerodromes to another MRTM The supervisor will be responsible for managing resources on tactical level on a daily basis. Hence resource management becomes less strategic and more tactical, i.e. on a shift basis rather than over a larger period of rotations. Some aspects need further local investigations: • Complexity: Work of ATCO was over-simplified in simulation environment (management of the light system, cameras, etc.) • Fatigue: Sessions were of limited duration. Fatigue tends to accumulate and toward the end of the shift, this might form a problem.
2. HUMAN & SYSTEM	
2.1 ALLOCATION OF TASKS (HUMAN & SYSTEM)	Compared to PJ05.02 MRTM no changes in task allocation between the ATCOs and the system are currently foreseen. As for single RT automated a/c identification and tracking may be implemented to enhance ATCOs situation awareness. The new task of assignment of operators to MRTMs/ aerodromes is envisaged to be allocated to the human [i.e. Supervisor], and the workload of the Supervisor is liable to increase. Nevertheless, human actors are expected to be supported by new tools in the decision-making process:

	• RTC supervisor is expected to be supported by a supervisor planning tool to establish the flexible allocation of aerodromes to the available MRTM. • ATCO is expected to be supported by an ATCO planning tool enabling the ATCO planning and prioritizing tasks for all aerodromes connected to the MRTM beyond the horizon of 30 minutes The system may optionally support monitoring tasks that are currently performed by the ATCO (e.g. conformance monitoring, monitoring of upcoming traffic, etc.)
2.2 PERFORMANCE OF TECHNICAL SYSTEM	Compared to PJ05.02 MRTM, there are changes expected in the performance of the technical system as the systems shall allow the supervisor to flexibly establish the allocation of aerodromes to the available MRTM and the ATCO to flexibly transfer the aerodromes to other MRTMs available in the RTC. Other expected changes in the performance rely on development of an ATCO planning tool and a Supervisor planning tool. The ATCO planning tool takes into consideration a number of aerodromes assigned to each MRTM and a flexible allocation of the RTC aerodromes to the available MRTMs. The simulation environment will consider up to 3 aerodromes for each MRTM. The supervisor planning tool may optionally take into consideration a number of clusters of aerodromes assigned to the RTC. Finally, for R/T communication performance different changes are expected: for some aerodromes (where relevant) speakers may be replaced by headphones, just to help reduce ambient noise in the multiple tower control room; air traffic frequencies from the different airports are expected to be coupled and flexibly allocated to the different MRTMs (e.g. airports frequencies A and B coupled and then changed to airports frequencies A, B, C coupled, etc.) while ground traffic, meaning vehicles at an aerodrome, may be coupled or not and in this last case may call for communication via speakers preferably situated in the MRTM to facilitate the notion from which aerodrome the call is coming from. Additionally, there might be the need for an alerting system to draw the attention of the ATCO to a certain airport under certain conditions e.g. aerodrome highlighted in case of communication; alerts for a pre-defined area. There should be a system tracking how much time the ATCO works on each airport to automatically monitor and ensure that the minimum required amount of hours (and therefore the endorsement) is maintained. EFS is minimum requirement for the CWP. Handover procedure may be supported by the technical system in silent transfer and acceptance of the split and merge

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	(without the need for a call).
2.3 HUMAN – MACHINE INTERFACE	When providing ATS to more than one aerodrome the ATCOs HMI will be configured so that the two (or more) aerodromes can be monitored & controlled by one ATCO. As PJ05.35 proposes the flexible allocation of aerodromes to the different MRTM, the HMI is expected to support the flexible transfer and switch of aerodromes between the different MRTM. Flexibility of the airport positions within the modules shall be available for the ATCO with use-friendly HMI to support the ATCO in maintaining SA (e.g. avoiding complex interactions to positioning a specific aerodrome in the desired position; automatic resize according to the available screen). Furthermore, as for PJ05.02 MRTM operations, additional information/ support tools may be added to support the ATCOs work e.g. automatic a/c identification & tracking (see HP assessment for single in SESAR). The ATCO may be provided with a visual indication of which aerodrome an incoming radio transmission is related to. The visual indications may be customisable and switched on-off on ATCO's request The CWP in the MRTM will display information & the OTW view will be displayed via visual reproduction (as is done for the single RTO) for each of the aerodromes being controlled by an ATCO. The actual design / setup of the CWP has not been decided at this stage (i.e. how to organise the HMIs / CWP to optimise ATCO performance and minimise the potential for error). The role of flexible allocation emphasizes this matter as it may happen that e.g. aerodrome A is at the left position of the MRTM (1) in the morning and after a transfer to another MRTM (2) is received back at the right part of the MRTM (1). The supervisors may require more information to support him/her with the additional tasks e.g. tactical resource management, slot co-ordination and transition of aerodromes via a Supervisor planning tool. Previous work on Safety Nets should be a prerequisite: e.g. a technical barrier to prevent clearing multiple aircrafts/vehicles for one runway should be available for the ATCO. ATCO planning tool and supervisor planning tool are also expected to be integrated in CWP HMI. MET information shall be displayed to the ATCO in the displays in the scan path of the ATCO considering he/she has already a significant number of screens in front.
3. TEAMS & COMMUNICATION	
3.1 TEAM COMPOSITION	While for W1 PJ05.02 there is currently a team of ATCOs working

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	in the RTC and responsible for the different airports, in Pj05.35 solution there will be a team that is responsible for more than one airport with Multiple Remote Tower: 1 ATCO for each Remote Tower Module and 1 supervisor for the RTC (this role can also be assigned to one ATCO of the RTC where complexity allows). Depending on local decision, the team might include an additional ATCO to support one of the MRTM in service in the RTC or to flexible support the opening of an additional MRTM if needed. The supervisor role will take on more responsibility, s/he will be responsible for distributing the work and deciding which positions to open and what and how many aerodromes each ATCO will be responsible for providing ATS services. Therefore, the supervisor role will become more prominent.
3.2 ALLOCATION OF TASKS	Instead of providing ATS to static PJ05.02 MRTM allocated aerodromes, ATCO will be expected to provide ATS to two or more aerodromes flexibly allocated during the working hours. However, the tasks the ATCOs will be required to do in order to provide ATS will be the same as with single RTO. The supervisor will take on additional tasks and his role will involve, as described in 3.1, deciding how many and what combination of aerodromes each ATCO can be responsible for providing ATS at a tactical level depending on traffic demands and available endorsements.
3.3 COMMUNICATION	Different changes are expected in terms of communication: frequencies are expected to be coupled between aerodromes for air traffic with flexible allocation of the coupling between MRTMs depending on the specific selected configuration, the consequences on flight crew require a dedicated assessment (flight crew on the frequencies will hear communications and clearances between ATCO and flight crew on other airports possibly affecting situation awareness, e.g. flight crew cleared to take-off at the airport A at the same time of flight crew cleared to land on the airport B) requiring the need of reinforcement of existing identification procedures between pilot, Approach and Tower Controller. Dedicated procedures for communicating the split (or merge) and aerodrome handover between the ATCOs who are sitting in two different MRTMs will need to be locally established, especially in cases with high workload –due to high traffic complexity or stemming from an abnormal scenario or system malfunction. Ground communications with vehicles might also be affected due to the flexible allocation of aerodromes between MTRMs, and procedures of communication of the changes between ATCO and ground traffic might be required. Supervisors need to have more information relating to the ATCOs workload and may require more tactical information about the

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	imminent traffic load as they will have to communicate tactical changes to resource management / allocation. Supervisors will be required to communicate with and co-ordinate more ATCOs on a shift than in current operations as they will have to tactically manage resources. The amount of communication and time on the frequency can still be a bottleneck: • Frequencies should be coupled, so pilots have to get used to hear pilots in other areas on the same frequency • Ground vehicles should have their own frequency, have to get used to the fact that the ATCO is communicating also with other airports
4. HP RELATED TRANSITION FACTORS	
4.1 ACCEPTANCE & JOB SATISFACTION	Having to dynamically, and more frequently, perform handover of aerodromes "may" impact job satisfaction (positively or negatively), also affected by the responsibility of controlling two or more airports at the same time. This may raise concerns specifically relating to safety – in particular concerns regarding whether or not ATCOs can provide a safe service if working multiple aerodromes concurrently, concerns regarding situation awareness and potential for error(e.g. Skill Based Errors, Rule Based Errors, Knowledge-based). Anyway, there might be possibilities to increase job satisfaction as work is more demanding and waiting time can be reduced. Working in teams in an MRT centre might have an impact on job satisfaction The supervisor will also be responsible for tactical resource management, potentially having an impact on job satisfaction.
4.2 COMPETENCE REQUIREMENTS	ATCO will hold ADI rating & unit endorsement (including endorsement for remote tower control) to a number of aerodromes- in this solution it is up to 4 aerodromes to enable flexible allocation. Additional skills might be needed: • Teamwork skills (TRM), depending on the context • SUP has to have a background in control tower
4.3 STAFFING REQUIREMENTS & STAFFING LEVELS	As one ATCO can provide ATS to more than one aerodrome the total number of ATCO required to provide ATS to all aerodromes in the RTC might be reduced.
4.4. RECRUITMENT AND SELECTION	No impact
4.5. TRAINING NEEDS	Based on the assumptions ATCOs can hold endorsements for up to 4 aerodromes. This may have an effect on training in terms of its length, content and complexity.

	ATCO will need to be trained to operate different aerodrome combinations; as well as to tactically receive new aerodromes to operate or handover aerodrome(s) to another operator/RTM. Procedures and working methods associated with the cooperation with the supervisor will also need to be part of the training

Table 3: Description of the change

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4.2 Step 2 Understand the HP implications

4.2.1 Identification of relevant arguments, HP issues & benefits and HP activities

All the HP Issues/ Benefits are considered as GROUND ATM scope. All the HP OBJ are considered Validated. The following table summarise the relevant arguments, HP issues & benefits and HP activities.

Argument	HP issue/ benefit ID	HP issue / benefit	Status	Potential mitigation to the HP issue	Source	HP/ validation objectives ID	Objectives	Addressed by	HP activity/is	Success criteria ID	Expected evidence (Success criteria)
Arg. 1.1.2:The description of roles & responsibilities cover all tasks to be performed by a human actor.	W2.PJ05.35_Is.1.1.2-1	The description of the roles & responsibilities does not cover all tasks to be performed by a human actor	Closed	To ensure the roles and responsibilities cover all tasks to be performed by human actor	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H07	Assess ATCO acceptance of roles and responsibilities when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H07.010	Majority of ATCOs assess that changes to ATCOs roles and responsibilities introduced by the multiple remote tower concept are clear, consistent, stable and acceptable when working in

											a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H10	Assess Supervisor acceptance of roles and responsibilities when supporting provision of ATS to multiple aerodromes	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H10.010	Majority of Supervisors assess that changes to their roles and responsibilities introduced by the multiple remote tower concept are clear, consistent, stable and acceptable.
Arg. 1.1.3: Roles and responsibilities are clear and consistent (in	W2.PJ05.35_Is.1.1.3-1	Roles & responsibilities are not clear & consistent	Closed	To ensure the roles are clear and consistent	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H07	Assess ATCO acceptance of roles and responsibilities when providing ATS to multiple	COOPANS INDRA/ AVINOR - INDRA/ HC ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H07.010	Majority of ATCOs assess that changes to ATCOs roles and responsibilities introduced by the multiple

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V1: non-contradictory).							aerodromes				remote tower concept are clear, consistent, stable and acceptable when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H10	Assess Supervisor acceptance of roles and responsibilities when supporting provision of ATS to multiple aerodromes	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H10.010	Majority of Supervisors assess that changes to their roles and responsibilities introduced by the multiple remote tower concept are clear, consistent, stable and acceptable.

Arg. 1.2.1: Operating methods cover operations in normal operating conditions.	W2.PJ05.35_Is.1.2.1-1	Operating methods do not cover all operations in normal operating condition	Closed	To ensure efficient operating methods are established and cover all operations in normal operating condition	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H09	Assess Supervisors acceptance of operating methods when supporting provision of ATS to multiple aerodromes	COOPANS DLR INDRA/ AVINOR - INDRA/ HC ENAV	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H09.010	Majority of SUPs assess that operating methods can be applied in an accurate, efficient and timely manner in normal and abnormal operating conditions and degraded modes when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H06	Assess ATCOs acceptance of operating methods when providing ATS to	COOPANS INDRA/ AVINOR - INDRA/ HC - DFS	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H06.010	Majority of ATCOs assess that operating methods can be applied in an accurate,

							multiple aerodromes	ENAV DLR			efficient and timely manner in normal and abnormal operating conditions and degraded modes when working in a RTC with a flexible allocation of aerodromes between MRTMs
Arg. 1.2.1: Operating methods cover operations in normal operating conditions.	W2.PJ05.35_Is.1.2.1-2	Operating methods might not be appropriate to control the required traffic volume in normal operating conditions	Closed		W1-PJ05.03						
Arg. 1.2.1: Operating	W2.PJ05.35_Is.1.2.1-4	Operating methods for transferrin	Closed	To ensure efficient operating methods are established and cover all operations in normal operating condition	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H09	Assess Supervisors acceptance of	COOPANS DLR INDRA/	RTS WS PSM	CRT-PJ05-W2-35-	Majority of SUPs assess that operating

methods cover operations in normal operating conditions.		g/assuming control of aerodromes from one MRTM to another are not clear or efficient. Transferring/assuming an aerodrome at an MRTM might increase workload depending on traffic volumes and traffic complexity.					operating methods when supporting provision of ATS to multiple aerodromes	AVINOR - INDRA/ HC ENAV		V3-VALP-H09.010	methods can be applied in an accurate, efficient and timely manner in normal and abnormal operating conditions and degraded modes when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H06	Assess ATCOs acceptance of operating methods when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H06.010	Majority of ATCOs assess that operating methods can be applied in an accurate, efficient and timely manner in normal and

											abnormal operating conditions and degraded modes when working in a RTC with a flexible allocation of aerodromes between MRTMs
Arg. 1.2.1: Operating methods cover operations in normal operating conditions.	W2.PJ05.35_Is.1.2.1-5	Different aerodromes have different procedures and different characteristics. This may add confusion, increase the amount of information ATCOs have to remember, and as a consequence increase the	Closed		W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H09	Assess Supervisors acceptance of operating methods when supporting provision of ATS to multiple aerodromes	COOPANS DLR INDRA/AVINOR - INDRA/HC ENAV	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H09.010	Majority of SUPs assess that operating methods can be applied in an accurate, efficient and timely manner in normal and abnormal operating conditions and degraded modes when working in a RTC with

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		potential for human error. This could have an impact at the system level on safety									a flexible allocation of aerodromes between MRTMs
Arg. 1.2.2: Operating methods cover operations in abnormal operating conditions.	W2.PJ05.35_Is.1.2.2-1	Operating methods do not cover all operations in abnormal conditions (like in emergency situations)	Closed	To ensure efficient operating methods are established and cover abnormal conditions	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H06	Assess ATCOs acceptance of operating methods when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H06.010	Majority of ATCOs assess that operating methods can be applied in an accurate, efficient and timely manner in normal and abnormal operating conditions and degraded modes when working in a RTC with a flexible allocation of aerodromes between MRTMs

						OBJ-PJ05-W2-35-V3-VALP-H06	Assess ATCOs acceptance of operating methods when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H06.010	Majority of ATCOs assess that operating methods can be applied in an accurate, efficient and timely manner in normal and abnormal operating conditions and degraded modes when working in a RTC with a flexible allocation of aerodromes between MRTMs
Arg. 1.2.4:The content of operati	W2.PJ05.35_Is.1.2.4-1	The content of the operating methods is unclear &	Closed	To ensure operating methods are clear and consistent	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H09	Assess Supervisors acceptance of operating methods	COOPANS DLR INDRA/ AVINOR -	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP	Majority of SUPs assess that operating methods can be

ng methods is clear and consistent (in V1: non-contradictory).		contradictory.					when supporting provision of ATS to multiple aerodromes	INDRA/ HC ENAV		- H09.010	applied in an accurate, efficient and timely manner in normal and abnormal operating conditions and degraded modes when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H06	Assess ATCOs acceptance of operating methods when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP - H06.010	Majority of ATCOs assess that operating methods can be applied in an accurate, efficient and timely manner in normal and abnormal operating

											conditions and degraded modes when working in a RTC with a flexible allocation of aerodromes between MRTMs
Arg. 1.2.5: Operating methods can be followed in an accurate, efficient and timely manner.	W2.PJ05.35_Is.1.2.5-1	The operating methods cannot be followed in an accurate, efficient and timely manner	Closed	To ensure the operating method can be followed in an accurate efficient and timely manner	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H09	Assess Supervisors acceptance of operating methods when supporting provision of ATS to multiple aerodromes	COOPANS DLR INDRA/AVINOR - INDRA/HC ENAV	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H09.010	Majority of SUPs assess that operating methods can be applied in an accurate, efficient and timely manner in normal and abnormal operating conditions and degraded modes when working in a RTC with a flexible allocation

											of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H06	Assess ATCOs acceptance of operating methods when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H06.010	Majority of ATCOs assess that operating methods can be applied in an accurate, efficient and timely manner in normal and abnormal operating conditions and degraded modes when working in a RTC with a flexible allocation of aerodromes between MRTMs
Arg. 1.3.1:The	W2.PJ05.35_Is.1.3.1-1a	ATCO might confuse	Closed		W1-PJ05.03						

potential for human error is reduced as far as possible.		displayed airports when searching for flights (search in wrong display) as some information is displayed in a combined HMI integrating the different airports or as information is displayed only temporarily.									
Arg. 1.3.1:The potential for human error is reduced as far as	W2.PJ05.35_Is.1.3.1-1b	SUP might confuse displayed airports when searching for flights (search in wrong display) as some	Closed	To ensure SUP is provided with appropriate identification means of displayed airport	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H01	Assess SUP situation awareness when working in a RTC	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS	CRT-PJ05-W2-35-V3-VALP-H01.010	Majority of SUPs state that situation awareness is at an acceptable level when working in a RTC with a flexible

possible.		information is displayed in a combined HMI integrating the different airports or as information is displayed only temporarily.									allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H01	Assess SUP situation awareness when working in a RTC	INDRA/ AVINOR - INDRA/ HC DLR	RTS	CRT-PJ05-W2-35-V3-VALP-H01.040	Majority of SUP confirm that they maintain an adequate level of SA, despite having to divide their attention to different clusters of aerodromes
						OBJ-PJ05-W2-35-V3-VALP-H12	Assess usability and utility of Supervisor human machine interface when supporting provision of ATS to multiple aerodromes	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H12.050	The SUP human machine interface does not increase the potential for human error

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						OBJ-PJ05-W2-35-V3-VALP-H18	Assess that human-machine interface supports the team in carrying out their tasks	COOPANS ENAV INDRA/AVINOR - INDRA/HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H18.010	Technical System/HMI support ATCOs and SUP when working in a RTC with a flexible allocation of aerodromes between MRTMs.
						OBJ-PJ05-W2-35-V3-VALP-H01	Assess SUP situation awareness when working in a RTC	COOPANS ENAV INDRA/AVINOR - INDRA/HC DLR	RTS	CRT-PJ05-W2-35-V3-VALP-H01.030	Majority of SUPs confirm that the user interface design supports a sufficient level of individual situation awareness
Arg. 1.3.1:The potential for human error is reduced as far as	W2.PJ05.35_Is.1.3.1-2	Wrong procedures applied to wrong APT. If an ATCO confuses the aerodromes she/he may	Closed		W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H02.040	ATCO maintain an adequate level of SA, despite having to divide their attention to several airports

possible.		provide erroneous control actions. Safety implications.									with different procedures and characteristics (geographical area, urban infrastructure, weather conditions etc.)
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.050	The ATCO human machine interface does not increase the potential for human error
Arg. 1.3.1:The potential for human error is reduced as far	W2.PJ05.35_Is.1.3.1-4	ATCOs confuse geographical local details of two airports. Pilots refer often to	Closed		W1-PJ05.03						

as possible.		local geographic positions, therefore the ATCO needs to be aware of the local geographical details for all aerodromes they are controlling.									
Arg. 1.3.1:The potential for human error is reduced as far as possible.	W2.PJ05.35_Is.1.3.1-5	ATCO might confuse / have difficulty to find the information for an a/c as some information is displayed in a combined HMI integrating the different airports or as information is	Closed		W1-PJ05.03						

		displayed only temporarily									
Arg. 1.3.1:The potential for human error is reduced as far as possible.	W2.PJ05.35_Is.1.3.1-6	Confusion related to phraseology	Closed		W1-PJ05.03						
Arg. 1.3.1:The potential for human error is reduced as far as possible.	W2.PJ05.35_Is.1.3.1-7	ATCO might confuse aerodromes, or aerodromes characteristics, when switching between different aerodromes and/or aerodromes arrangements within the RTM	Closed	To ensure ATCO is provided with appropriate identification means of displayed airport and airport characteristics	W2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H02.010	Majority of ATCOs state that situation awareness is at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness	COOPANS INDRA/AVINO	RTS PSM	CRT-PJ05-W2-35-	ATCOs confirm that the user

							when providing ATS to multiple aerodromes	R - INDRA/ HC - DFS ENAV DLR		V3-VALP-H02.030	interface design supports a sufficient level of situation awareness
						OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H02.040	ATCO maintain an adequate level of SA, despite having to divide their attention to several airports with different procedures and characteristics (geographical area, urban infrastructure, weather conditions etc.)
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine	COOPANS INDRA/ AVINOR - INDRA/	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP	Majority of ATCOs asses that they have all required information

							interface when providing ATS to multiple aerodromes	HC - DFS ENAV DLR		- H11.010	easy to access and presented in an effective way.
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS DLR ENAV INDRA/AVINOR - INDRA/HC - DFS	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP - H11.070	Majority of ATCOs confirm there is no confusion about which aerodromes are displayed on which display
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP - H11.050	The ATCO human machine interface does not increase the potential for human error
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility	COOPANS ENAV	RTS WS PSM	CRT-PJ05-W2-	Majority of ATCOs confirm

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							of ATCO human machine interface when providing ATS to multiple aerodromes	INDRA/ AVINOR - INDRA/ HC DLR		35-V3-VALP-H11.080	there is no confusion about which aerodrome will be transferred between the MRTMs.
Arg. 1.3.2: Tasks can be achieved in a timely manner.	W2.PJ05.35_Is.1.3.2-1	SUP tasks cannot be achieved in a timely manner. Resulting in operator stress (with tasks stacking up and requiring recall) leads to increased human error probabilities and consequences. At system level could impact efficiency and safety	Closed	To ensure SUP is provided with appropriate identification means od displayed airport	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H01	Assess SUP situation awareness when working in a RTC	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS	CRT-PJ05-W2-35-V3-VALP-H01.020	Majority of SUPs state that they can prioritise tasks
						OBJ-PJ05-W2-35-V3-VALP-H12	Assess usability and utility of Supervisor human machine interface when supporting provision of ATS to multiple aerodromes	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H12.050	The SUP human machine interface does not increase the potential for human error

						OBJ-PJ05-W2-35-V3-VALP-H18	Assess that human-machine interface supports the team in carrying out their tasks	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H18.010	Technical System/HMI support ATCOs and SUP when working in a RTC with a flexible allocation of aerodromes between MRTMs.
Arg. 1.3.2: Tasks can be achieved in a timely manner.	W2.PJ05.35_Is.1.3.2-3a	ATCO might focus on tasks at one airport neglecting priorities at other airport	Closed	To ensure ATCO is provided with appropriate means to focus on primary tasks and is able to prioritise effectively	W1-PJ05.03						
Arg. 1.3.2: Tasks can be achieved in a timely manner.		SUPs might focus on tasks at one airport neglecting priorities at other airport	Closed			OBJ-PJ05-W2-35-V3-VALP-H01	Assess SUP situation awareness when working in a RTC	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS	CRT-PJ05-W2-35-V3-VALP-H01.020	Majority of SUPs state that they can prioritise tasks
						OBJ-PJ05-W2-35-V3-VALP-H12	Assess usability and utility of Supervisor	COOPANS ENAV INDRA/ AVINO	RTS WS PSM	CRT-PJ05-W2-35-V3-	The SUP human machine interface does not

							human machine interface when supporting provision of ATS to multiple aerodromes	R - INDRA/ HC DLR		VALP - H12.050	increase the potential for human error
						OBJ-PJ05-W2-35-V3-VALP-H18	Assess that human-machine interface supports the team in carrying out their tasks	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP - H18.010	Technical System/HMI support ATCOs and SUP when working in a RTC with a flexible allocation of aerodromes between MRTMs.
Arg. 1.3.2: Tasks can be achieved in a timely manner.	W2.PJ05.35_Is.1.3.2-3b	Handover cannot be achieved in a timely manner, for example in case of an emergency situation at one aerodrome requiring	Closed	To ensure handover can be timely achieved	W2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC - DFS ENAV DLR	RTS	CRT-PJ05-W2-35-V3-VALP - H02.020	Majority of ATCOs assess that they can prioritise tasks
						OBJ-PJ05-W2-35-V3-VALP-H18	Assess that human-machine	COOPANS ENAV	RTS WS PSM	CRT-PJ05-W2-	Technical System/HMI support

		to handover the other aerodrome (s) to another RTM					interface supports the team in carrying out their tasks	INDRA/ AVINOR - INDRA/ HC DLR		35-V3-VALP-H18.010	ATCOs and SUP when working in a RTC with a flexible allocation of aerodromes between MRTMs.
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.020	Majority of ATCOs confirm adequate usability of input devices and HMI controls.
Arg. 1.3.3:The level of workload (induced by cognitive and/or physical task	W2.PJ05.35_Is.1.3.3-1	Exceeding workload (increased number of aerodromes to be controlled) might lead to errors	Closed		W1-PJ05.03						

demands) is acceptable.											
Arg. 1.3.3:The level of workload (induced by cognitive and/or physical task demands) is acceptable.	W2.PJ05.35_Is.1.3.3-2	Simultaneous activities at different aerodromes may overload the ATCO increasing thus the potential for human errors.	Closed		W1-PJ05.03						
Arg. 1.3.3:The level of workload (induced by cognitive and/or physical task demands) is	W2.PJ05.35_Ben.1.3.3-4	Potential benefit of dynamic allocation on the management of ATCO's workload	Closed	To ensure dynamic allocation maintain adequate ATCO's workload level	W2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H04	Assess ATCO workload when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H04.010	Majority of ATCOs assess workload at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs

acceptable.											
Arg. 1.3.3:The level of workload (induced by cognitive and/or physical task demands) is acceptable.	W2.PJ05.35_Is.1.3.3-3	Potential increase in ATCO workload due to frequent handover of aerodromes between MRTMs	Closed	To ensure dynamic allocation maintain adequate ATCO's workload level	W2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H04	Assess ATCO workload when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H04.010	Majority of ATCOs assess workload at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs
Arg. 1.3.3:The level of workload (induced by cognitive and/or physical task demands) is	W2.PJ05.35_Is.1.3.3-3	Potential increase in ATCO workload due to the responsibility of too many simultaneous aerodromes to be controlled	Closed	To ensure adequate ATCO's workload level	W2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H04	Assess ATCO workload when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H04.010	Majority of ATCOs assess workload at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs

acceptable.						OBJ-PJ05-W2-35-V3-VALP-H07	Assess ATCO acceptance of roles and responsibilities when providing ATS to multiple aerodromes	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC - DFS DLR	RTS	CRT-PJ05-W2-35-V3-VALP-H07.030	Majority of ATCOs confirm the feasibility and acceptability of providing ATS services to the assigned number of aerodromes
Arg. 1.3.3:The level of workload (induced by cognitive and/or physical task demands) is acceptable.	W2.PJ05.35_Is.1.3.3-3	Potential increase in SUP workload due to responsibility of several clusters of airports in the MRTMs	Closed	To ensure adequate SUP's workload level	W2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H05	Assess Supervisor workload when supporting the provision of ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H05.010	Majority of SUPs assess workload at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H10	Assess Supervisor acceptance of roles and responsibilities when	COOPANS ENAV INDRA/ AVINOR - INDRA/	RTS WS	CRT-PJ05-W2-35-V3-VALP-	Majority of Supervisors confirm the feasibility and acceptability of

							supporting provision of ATS to multiple aerodromes	HC DLR		H10.030	supervise the assigned number of clusters of aerodromes
Arg. 1.3.3:The level of workload (induced by cognitive and/or physical task demands) is acceptable.		SUP tasks cannot be achieved in a timely manner. Resulting in operator stress (with tasks stacking up and requiring recall) leads to increased human error probabilities and consequences. At system level could impact efficiency and safety	Closed		W2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H05	Assess Supervisor workload when supporting the provision of ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H05.010	Majority of SUPs assess workload at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H10	Assess Supervisor acceptance of roles and responsibilities when supporting provision of ATS to multiple aerodromes	COOPANS ENAV INDRA/AVINOR - INDRA/HC DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H10.030	Majority of Supervisors confirm the feasibility and acceptability of supervise the assigned number of clusters of aerodromes

Arg. 1.3.4:The level of trust in the new concept/the new procedures is appropriate.	W2.PJ05.35_Is.1.3.4-1a	The level of trust in the new concept and system is not appropriate for the ATCO	Closed		W1-PJ05.03						
Arg. 1.3.4:The level of trust in the new concept/the new procedures is appropriate.	W2.PJ05.35_Is.1.3.4-1b	The level of trust in the new concept and system is not sufficient for the SUP	Closed	To ensure SUP is provided with reliable systems that ensure an appropriate trust level	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H14	Assess Supervisor trust in support systems when supporting provision of ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC ENAV DLR	RTS PSM	CRT-PJ05-W2-35-V3-VALP-H14.010	Supervisor trust the functionalities of the supervisor planning tool when working in a RTC with a flexible allocation of aerodromes between MRTMs
Arg. 1.3.5: Human actors can maintain a sufficie	W2.PJ05.35_Is.1.3.5-2	ATCOs/ SUPs might not be able to maintain Situation awareness if there are	Closed	To ensure ATCO/SUP situation awareness is at appropriate level to perform their tasks in any conditions	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H01	Assess SUP situation awareness when working in a RTC	COOPANS ENAV INDRA/AVINOR - INDRA/	RTS	CRT-PJ05-W2-35-V3-VALP-	Majority of SUPs state that situation awareness is at an acceptable level when

nt level of situation awareness.		various operating conditions.						HC DLR		H01.010	working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H02.010	Majority of ATCOs state that situation awareness is at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs
Arg. 1.3.5: Human actors can maintain a sufficient level of	W2.PJ05.35_Is.1.3.5-3	ATCO/SUPs might not be able to maintain situation awareness if there are various weather	Closed	To ensure ATCO/SUP situation awareness is at appropriate level to perform their tasks in any conditions	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H02.010	Majority of ATCOs state that situation awareness is at an acceptable level when working in a RTC with

situation awareness.		conditions (wind or visibility) at the different airports									a flexible allocation of aerodromes between MRTMs
Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.	W2.PJ05.35_Is.1.3.5-4	ATCOs/SUPs might not be able to maintain Situation awareness if there is a geographical difference between the aerodromes	Closed	To ensure ATCO/SUP situation awareness is at appropriate level to perform their tasks in any conditions	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H01	Assess SUP situation awareness when working in a RTC	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS	CRT-PJ05-W2-35-V3-VALP-H01.010	Majority of SUPs state that situation awareness is at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC - DFS ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H02.010	Majority of ATCOs state that situation awareness is at an acceptable level when working in a RTC with a flexible allocation of aerodrome

											s between MRTMs
Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.	W2.PJ05.35_Is.1.3.5-5	ATCOs/ SUPs might be overlooking or missing movements on one APT, while focusing on the other one.	Closed	To ensure ATCO/SUP situation awareness is at appropriate level to perform their tasks in any conditions	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H01	Assess SUP situation awareness when working in a RTC	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS	CRT-PJ05-W2-35-V3-VALP-H01.010	Majority of SUPs state that situation awareness is at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H03	Assess team situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H03.010	HMI supports an acceptable level of team (ATCOs and SUP) situation awareness when working in a RTC with a flexible allocation of aerodromes between MRTMs

						OBJ-PJ05-W2-35-V3-VALP-H12	Assess usability and utility of Supervisor human machine interface when supporting provision of ATS to multiple aerodromes	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H12.050	The SUP human machine interface does not increase the potential for human error
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.050	The ATCO human machine interface does not increase the potential for human error
						OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple	COOPANS INDRA/ AVINOR - INDRA/ HC - DFS	RTS WS	CRT-PJ05-W2-35-V3-VALP-	Majority of ATCOs state that situation awareness is at an acceptable level when

							aerodromes	ENAV DLR		H02.010	working in a RTC with a flexible allocation of aerodromes between MRTMs
Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.	W2.PJ05.35_Is.1.13.5-11	Switching between different aerodromes allocation in an RTM could impact negatively the SA (e.g., if the transfer of information during the handover is not complete; if there are confusions between aerodromes or aerodromes characteristics etc.)	Closed	To ensure ATCO/SUP situation awareness is at appropriate level to perform their tasks in any conditions	W2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H02.010	Majority of ATCOs state that situation awareness is at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs
									RTS WS		

Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.	W2.PJ05.35_Ben.1.3.5-12	The support of the supervisor can improve ATCO SA because future workload is better anticipated and more efficiently managed by dynamic allocation of aerodromes	Closed	To ensure ATCO situation awareness is at appropriate level to perform their tasks in any conditions	W2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR		CRT-PJ05-W2-35-V3-VALP-H02.010	Majority of ATCOs state that situation awareness is at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs
Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.	W2.PJ05.35_Is.1.13.5-13	SA is not sufficient because the number of aerodromes to monitor and/or the number of tasks to manage are too important, and/or because	Closed	To ensure SUP situation awareness is at appropriate level to perform their tasks in any conditions	W2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H02.010	Majority of ATCOs state that situation awareness is at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs

		information/functions available to the SUP are not sufficient.				OBJ-PJ05-W2-35-V3-VALP-H12	Assess usability and utility of Supervisor human machine interface when supporting provision of ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC ENAV DLR	RTS PSM	CRT-PJ05-W2-35-V3-VALP-H12.010	Majority of Supervisors asses that they have all required information available when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H01	Assess SUP situation awareness when working in a RTC	COOPANS ENAV INDRA/AVINOR - INDRA/HC DLR	RTS	CRT-PJ05-W2-35-V3-VALP-H01.030	Majority of SUPs confirm that the user interface design supports a sufficient level of individual situation awareness
						OBJ-PJ05-W2-35-V3-VALP-H01	Assess SUP situation awareness when working in a RTC	COOPANS ENAV INDRA/AVINOR - INDRA/	RTS	CRT-PJ05-W2-35-V3-VALP-	Majority of SUPs state that situation awareness is at an acceptable

								HC DLR		H01.010	level when working in a RTC with a flexible allocation of aerodromes between MRTMs
Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.	W2.PJ05.35_Is1.3.5-6	ATCO ability to judge distance/separation may be impacted by compressed OTW presentation.	Closed	To ensure OTW provides ATCO with appropriate HMI to be able to judge separations/distances	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS PSM	CRT-PJ05-W2-35-V3-VALP-H02.030	ATCOs confirm that the user interface design supports a sufficient level of situation awareness
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.020	Majority of ATCOs confirm adequate usability of input devices and HMI controls.
Arg. 1.3.5: Human	W2.PJ05.35_Is1.3.5-10	Various similarities on the	Closed	To ensure OTW provides ATCO/SUP with appropriate HMI	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility	COOPANS DLR	RTS WS PSM	CRT-PJ05-W2-	Majority of ATCOs confirm

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actors can maintain a sufficient level of situation awareness.		airports controlled (landscape, buildings, runway configuration etc.) induce a risk to mismatch signal/cue and relate that to the wrong airport. (configuration of airport)		to be able to judge separations/distances			of ATCO human machine interface when providing ATS to multiple aerodromes	ENAV INDRA/ AVINOR - INDRA/ HC - DFS		35-V3-VALP-H11.070	there is no confusion about which aerodromes are displayed on which display
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.080	Majority of ATCOs confirm there is no confusion about which aerodrome will be transferred between the MRTMs.
Arg. 2.1.6:The level of trust in automated functions is appropriate.	W2.PJ05.35_Is.2.1.6-1	ATCOs might not trust in the system if: - the reliability of the supported task priorities is too low - the reliability	Closed	To ensure ATCOs is provided with reliable systems that ensure an appropriate trust level	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H13	Assess ATCO trust in support systems when providing ATS to multiple aerodromes	- DFS ENAV	RTS	CRT-PJ05-W2-35-V3-VALP-H13.010	ATCOs trust the functionality of the automated task prioritisation
						OBJ-PJ05-W2-35-V3-VALP-H13	Assess ATCO trust in support	- DFS	RTS	CRT-PJ05-W2-	ATCOs trust the functionalit

		of the conformance monitoring is too low					systems when providing ATS to multiple aerodromes			35-V3-VALP-H13.020	y of the conformance monitoring
Arg. 2.3.1:The type of information provided satisfies the information requirements of the human.	W2.PJ05.35_Is.2.3.1-1	The type of information provided does not satisfy the information requirements of the ATCOs (and SUP).	closed	To ensure ATCO and SUP are provided with adequate and required information	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.010	Majority of ATCOs asses that they have all required information easy to access and presented in an effective way.
						OBJ-PJ05-W2-35-V3-VALP-H12	Assess usability and utility of Supervisor human machine interface when supporting provision of ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC ENAV DLR	RTS PSM	CRT-PJ05-W2-35-V3-VALP-H12.010	Majority of Supervisors asses that they have all required information available when working in a RTC with a flexible allocation of aerodromes between MRTMs

Arg. 2.3.1:The type of information provided satisfies the information requirements of the human.	W2.PJ05.35_Is.2.3.1-2	ATCOs are not aware of the traffic forecast and thus expected workload level at the different airports in the short term execution phase negatively affecting ATCOs' situation awareness	Closed	To ensure ATCO is provided with a short term ATCO planning tool to have a clear view of the traffic level and thus the expected workload at the different airports in the short term execution phase. The short term planning tool might be a complex forecast tool or a simple flight list depending on the specific operational environment complexity	w2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS PSM	CRT-PJ05-W2-35-V3-VALP-H02.030	ATCOs confirm that the user interface design supports a sufficient level of situation awareness
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS ENAV INDRA/AVINOR - INDRA/HC - DFS DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.060	ATCOs confirm the adequacy of the general usability and utility of ATCO short term planning tool/traffic forecast and/or prioritisation tool.
Arg. 2.3.2: Input devices (e.g. keyboard, mouse, touch screen)	W2.PJ05.35_Is.2.3.2-1	Wrong APT input device is used to control function in the different APT. Some errors	Closed	To ensure usability of input devices	W1-PJ05.03						

correspond to HF principles. [V1: AIR only]		would be readily identified and corrected, others not. If ATCOs are controlling more than one APT they may have different input devices for different APT, these may lead to the wrong input device being used to control a function in a different APT. This may affect the efficiency with end user can execute a task.									

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Arg. 2.3.3: Visual displays and other types of output devices adhere to HF principles. [V1: AIR only]	W2.PJ05.35_Is.2.3.3-1	Visual displays and other output devices usability lack, for example there can be a confusion with regards to which aerodrome is displayed on which visual display.	Closed	To ensure consistency, reliability and clearness of output devices	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS DLR ENAV INDRA/AVINOR - INDRA/HC - DFS	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.070	Majority of ATCOs confirm there is no confusion about which aerodromes are displayed on which display
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS ENAV INDRA/AVINOR - INDRA/HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.080	Majority of ATCOs confirm there is no confusion about which aerodrome will be transferred between the MRTMs.
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.020	Majority of ATCOs confirm adequate usability of input devices and HMI controls.

							multiple aerodromes				
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS ENAV INDRA/AVINOR - INDRA/HC - DFS DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.060	ATCOs confirm the adequacy of the general usability and utility of ATCO short term planning tool/traffic forecast and/or prioritisation tool.
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.050	The ATCO human machine interface does not increase the potential for human error
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human	COOPANS - DFS ENAV DLR	RTS	CRT-PJ05-W2-35-V3-	Majority of ATCOs confirm adequate usability

							machine interface when providing ATS to multiple aerodromes			VALP-H11.040	and utility of alarms and alerts
Arg. 2.3.3: Visual displays and other types of output devices adhere to HF principles. [V1: AIR only]	W2.PJ05.35_Is.2.3.3-1	The visual displays do not sufficiently support the accomplishment of approach tasks when providing ATS to multiple aerodromes	Closed	To ensure consistency, reliability and clearness of output devices	W2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H18	Assess that human-machine interface supports the team in carrying out their tasks	COOPANS ENAV INDRA/AVINOR - INDRA/HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H18.010	Technical System/HMI support ATCOs and SUP when working in a RTC with a flexible allocation of aerodromes between MRTMs.
Arg. 2.3.3: Visual displays and other types of output devices adhere to HF	W2.PJ05.35_Is.2.3.3-2	The visual presentation does not contain complete information and therefore impacting the detection, recognition	Closed		W1-PJ05.03						

principles. [V1: AIR only]		, identification and ranging of objects relevant for service provision									
Arg. 2.3.3: Visual displays and other types of output devices adhere to HF principles. [V1: AIR only]	W2.PJ05.35_Is.2.3.3-3	The visual presentation for multiple aerodromes should incorporate overlaid information to indicate / high light specific parts of the aerodrome, such as runways, taxiways, in order to enhance the ATCO (and SUP) situational awareness, specifically in darkness and low	Closed		W1-PJ05.03						

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		visibility conditions									
Arg. 2.3.3: Visual displays and other types of output devices adhere to HF principles. [V1: AIR only]	W2.PJ05.35_Is.2.3.3-4	Situation awareness negatively affected by the flexible positioning of aerodromes in the visual display (In RTC where there is the need to allocate more than 3 airports (e.g. 4) it is not possible to maintain the same position of the aerodromes in the visual display)	Closed	To ensure ATCO situation awareness is not affected by the flexible positioning of aerodromes in the visual displays: a potential mitigation might be to allow the ATCO to customise the positioning of the aerodromes in the visual display	w2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS PSM	CRT-PJ05-W2-35-V3-VALP-H02.030	ATCOs confirm that the user interface design supports a sufficient level of situation awareness
						OBJ-PJ05-W2-35-V3-VALP-H18	Assess that human-machine interface supports the team in carrying out their tasks	COOPANS ENAV INDRA/AVINOR - INDRA/HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H18.010	Technical System/HMI support ATCOs and SUP when working in a RTC with a flexible allocation of aerodromes between MRTMs.
Arg. 2.3.4: Alarms and alerts have	W2.PJ05.35_Is.2.3.4-1	ATCO do not notice or wrongly interpret alarms and alerts	Closed	To ensure alarms and alerts provide clear and consistent information on safety critical events	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine	COOPANS - DFS ENAV DLR	RTS	CRT-PJ05-W2-35-V3-VALP	Majority of ATCOs confirm adequate usability and utility

been developed according to HF principles. [V1: AIR only]		provided by the system					interface when providing ATS to multiple aerodromes			-H11.040	of alarms and alerts
Arg. 2.3.4: Alarms and alerts have been developed according to HF principles. [V1: AIR only]	W2.PJ05.35_Is.2.3.4-2	SUP do not notice or wrongly interpret alarms and alerts provided by the system	Closed	To ensure alarms and alerts provide clear and consistent information on safety critical events		OBJ-PJ05-W2-35-V3-VALP-H12	Assess usability and utility of Supervisor human machine interface when supporting provision of ATS to multiple aerodromes	ENAV DLR	RTS	CRT-PJ05-W2-35-V3-VALP-H12.040	Majority of Supervisors confirm adequate usability and utility of alarms and alerts
Arg. 2.3.6:The usability of the user interface (input devices, visual	W2.PJ05.35_Is.2.3.6-1	The usability of the user interface is not acceptable (e.g. display of two APT on one screen	Closed								-

displays /output devices , alarm& alerts) is acceptable. [V1: AIR only]		at the same time is not acceptable)									
Arg. 2.3.6:The usability of the user interface (input devices , visual displays /output devices , alarm& alerts) is acceptable. [V1: AIR only]	W2.PJ05.35 _Is.2.3.6-2	The handling of input devices for more than one airport is not acceptable	Closed								-
Arg. 2.3.6:The usabilit	W2.PJ05.35 _Is.2.3.6-3	Input devices and HMI controls	Closed	To ensure adequate usability of input devices and HMI controls	w2-PJ05.35 / HP Plan drafting	OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO	COOPANS INDRA/ AVINO	RTS WS PSM	CRT-PJ05-W2-35-	Majority of ATCOs confirm adequate

y of the user interface (input devices, visual displays /output devices, alarm& alerts) is acceptable. [V1: AIR only]		usability do not support ATCOs in the smooth and efficient execution of tasks					human machine interface when providing ATS to multiple aerodromes	R - INDRA/ HC - DFS ENAV DLR		V3-VALP-H11.020	usability of input devices and HMI controls.
Arg. 2.3.7:The user interface design reduces human error as far as possible. [V1: AIR only]	W2.PJ05.35_Is.2.3.7-1	Confusion of which information (e.g. strips, meteo etc.) is linked to which APT. This could increase the potential for human error, as ATCOs may give the wrong information,	Closed		W1-PJ05.03						

		instruction to wrong a/c at another aerodrome. Therefore, this could have a potential negative impact on system safety.									
Arg. 2.3.8:The user interface supports a sufficient level of individual situation awareness. [V1: AIR only]	W2.PJ05.35_Is.2.3.8-2	Simultaneous radio calls on different frequencies (decoupled) might lead to the loss of information.	Closed		W1-PJ05.03						
Arg. 2.3.8:The user interfac	W2.PJ05.35_Is.2.3.8-3	Coupling of frequencies might lead to	Closed		W1-PJ05.03						

e supports a sufficient level of individual situation awareness. [V1: AIR only]		ATCO, pilot and vehicle driver`s confusion. (refer to Arg. 1.3.1)									
Arg. 2.3.8:The user interface supports a sufficient level of individual situation awareness. [V1: AIR only]	W2.PJ05.35_Is.2.3.8-4	Confusion relating to which pilot at which APT, ATCO is communicating / How to ensure that the ATCO understand which aircraft is calling.	Closed		W1-PJ05.03						
Arg. 2.3.8:The user interfac	W2.PJ05.35_Is.2.3.9-1	The supervisor is not aware of	Closed	To ensure SUPs are provided with adequate means to monitor ATCOs workload	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H01	Assess SUP situation awareness when	INDRA/ AVINOR - INDRA/	RTS	CRT-PJ05-W2-35-	Majority of SUP confirm that they

e supports a sufficient level of individual situation awareness. [V1: AIR only]		the task load of the ATCO information available to the SUP is not sufficient or not presented in a suitable way)					working in a RTC	HC DLR		V3-VALP-H01.040	maintain an adequate level of SA, despite having to divide their attention to different clusters of aerodromes
						OBJ-PJ05-W2-35-V3-VALP-H12	Assess usability and utility of Supervisor human machine interface when supporting provision of ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC ENAV DLR	RTS PSM	CRT-PJ05-W2-35-V3-VALP-H12.010	Majority of Supervisors asses that they have all required information available when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H12	Assess usability and utility of Supervisor human machine interface when	COOPANS INDRA/AVINOR - INDRA/HC ENAV DLR	RTS PSM	CRT-PJ05-W2-35-V3-VALP-H12.030	Majority of Supervisors confirm adequate usability and utility of supervisor

							supporting provision of ATS to multiple aerodromes				planning tool
Arg. 2.3.9:The user Interface design supports a sufficient level of team situational awareness. [V1: AIR only]	W2.PJ05.35_Is.2.3.9-1	The flexible frequent allocation of aerodromes generates confusion affecting the team situation awareness with a possible increase of human error and workload	Closed	To ensure the design of HMI supports the team situation awareness and task execution	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H03	Assess team situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H03.010	HMI supports an acceptable level of team (ATCOs and SUP) situation awareness when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H03	Assess team situation awareness when providing ATS to multiple aerodromes				
						OBJ-PJ05-W2-35-V3-VALP-H18	Assess that human-machine interface supports the team in carrying out their tasks	COOPANS ENAV	RTS WS	CRT-PJ05-W2-35-V3-VALP-H18.020	Number and/or severity of team errors in the solution is within tolerable limits or not

											increased with respect to the reference scenario.
Arg. 3.2.2:The proposed task allocation between human actors is supported by technical systems/the HMI.	W2.PJ05.35_Is.3.2.2-1	The task allocation for the SUP/ATCO is not supported by technical systems / the HMI	Closed	To ensure an appropriate Technical system/HMI support to human actors	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H18	Assess that human-machine interface supports the team in carrying out their tasks	COOPANS ENAV INDRA/AVINOR - INDRA/HC DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP - H18.010	Technical System/HMI support ATCOs and SUP when working in a RTC with a flexible allocation of aerodromes between MRTMs.
Arg. 3.2.2:The proposed task allocation between human actors	W2.PJ05.35_Is.3.3.2-1	APTs having the same or similar RWY designators could lead to confusion. (the inclusion of	Closed		W1-PJ05.03						

is supported by technical systems/the HMI.		airport names in clearances / radio transmissions shall be considered as a standard procedure) (Arg. 1.3.1)									
Arg. 3.3.2:The phraseology supports communication in all operating conditions.	W2.PJ05.35_Is.3.3.2-2	Not clear on which airport is the flight that is receiving clearances (Also affecting Arg. 1.3.5)	Closed			OBJ-PJ05-W2-35-V3-VALP-H02	Assess ATCO situation awareness when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H02.010	Majority of ATCOs state that situation awareness is at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing	COOPANS DLR ENAV INDRA/AVINOR - INDRA/	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.070	Majority of ATCOs confirm there is no confusion about which aerodromes are

							ATS to multiple aerodromes	HC - DFS			displayed on which display
						OBJ-PJ05-W2-35-V3-VALP-H08	Assess usage of the ATCO phraseology when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP-H08.010	The phraseology is acceptable for the ATCO in normal and abnormal operating conditions and degraded modes
						OBJ-PJ05-W2-35-V3-VALP-H11	Assess usability and utility of ATCO human machine interface when providing ATS to multiple aerodromes	COOPANS INDRA/AVINOR - INDRA/HC - DFS ENAV DLR	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H11.010	Majority of ATCOs asses that they have all required information easy to access and presented in an effective way.
Arg. 3.3.4:The communication load	W2.PJ05.35_Is.3.3.4-1	The amount of communication and time on the	Closed			OBJ-PJ05-W2-35-V3-VALP-H04	Assess ATCO workload when providing ATS to	COOPANS ENAV INDRA/AVINOR -	RTS	CRT-PJ05-W2-35-V3-VALP	Majority of ATCOs confirm that the amount of communica

of team members is acceptable in normal and abnormal conditions and degraded mode of operations.		frequency can be a bottleneck in situations with high task load, rather than workload or situation awareness and should be further evaluated at V3 level					multiple aerodromes	INDRA/ HC DLR		- H04. 020	tion and time on the frequency are acceptable
Arg. 4.1.1: Changes in roles and responsibilities are acceptable to the affected human actors.	W2.PJ05.35 _Is.4.1.1-1	The concept and resulting changes in roles & responsibilities are not acceptable to the affected actors	Closed	To ensure acceptability of changes in roles and responsibilities and concept	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H07	Assess ATCO acceptance of roles and responsibilities when providing ATS to multiple aerodromes	COOPANS INDRA/ AVINOR - INDRA/ HC ENAV DLR	RTS WS	CRT-PJ05-W2-35-V3-VALP - H07. 010	Majority of ATCOs assess that changes to ATCOs roles and responsibilities introduced by the multiple remote tower concept are clear, consistent, stable and acceptable when working in

											a RTC with a flexible allocation of aerodromes between MRTMs
						OBJ-PJ05-W2-35-V3-VALP-H09	Assess Supervisors acceptance of operating methods when supporting provision of ATS to multiple aerodromes	COOPANS DLR INDRA/AVINOR - INDRA/HC ENAV	RTS WS PSM	CRT-PJ05-W2-35-V3-VALP-H09.010	Majority of SUPs assess that operating methods can be applied in an accurate, efficient and timely manner in normal and abnormal operating conditions and degraded modes when working in a RTC with a flexible allocation of aerodromes between MRTMs

Arg. 4.2.1: Knowledge, skill and experience requirements for human actors have been identified.	W2.PJ05.35_Is.4.2.1-1	New MRTM system might require new knowledge, skills and experience	Closed	To ensure MTI system transition factors are taken into consideration	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H15	Early assessment of transition factors in a RTC with a flexible allocation of aerodromes between MRTMs	COOPANS ENAV INDRA/ AVINOR - INDRA/ HC	RTS WS	CRT-PJ05-W2-35-V3-VALP-H15.010	Knowledge, skill and experience requirements are identified/consolidated per actor group
Arg. 4.3.2:The impact on shift organisation is identified.	W2.PJ05.35_Is.4.3.2-1	The maximum shift length of an ATCO might be reduced with Multiple Remote Tower compared to single remote tower	Closed		W1-PJ05.03						
Arg. 4.5.1:The content of	W2.PJ05.35_Is.4.5.1-1	The training does not sufficiently contain a	Closed	To ensure ATCOs/SUP are provided with appropriate level of training and familiarizations	W1-PJ05.03	OBJ-PJ05-W2-35-V3-VALP-H15	Early assessment of transition factors in a	COOPANS ENAV INDRA/ AVINO	RTS WS	CRT-PJ05-W2-35-V3-	Training needs per actor group are identified

training for each actor group is specified. (V3 only)		technical part on the new MRTM The ATCOs/ SUPs are not sufficiently familiarised with the aerodrome (physical characteristics, procedures, operating conditions etc.) The ATCO/ SUPs is not sufficiently familiarised with the technical behaviour of the camera and other RT specific technical components.					RTC with a flexible allocation of aerodromes between MRTMs	R - INDRA/ HC		VALP - H15.020	(preliminary identification only).

Table 4: Identification of relevant arguments, HP issues & benefits and HP activities

4.3 Step 3 Improve and validate the concept

4.3.1 Description of HP activities conducted

The following table summarises the planned HP activities:

HP activity	HP activity	By when
Activity 1.	HP Change assessment Review	Q3 2020
Activity 2.	HP Focus Group	Q4 2020
Activity 3.	RTS EXE-2.1-V3-DLR Remote Tower Lab at DLR Braunschweig	Q4 2021
Activity 4.	RTS EXE-2.2-V3-COOPANS MRTC	Q3 (early Q4) 2021 and Q1 2022 respectively
Activity 5.	RTS EXE-2.3-V3-INDRA/AVINOR Norway Remote Tower Simulation	Q2-Q3 2021
Activity 6.	EXE-2.6-V3-INDRA/HC Hungary Remote Tower Trials (Shadow Mode & RTS)	Q3 and Q4 2021, respectively
Activity 7.	RTS EXE-2.4-V3-ENAV Remote Tower Modules	Q4 2021
Activity 8.	RTS EXE-2.5-V3-DFS MRTC Simulation Automation Features	Q4 2021
Activity 9.	HP Post-simulations workshop	Q1 2022
Activity 10.	HP Requirements workshop	Q2 2022
Activity 11.	HP and SAF Final Solution Workshop	Q3 2022

Table 5: Table of proposed HP activities

The following tables details the executed HP related validation activities:

ACTIVITY 1.	HP Change assessment Review
Description	Review and integration of change assessment
Arguments & related issues addressed	See section 4.1.5

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HP OBJECTIVES	Updates of reference and solution scenarios according to the latest OSED updates and solution members common understanding Updates of change assessment of relevant arguments Updates of issues and benefits Updates of HP validation objectives
Tool selected out of the HP repository	Off-line review
Summary of the HP activity	Change assessment reviewed

Table 6: Description of Activity 1

ACTIVITY 2.	HP Focus Group
Description	HP tools, metrics and indicators focus group
HP objectives	To discuss a set of possible common methods/metrics/tools • To harmonize the HP assessment • To harmonize the solution results • To enhance the data comparison
Tool selected out of the HP repository	Focus Group
Summary of the HP activity	HP tools, metrics and indicators identified

Table 7: Description of Activity 2

ACTIVITY 3.	RTS EXE-2.1-V3-DLR Remote Tower Lab at DLR Braunschweig
Description	The DLR Validation will be performed as a Real Time Simulation in the first part and passive shadow mode in the second parts: Part 1: The operational scope of this exercise includes the dynamic allocation with a maximum of 15 simulated small sized airports. The excessive focus is on the interaction of several multiple remote tower module with the supervisor workplace. In relation to the supervisor workplace, the focus is on dynamic situations within such an environment. This includes that the supervisor interacts with each remote tower workplace.

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	Part 2: The focus area of the second part is how the correlation and fusion of electro-optical and traditional surveillance detections and thereby possible safety net improvements can enhance the situational awareness.
Arguments & related issues addressed	See Section 4.4.1
HP objectives	H01; H02; H03; H04; H05; H06; H07; H09; H10; H11; H12; H13.040; H13.080; H14; H15; H18.010
Tool selected out of the HP repository	Bedford; NASA-TLX (+customized quest); SASHA-Q; CARS; Eye tracking; SUS; SATI; Tailor-Made Questionnaires;
Summary of the HP activity	See VALR

Table 8: Description of Activity 3

ACTIVITY 4.	RTS EXE-2.2-V3-COOPANS MRTC
Description	The COOPANS Validation will be performed as a Real Time Simulation divided in two parts: • Part 1 will focus only on providing ATS to three aerodromes from one MRTM and by one ATCO at a time. This will stabilize the results gained in the previous PJ05.03-V2 phase and will ensure ATCOs with sufficient basis to provide simultaneous ATS to three aerodromes. • Part 2 will focus on RTC and flexible allocation of aerodromes to MRTMs. This flexible allocation will be assisted by a role of RTC Supervisor supported with RTC Supervisor Planning Tool.
Arguments & related issues addressed	According to SESAR Solution 05.35: Validation Plan (VALP) for V3 – Part IV Human Performance Assessment Plan
HP objectives	**H01**.010,020,030 **H02**.010,020,030,040 **H03**.010 **H04.**010,020 **H05**.010 **H06**.010 **H07**.010,030 **H0**8.010 **H09**.010 **H10**.010,030 **H11**.010,020,040,050,060,070,080 **H12**.010,020,030,050 **H13**.040,080 **H14**.010 **H15**.010,020 **H18**.010,020
Tool selected out of the HP repository	Workload: Bedford (+ customized questionnaires) Situation Awareness: China Lake, SASHA Acceptability: CARS Usability: SUS Trust: SATI Human Error: Observations, De-briefing, Tailor–Made questionnaire

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Summary of the HP activity	RTS Standard Questionnaires Tailor–Made Questionnaires De-briefings Observations Log-Data Workshops

Table 9: Description of Activity 4

ACTIVITY 5.	RTS EXE-2.3-V3-INDRA/AVINOR Norway Remote Tower Simulation
Description	Real Time Simulation utilizing four simulated Norwegian aerodromes and a Remote Tower Centre with two Multiple Remote Tower Modules (MRTM), an approach position and a supervisor position. The MRTMs may present up to three aerodromes simultaneously or a combination of two aerodromes and approach area. The objective is to assess dynamic allocation of aerodromes to MRTMs while maintaining operations as well as the supervisor tools to support the dynamic allocation and planning of aerodrome allocation. A Human Performance analysis will be conducted as well as part of the activities.
Arguments & related issues addressed	See Section 4.4.1
HP objectives	**H01**.010,020,030,040 **H02**.010,020,030,040 **H03**.010 **H04.**010,020 **H05**.010 **H06**.010 **H07**.010,030 **H0**8.010 **H09**.010 **H10**.010,030 **H11**.010,020, 050,060,070,080 **H12**.010,020,030,050 **H13**.080 **H14**.010 **H15**.010,020 **H18**.010,030
Tool selected out of the HP repository	Bedford, China Lake, CARS, Tailor-made questionnaires
Summary of the HP activity	See VALR

Table 10: Description of Activity 5

ACTIVITY 6.	EXE-2.6-V3-INDRA/HC Hungary Remote Tower Trials (Shadow Mode & RTS)
Description	The Passive Shadow Mode (PSM) exercise will include three Hungarian aerodromes (Pápa, Győr-Pér, Nyíregyháza) with two MRTMs and one Supervisor position with long-term planning tool. This modus operandi allows the evaluation of the system and flexible allocation concept with realistic/real

	operational data without affecting the safety and processes of the real airport. However, this also implies that workload and situational awareness measurements are not reliable as the traffic is indeed handled by OPS actors on duty. The validation platform to be used by HungaroControl will be INDRA RTWR IBP platform delivered by INDRA. PSM will be followed by the RTS utilizing four simulated Norwegian aerodromes and a Remote Tower Centre with two Multiple Remote Tower Modules (MRTM) and a supervisor position. The MRTMs may present up to three aerodromes simultaneously or a combination of two aerodromes and approach area. The objective is to assess dynamic allocation of aerodromes to MRTMs while maintaining operations as well as the supervisor tools to support planning of aerodrome allocation.
Arguments & related issues addressed	See Section 4.4.1
HP objectives	**PSM:** **H06**.010 **H09**.010 **H10**.010 **H11**.010,020,050,060,070,080 **H12**.010,020,030,050 **H13**.080 **H14**.010 **H18**.010 **RTS:** **H01**.010,020,030,040 **H02**.010,020,030,040 **H04.**010,020 **H05**.010 **H06**.010 **H07**.010 **H0**8.010 **H09**.010 **H10**.010 **H11**.010,020,050,060,070,080 **H12**.010,020,030,050 **H13**.080 **H14**.010 **H15**.010,020 **H18**.010
Tool selected out of the HP repository	Bedford, SASHA-Q, AIM, SATI and tailor-made questionnaires (post-run and post-exercise)
Summary of the HP activity	See VALR

Table 11: Description of Activity 6

ACTIVITY 7.	RTS EXE-2.4-V3-ENAV Remote Tower Modules
Description	RTS including 2 MRTM ATCO CWP and 1 RTC SUP WP; The Supervisor position is provided with a SUP planning tool to supervise and plan the flexible allocation of 3 aerodromes between the 2 MRTMs. An ATCO planning tool to prioritise next high priority action is integrated in the EFPS system of ATCO MRTM CWP.
Arguments & related issues addressed	See Section 4.4.1
HP objectives	• H01: CRT-H01.010 /CRT- H01.020/CRT--H01.030 • H02: CRT-H02.010 /CRT-H02.020/CRT-H02.030 • H03: CRT-H03.010

	• H04: CRT-H04.010/CRT-H04.020 • H05: CRT-H05.010 • H06: CRT-H06.010 /OBJ-H07/CRT-H07.010/CRT-H07.030 • H08: CRT-H08.010 • H09: CRT-H09.010 • H10: CRT-H10.010 /CRT-H10.030 • H18: CRT-H18.010 /CRT-H18.020 • H11: CRT-H11.010 /CRT-H11.020 /CRT-H11.040 /CRT-H11.050 /CRT-H11.060/CRT-H11.070/CRT-H11.080 • H12: CRT-H12.010/ CRT-H12.020 /CRT-H12.030/ CRT-H12.040/ CRT-H12.050 • H13: CRT-H13.010 /CRT-H13.040/CRT-H13.080 • H14: CRT-H14.010 • H15: CRT-H15.010 /CRT-H15.020
Tool selected out of the HP repository	Workload: Bedford (+customized quest) Situation awareness: China Lakes Acceptability: CARS Usability: SUS Trust: SATI Human Error: Tailor-Made Questionnaires End of simulation questionnaire
Summary of the HP activity	See VALR

Table 12: Description of Activity 7

ACTIVITY 8.	RTS EXE-2.5-V3-DFS MRTC Simulation Automation Features
Description	Real Time Simulation with an ATCO providing ATS to 3 small size aerodromes at a time with the aerodromes flexibly allocated to the MRTM. The ATCO will be supported by automation tools (e.g. conformance monitoring, attention guidance with event list) which are based on basic ground and airborne surveillance. The visual presentation will be reduced to a minimum with the surveillance being focussed on radar/MLAT/ADS-B and use of PTZ. The objective is to assess the ATCO situation awareness and human performance in different scenarios
Arguments & related issues addressed	See Section 4.4.1

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HP objectives	**H02**.010,020,030 **H04.**010,020 **H06**.010 **H07**.030 **H0**8.010 **H11**.010,020,040,050,060,070 **H13**.010,020,040
Tool selected out of the HP repository	Bedford, China Lake, CARS, SUS, SATI and questionnaires (standardized and tailored)
Summary of the HP activity	See VALR

Table 13: Description of Activity 8

ACTIVITY 9.	HP Post-simulations workshop
Description	Workshop to integrate and consolidate HP solution results
Arguments & related issues addressed	See Section 4.4.1
HP objectives	Review and integration of HP solution results
Tool selected out of the HP repository	Focus group
Summary of the HP activity	Review of HP Issues & Benefits, HP results

Table 14: Description of Activity 9

ACTIVITY 10.	HP Requirements workshop
Description	Workshop to consolidate HP requirements and remove potential duplication with safety requirements
Arguments & related issues addressed	See Section 4.4.1
HP objectives	Consolidation of HP requirements
Tool selected out of the HP repository	Focus group

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Summary of the HP activity	HP Mitigation

Table 15: Description of Activity 10

ACTIVITY 11.	HP and SAF Final Solution Workshop
Description	Workshop
Arguments & related issues addressed	See Section 4.4.1
HP objectives	To harmonise HP and Safety achievements To verify requirements' overlap between HP and SAF
Tool selected out of the HP repository	Structured Walkthrough
Summary of the HP activity	HP&SAF requirements input

Table 16: Description of Activity 11

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4.4 Step 4 Collate findings & conclude on transition to next V-phase

4.4.1 Summary of HP activities results & recommendations / requirements

Final Recommendations and Requirements are provided in Appendix B and C respectively. More readable table providing the full traceability is available in the HP-Log in Appendix D.

Arg	***ISSUE /BEN ID***	***HP issue / benefit***	***Status***	*HP Obj ID*	*HP SUC ID*	***Actual evidence***	***Input Requirement & EXE req***		*Input**_Recommendation & EXE rec***		***Final Requirement***	***Final Recommendation***
Arg. 1.1.2: The description of roles & responsibilities cover all task	W2.PJ05.35_Is.1.1.2-1	The description of the roles & responsibilities does not cover all tasks to	Closed	OBJ-PJ05-W2-35-V3-VALP-H07	CRT-PJ05-W2-35-V3-VALP-H07.010	Indra/HCRTS: The majority of the ATCOs indicated that ATCO roles and responsibilities were clear. In terms of split and merge, it is vital to differentiate between the SUP and the ATCO	If an additional spare ATCO or assistant is required, the corresponding roles and responsibilities and the coordination procedures shall be locally defined.	If an additional spare ATCO or assistant is required, the corresponding roles and responsibilities and the coordination procedures shall be locally defined. The RTC supervisor role shall monitor the RTC aerodromes conditions and traffic load to establish the aerodromes allocation to the RTC modules	The Supervisor should initiate the split as s/he is the one who has the overview of the predicted traffic load. If the overload is uncertain or would last for a short period, the SUP should consult with the ATCO whether s/he wants to split or keep the aerodrome. It is possible that the ATCO would rather take on 2 additional flights than to split. It should be the ATCOs' responsibility to	The handover procedure initiation should be responsibility of the RTC supervisor role.	The receiving ATCO shall be responsible to finalise the transfer of control and complete the	In case of contingency and in case of emergency part of ATCOs task may

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s to be performed by a human actor.		be performed by a human actor				responsibilities. The SUP should monitor the RTC traffic situation and shall initiate the split. The ATCO is responsible to execute the task (i.e. coordination with the other MRTM and managing the system) and shall also have a say in exactly when the split should happen. It is also crucial to inform the MRTM which will take over the aerodrome as timely as			manage the handover between themselves, thus the timing of the split should be coordinated between SUP and ATCOs. Local assessment is recommended to establish if part of ATCOs task of coordination with other entities can be delegated to the supervisor e.g. the coordination with other entities might be delegated to the supervisor rather than the ATCOs.		handover procedure The RTC supervisor role shall monitor the RTC aerodromes conditions and traffic load to establish the aerodromes allocation to the RTC modules	be delegated to The RTC supervisor to reduce the workload for the remote tower module ATCO The handover procedure initiation should be

						possible, so that s/he can mentally prepare for the merge. Indra/Avinor: All ATCOs agreed that their roles and responsibilities when providing ATS to multiple aerodromes with flexible allocation were clear and acceptable, on condition that clear rules and procedures were established to prevent overload on the position.						responsibility of the RTC supervisor role. Timing of the handover procedure should be coordinated between SUP and ATCOs as it's ATCO responsibility

						2.1 DLR The results show that the majority of participants finds the changes clear, consistent, acceptable, and applicable. COOPANS: In general, ATCOs agreed that applied roles and responsibilities remain as clear, consistent, stable and acceptable as they are when controlling only one tower. ATCOs roles and						to manage the hand over

						responsibilities introduced by the multiple remote tower concept when working with a flexible allocation of aerodromes between the modules do not change, only the amount of areas in which the roles and responsibilities are executed multiply with each tower. ENAV: The description of the roles &						

						Responsibilities was found clear and complete, nevertheless the ATCOs suggested some coordination tasks might be delegated to the supervisor (e.g. coordination with other ground entities). Also checklist for the handover, for abnormal and for degraded mode were recommended to be consolidated						

							Roles and responsibilities shall be locally defined, ensuring they cover all actors involved for normal, abnormal and degraded modes of operations.	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.		A local assessment should be conducted to establish supervisor and ATCOs responsibilities in the remote tower centre with the flexible allocation depending on the available level of automation and the RTC size The time the ATCO works on each airport should be automatically monitored to ensure that the minimum required amount of	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	A local assessment should be conducted to establish supervisor and ATCOs responsibilities in the remote tower centre with the flexible allocation

										hours (and therefore the endorsement) is maintained.	ng coordination procedures.	depending on the available level of automation and the RTC size The time the ATCO works on each airport should be automatically monitored to ensur

												e that the minimum required amount of hours (and therefore the endorsement) is maintained.
				OBJ-PJ05-W2-35-V3-VALP-H10	CRT-PJ05-W2-35-V3-VALP-H10.010	Indra/HC RTS: Participating ATCOs unanimously agree that the SUP roles and responsibilities are clear and	~~Future validation activities shall involve the Supervisor position~~	Roles and responsibilities shall be locally defined, ensuring they cover all actors involved for normal, abnormal and degraded modes of operations.	For the SUP position, the roles should be clearly defined because different interaction would be expected from a big center SUP and from a 2-3 airport multi remote tower center SUP. A local assessment of	ATCO shall be able to request a transfer even if he/she is not holding the RTC supervisor role	ATCO shall be able to request a transfer even if he/sh	In case of contingency and in case of emer

						acceptable in a RTC environment. It was a bit unusual for them to step back and do not get involved in an unexpected situation. Also, sectorisation is a task that is not part of the current Budapest TWR Supervisor's responsibilities. Importantly, one participant made the following observation: •"For the SUP position, the roles			which coordination task actually assigned to the ATCOs can be delegated to the supervisor might be needed. Also, a local assessment of extended SUP support of the handover phase might be needed before the deployment		e is not holding the RTC supervisor role	agency part of ATCOs task may be delegated to The RTC supervisor to reduce the workload for the remote tower module ATCO Timing of the

						should be defined because different interaction would be expected from a big centre SUP and from a 2-3 airport multi remote centre." Indra/Avinor: There was not a majority of supervisors assessing that the change in roles and responsibilities was acceptable since improvements were needed on the supervisor position.						hand over procedure should be coordinated between SUP and ATCOs as it's ATCO responsibility to manage the hand over

						The acceptability of the change in roles and responsibilities was conditioned for supervisors to necessary system improvements to better monitor the traffic situation and workload at MRTMs, to have a cleared view on ATCOs endorsements and availability, and a better planning tool to support the flexible allocation of						

						aerodromes . 2.1 DLR The majority of the participants at the SUP workplace agreed with their roles and responsibilities and also confirmed that they are clear, consistent, stable and acceptable. Even so, the expert comments suggest that there is still work to do and the roles and responsibilities have to be defined in more detail						

						ENAV: The description of the roles & Responsibilities was found clear, stable and complete, but supervisors test subjects raised and agreed on the possibility of undertaking some of the coordination tasks currently assigned to the ATCOs as mentioned in the previous objective. A further comment was also raised about						

						the possibility for the supervisor to support more the handover phase, but while both the supervisor agreed on this option, they did not fully agree on which extend this support was to be provided and on the modality.						
Arg. 1.1.3: Roles and responsibilities are clea	W2.PJ05.35_Is.1.1.3-1	Roles & responsibilities are not clear & cons	Closed	OBJ-PJ05-W2-35-V3-VALP-H07	CRT-PJ05-W2-35-V3-VALP-H07.010	Indra/HCRTS: See W2.PJ05.35_Is.1.1.2-1 Indra/Avinor: Same as W2.PJ05.35_Is.1.1.2-1 2.1 DLR The results	In case the TWR ATCO`s responsibility covers the apron area as well, the apron shall be visible on the cameras.					

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r and consistent (in V1: non-contradictory).		istent				show that the majority of participants finds the changes clear, consistent, acceptable, and applicable. COOPANS: Check W2.PJ05.35_Is.1.1.2-1 ENAV: roles and responsibilities were acceptable for the participating ATCOs						
							Split and merge procedures shall be locally defined with a clear description of the associated roles and responsibilities	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		A local assessment should be conducted to establish supervisor and ATCOs responsibilit	Transfer procedures (for the transf er of	A local assessment should be cond

							and corresponding coordination	corresponding coordination procedures.		ies in the remote tower centre with the flexible allocation depending on the available level of automation and the RTC size 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.	an aerodrome between MRTMs) shall be locally defined with a clear description of the associated roles and responsibilities and corresponding coordination procedures.	ucted to establish supervisor and ATCOs responsibilities in the remote tower centre with the flexible allocation depending on the available level of

												automation and the RTC size The time the ATCO works on each airport should be automatically monitored to ensure that the minimum required amo

												unt of hours (and therefore the endorsement) is maintained.
							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.				Transfer procedures (for the transfer of an aerodrome between MRTMs) shall be locally define	

											d with a clear description of the associated roles and responsibilities and corresponding coordination procedures.	
				OBJ-PJ05-W2-35-V3-VALP-H10	CRT-PJ05-W2-35-V3-VALP-H10.010	Indra/HCRTS: See W2.PJ05.35_Is.1.1.2-1 Indra/Avinor: Same as W2.PJ05.35_Is.1.1.2-1 2.1 DLR Same as W2.PJ05.35_Is.1.1.2-1	Roles and responsibilities shall be locally defined, ensuring they cover all actors involved for normal, abnormal and degraded modes of operations.					

						ENAV: roles and responsibilities were acceptable for the participating ASUPs						
							~~Future validation activities shall involve the Supervisor position~~					

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Arg. 1.2.1: Operating methods cover operations in normal operating conditions.	W2.PJ05.35_Is.1.2.1-1	Operating methods do not cover all operations in normal operating condition	Closed	OBJ-PJ05-W2-35-V3-VALP-H09	CRT-PJ05-W2-35-V3-VALP-H09.010	Indra/HC RTS: Supervisors reported that they were able to efficiently support ATCOs in non-nominal situations, and were also able to make decisions about the split. However, they also expressed some of the difficulties they faced as first-time RTC Supervisors. Some of their issues were the followings: •"To precisely	Split and merge procedures shall be locally defined with a clear description of the associated roles and responsibilities and corresponding coordination	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.	The Supervisor should initiate the split as s/he is the one who has the overview of the predicted traffic load. If the overload is uncertain or would last for a short period, the SUP should consult with the ATCO whether s/he wants to split or keep the aerodrome. It is possible that the ATCO would rather take on 2 additional flights than to split. It should be the ATCOs' responsibility to manage the handover between themselves, thus the timing of the split should be coordinated between SUP and ATCOs. Operational procedures and check lists for nominal conditions as well as for abnormal and degraded mode shall be revised, definitely consolidated and put in place to	Operating procedure for the handover should foresee a period dedicated to the monitoring including frequency monitoring before the actual handover and a coordination between the ATCOs	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 correspondi	Operating procedure for the handover should foresee a period dedicated to the monitoring including frequency monitoring before the actual handover

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						identify the peaks. I needed to analyse the data provided by the system, because the yellow marked periods were not real peaks in most cases." •"To stay in my place and not to take part physically in the situation. Maybe bigger distances between the positions and direct phone lines would have solved this issue."			support the RTC with flexible allocation		ng coordination procedures. The receiving ATCO shall be responsible to finalise the transfer of control and complete the handover procedure Handover Operational proce	and a coordination between the ATCOs The handover procedure initiation should be responsibility of the RTC supervisor role. Timing of the hand

						Indra/Avinor: The majority of SUPs assessed that operating methods could be applied in an efficient manner in normal operating conditions but not in abnormal operating conditions or degraded modes. The operating methods consisting in changing the allocation of aerodromes by splitting aerodrome(s) could not always be applied in					dures and check lists for nominal conditions, abnormal and degraded mode shall be locally established to support the RTC.	over procedure should be coordinated between SUP and ATCOs as it's ATCO responsibility to manage the hand over

						case of unexpected situations or overload on a position, because there was no other ATCO available to take over the aerodrome(s) when needed. This illustrates the necessity to have sufficient personnel available to make the dynamic allocation operating method applicable for supervisors. 2.1 DLR The majority of						

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						the participants agreed that their mental workload was not above average and therefore in a timely manner and that they could perform their task efficiently. No abnormal or degraded modes were tested in the scenarios. It has to be noted that abnormal operating conditions and degraded modes were not tested and were only part of						

						the tailor-made questionnaire. ENAV: The participating supervisors agreed that that operating methods can be applied in an accurate, efficient and timely manner in normal operating conditions, in case of aircraft emergency and in case of failure of the system when working in a RTC with a flexible allocation of						

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						aerodromes between MRTMs, but as already mentioned they recommended that operational procedures and check lists for nominal conditions as well as for abnormal and degraded mode shall be revised, definitely consolidated and put in place to support the RTC with flexible allocation						

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							Supervisor operating methods for frequently occurring abnormal conditions and emergency situations shall be defined.		It should be the ATCOs' responsibility to manage the handover between themselves, thus the timing of the split should be coordinated between SUP and ATCOs.		Supervisor operating methods for frequently occurring abnormal conditions and emergency situations shall be defined.	Timing of the handover procedure should be coordinated between SUP and ATCOs as it's ATCO responsibility to manage the handover

				OBJ-PJ05-W2-35-V3-VALP-H06	CRT-PJ05-W2-35-V3-VALP-H06.010	Indra/HC RTS: The majority of the ATCOs indicate that the procedures adequately support efficient task performance. Indra/Avinor: All ATCOs confirmed that Operating methods when providing ATS services to multiple aerodromes were efficient under both normal and abnormal operating conditions. 2.1 DLR The	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.		Split should happen in a lower traffic period, when the ATCOs have spare capacity for the handover process and to build up the situational awareness. Operational procedures and check lists for nominal conditions as well as for abnormal and degraded mode shall be revised, definitely consolidated and put in place to support the RTC with flexible allocation It is recommended to finalise operational procedures and checklist for the handover, for abnormal and for degraded mode to support the deployment	Handover procedure should be initiated in lower traffic period to not affect ATCOs workload and situational awareness in nominal conditions Handover procedure should be initiated in lower traffic period to not affect ATCOs workload and situational awareness in nominal conditions	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	Handover procedure should be initiated in lower traffic period to not affect ATCOs workload and situational awareness in nominal conditions

						results show that the majority of participants took below medium effort to issue timely commands. The tailor-made PE questionnaire shows that the majority of participants agrees with the statements concerning the different modes of operation. And the final comment indicates a general need for more training of the					transfer process is finished, readiness by overtaking ATCO is confirmed and the fully control over the new aerodrome is being reported established. Checklist for the handover	

						operational methods. COOPANS: Operating methods could be applied in accurate, efficient and timely manner in normal operating conditions. ENAV: the participating ATCOs agreed that that operating methods can be applied in an accurate, efficient and timely manner in normal operating conditions, in case of aircraft					shall be defined The receiving ATCO shall be responsible to finalise the transfer of control and complete the handover procedure	

						emergency and in case of failure of the system when working in a RTC with a flexible allocation of aerodromes between MRTMs, but as already mentioned they recommended that operational procedures and check lists for nominal conditions as well as for abnormal and degraded mode shall be revised, definitely consolidated and put in place to						

						support the RTC with flexible allocation						
							Operating methods shall be locally defined covering normal, abnormal and degraded modes of operations.					
							~~Future validation activities shall involve the Supervisor position~~					
Arg. 1.2. 1: Operating methods cover operati	W2.PJ 05.35 _Is.1.2 .1-2	Operating methods might not be appropriate	Closed	#N/D	#N/D							
								Split and merge procedures shall be locally defined with a clear description of the associated roles and responsibilities and corresponding coordination				

ons in normal operating conditions.		to control the required traffic volume in normal operating conditions										
Arg. 1.2.1: Operating methods cover operations in	W2.PJ05.35_Is.1.2.1-4	Operating methods for transferring/ assuming control of	Closed	OBJ-PJ05-W2-35-V3-VALP-H09	CRT-PJ05-W2-35-V3-VALP-H09.010	Indra/HCRTS: Same as W2.PJ05.35_Is.1.2.1-1 Indra/Avinor: Same as W2.PJ05.35_Is.1.2.1-1 2.1 DLR Same as W2.PJ05.35_Is.1.2.1-1	~~-Assess Supervisor workload in scenarios addressing the transfer/ assuming of aerodromes.~~			In case of high workload situations, such as an emergency situation, at one of the airports - significantly increasing the ATCO/AFISO workload and	Checklist for the handover shall be defined Handover Operational proce	

normal operating conditions.		aerodromes from one MRTM to another are not clear or efficient. Transferring/assuming an aerodrome at an MRTM might increase wor				ENAV: Supervisors recommended to finalise operational procedures and checklist for the handover, for abnormal and for degraded mode to support the deployment				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: • Temporarily stopping/delaying traffic at the other/all airport(s); • Transferring the provisioning of ATS for the	dures and check lists for nominal conditions, abnormal and degraded mode shall be locally established to support the RTC.	

		kload dep endi ng on traff ic volu mes and traff ic com plexi ty.								airport(s) not affected by the unexpected event to another MRTM; • Requesting the support of another ATCO to be able to continue the service provision for all aerodromes from the existing RTM. Note: The RTC Supervisor may support the controller to apply these procedures.		

				OBJ-PJ05-W2-35-V3-VALP-H06	CRT-PJ05-W2-35-V3-VALP-H06.010	Indra/HCRTS: Same as in W2.PJ05.35_Is.1.2.1-1 Indra/Avinor: Same as W2.PJ05.35_Is.1.2.1-1 2.1 DLR Same as W2.PJ05.35_Is.1.2.1-1 COOPANS: ATCOs agreed that the operating methods for transfer of the aerodromes between the MRTMs were feasible and acceptable. Since the traffic volume and traffic	~~Assess Supervisor acceptance of operating methods in scenarios addressing transferring of aerodromes.~~		The Supervisor should initiate the split as s/he is the one who has the overview of the predicted traffic load. If the overload is uncertain or would last for a short period, the SUP should consult with the ATCO whether s/he wants to split or keep the aerodrome. It is possible that the ATCO would rather take on 2 additional flights than to split. It should be the ATCOs' responsibility to manage the handover between themselves, thus the timing of the split should be coordinated between SUP and ATCOs. It is recommended to finalise operational procedures and checklist for the handover, for abnormal and for degraded mode to support the deployment	The handover procedure initiation should be responsibility of the RTC supervisor role.	Checklist for the handover shall be defined The receiving ATCO shall be responsible to finalise the transfer of control and complete the handover procedure Hando	The handover procedure initiation should be responsibility of the RTC supervisor role. Handover procedure should be initiated in lower traffic

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						complexity can contribute to increased workload, timely transfer of the aerodromes between MRTMs should be performed in order to mitigate high workload at one of the MRTMs. ENAV: ATCOs recommended to finalise operational procedures and checklist for the handover, for abnormal and for					ver Operational procedures and check lists for nominal conditions, abnormal and degraded mode shall be locally established to support the RTC.	period to not affect ATCOs workload and situational awareness in nominal conditions Timing of the handover procedure should be coordinated

						degraded mode to support the deployment						between SUP and ATCOs as it's ATCO responsibility to manage the hand over
Arg. 1.2.1: Operating methods cover operations in normal	W2.PJ05.35_Is.1.2.1-5	Different aerodromes have different procedures and different char	Closed	OBJ-PJ05-W2-35-V3-VALP-H09	CRT-PJ05-W2-35-V3-VALP-H09.010							

operating conditions.		acteristics. This may add confusion, increase the amount of information ATCOs have to remember, and as a consequence increase the pote										

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		ntial for human error. This could have an impact at the system level on safety										
Arg. 1.2.2: Operating methods cover operati	W2.PJ05.35_Is.1.2.2-1	Operating methods do not cover all operations in abn	Open	OBJ-PJ05-W2-35-V3-VALP-H06	CRT-PJ05-W2-35-V3-VALP-H06.010	Indra/HCRTS: Same as in W2.PJ05.35_Is.1.2.1-1, however, the abnormal scenario has been touched upon during the	The ATCO shall be able to provide uninterrupted service during transfer of responsibility between MRTMs		In case of an emergency, the other aerodrome(s) should be handed over to make sure that the ATCO can fully focus on the non-nominal situation. It is better to split as soon as possible, and not to wait for additional information on the emergency to predict the expected workload,		Checklist for the handover shall be defined	

ons in abnormal operating conditions.		normal conditions (like in emergency situations)				debriefing sessions. According to ATCO feedbacks, the emergency situation (aircraft emergency due to landing gear problem) was manageable, although it is important that the aerodrome(s) which are not affected with the emergency situation should always be split as soon as possible, and the ATCO should not wait for additional information			because such a situation can quickly escalate, which would make split process more challenging. HMI for the emergency communication should be refined Checklists are recommended to be refined to handle emergency situation. It is recommended to isolate the airport hosting the aircraft in emergency			

						on the emergency to predict the expected workload, because such a situation can quickly escalate, which would make split process more challenging. It is recommend ed to apply this as an obligatory rule. Indra/Avino r: Same as W2.PJ05.35 _Is.1.2.1-1 2.1 DLR Same as W2.PJ05.35 _Is.1.2.1-1 COOPANS:						

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						No abnormal situation was tested. ENAV: Emergency scenario has been tested, HMI for the emergency communication should be refined, anyway situation awareness was maintained at acceptable level. Checklists were recommended to be refined to handle emergency situation. It was also suggested to isolate						

						the airport hosting the aircraft in emergency so that ATCO attention can be focused on the aircraft in emergency						
				OBJ-PJ05-W2-35-V3-VALP-H06	CRT-PJ05-W2-35-V3-VALP-H06.010	Indra/HCRTS: same as above Indra/Avinor: Same as W2.PJ05.35_Is.1.2.1-1 2.1 DLR Same as W2.PJ05.35_Is.1.2.1-1 COOPANS: No abnormal situation was tested. ENAV: Same	The ATCO shall be able to transfer one of the controlled aerodromes to another MRTM					

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						as W2.PJ05.35 _Is.1.2.1-1						
							In case of 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: • Temporarily stopping/delaying traffic at the other/all airport(s); • Transferring the					

							provisioning of ATS for the airport(s) not affected by the unexpected event to another MRTM; • Requesting the support of another ATCO to be able to continue the service provision for all aerodromes from the existing RTM. Note: The RTC Supervisor may support the controller to apply these procedures.					
				#N/D	#N/D		Supervisor operating methods for frequently occurring abnormal conditions and emergency situations shall be defined.				Supervisor operating methods for frequently occurring abnormal	

											conditions and emergency situations shall be defined.	
Arg. 1.2.4: The content of operating methods is clear and consistent (in	W2.PJ05.35_Is.1.2.4-1	The content of the operating methods is unclear & contradictory.	Closed	OBJ-PJ05-W2-35-V3-VALP-H09	CRT-PJ05-W2-35-V3-VALP-H09.010	Indra/HCRTS: Same as in W2.PJ05.35_Is.1.2.1-1 Indra/Avinor: Same as W2.PJ05.35_Is.1.2.1-1 2.1 DLR Same as W2.PJ05.35_Is.1.2.1-1 ENAV: Same as W2.PJ05.35_Is.1.2.1-1			Local guidelines with regard to when the support from an additional ATCO or assistant shall be asked for, should be locally defined			

V1: non-contradictory).				OBJ-PJ05-W2-35-V3-VALP-H06	CRT-PJ05-W2-35-V3-VALP-H06.010	Indra/HC RTS: Same as in W2.PJ05.35_Is.1.2.1-1 Indra/Avinor: Same as W2.PJ05.35_Is.1.2.1-1 2.1 DLR Same as W2.PJ05.35_Is.1.2.1-1 COOPANS: Same as W2.PJ05.35_Is.1.2.1-1 ENAV: Same as W2.PJ05.35_Is.1.2.1-1	NOTAM and AIP information shall clearly indicate to the flight crew that they are going to fly to a "multiple remote" TWR, in order to ensure appropriate awareness about the possibility of hearing multiple clearances on frequency that apply to other aerodromes.					
							~~Assess Supervisor acceptance of operating methods in scenarios addressing transferring of aerodromes.~~					

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Arg. 1.2.5: Operating methods can be followed in an accurate, efficient and timely manner.	W2.PJ05.35_Is.1.2.5-1	The operating methods can not be followed in an accurate, efficient and timely manner	Closed	OBJ-PJ05-W2-35-V3-VALP-H09	CRT-PJ05-W2-35-V3-VALP-H09.010	Indra/HC RTS: Same as in W2.PJ05.35_Is.1.2.1-1 Indra/Avinor: Same as W2.PJ05.35_Is.1.2.1-1 2.1 DLR Same as W2.PJ05.35_Is.1.2.1-1 ENAV: Same as W2.PJ05.35_Is.1.2.1-1	~~Future validation activities shall involve the Supervisor position~~					
							~~Future validation activities shall assess the timeliness of executing tasks for the supervisor position.~~					
				OBJ-PJ05-W2-35-V3-VALP-H06	CRT-PJ05-W2-35-V3-VALP-H06.010	Indra/HC RTS: Same as in W2.PJ05.35_Is.1.2.1-1 Indra/Avino						

						r: Same as W2.PJ05.35 _Is.1.2.1-1 2.1 DLR Same as W2.PJ05.35 _Is.1.2.1-1 COOPANS: Same as W2.PJ05.35 _Is.1.2.1-1 ENAV: Same as W2.PJ05.35 _Is.1.2.1-1						
Arg. 1.3. 1: The potential for human error is reduced as far	W2.PJ 05.35 _Is.1.3 .1-1a	ATC O might confuse displayed airports when searchin	Closed	#N/D	#N/D							

as possible.		g for flights (search in wrong display) as some information is displayed in a combined HMI integrating the different airports or as										

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		information is displayed only temporarily.										
Arg. 1.3.1: The potential for human error is reduced as far as possible.	W2.PJ05.35_Is.1.3.1-1b	SUP might confuse displayed airports when searching for flights (search in wrong display)	Closed	OBJ-PJ05-W2-35-V3-VALP-H01	CRT-PJ05-W2-35-V3-VALP-H01.010	Indra/HCRTS: The mean scores of the China-Lake metric suggest that SUPs' situational awareness was at acceptable level. Indra/Avinor: Situation awareness could not always be maintained at a satisfying level because	~~Future validation activities shall identify system possibilities on the SUP HMI to indicate different airports.~~		SUP tool HMI should allow multiple windows to access all the needed information displayed at the same time and should include airport transfer system			

		as some information is displayed in a combined HMI integrating the different airports or as information is displayed only temporarily.				supervisors lacked sufficient information on their position to monitor workload and manage unexpected situations at MRTMs. 2.1 DLR The majority of participants at the SUP workplace indicates a positive SA. The PE tailor-made questionnaire even indicates so much that the participants thought they could also keep the same SA under abnormal						

						condition. ENAV: Supervisor situation awareness was found acceptable by all the participating test subjects, nevertheless they suggested improvement in the HMI supervisor tool, even if there was never confusion about which airport was displayed						
				OBJ-PJ05-W2-35-V3-VALP-H01	CRT-PJ05-W2-35-V3-VALP-H01.040	Indra/HCRTS decided not addressed this specifically. Indra/Avino	The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC.					The RTC Supervisor should be provi

						r: The majority of SUP confirmed that they could maintain an adequate level of SA, despite having to divide their attention to different clusters of aerodromes. The validity of the results for the criteria applies to an assigned number of 4 aerodromes. 2.1 DLR China Lake and tailor-maid results show that that the participants						ded with the forecasted demand for all involved aerodromes part of the RTC.

						were able to divide their attention and keep SA on an adequate level. ENAV: one cluster of aerodrome only was addressed						
				OBJ-PJ05-W2-35-V3-VALP-H12	CRT-PJ05-W2-35-V3-VALP-H12.050	Indra/HC RTS: The number of errors made in the simulation was negligible and was due to the unfamiliarity with the system. The issue mentioned in Column D did not come up during the simulation.	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.		SUP tool HMI should allow multiple windows to access all the needed information displayed at the same time.			The RTC Supervisor role should be provided with a display presenting an overview of the

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						Indra/Avinor: The supervisor HMI did not lead to error during the validation; however, some HMI improvements are needed to prevent use errors such as confusion between the live vs. the planned allocation of aerodromes to MRTMs. 2.1 DLR Even so, the system is usable above average the participant agreed that changes to the SUP role						RTC, including e.g. MRTM status, aerodromes allocated to MRTMs, traffic load, etc. to be able to transfer an airport.

						would significantly contribute to human error. The human error could be decreased with automation in the SUP user interface. ENAV: No critical errors were observed during the simulation execution. Anyway, supervisor planning tool HMI improvements were suggested to have the option of multiple windows that could						

						reduce the possibility of human error by having all the needed information displayed at the same time.						

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				OBJ-PJ05-W2-35-V3-VALP-H18	CRT-PJ05-W2-35-V3-VALP-H18.010	Indra/HC RTS: The HMI supported the SUP to identify peak traffic periods and initiate the split and merge process. On the ATCO side however, the HMI's radar map layout and the EFS bay changed to accommodate the new aerodrome, but the MET window remained at the same position which led to confusion. The same happened even if the ATCOs just	The video system shall follow the ATM system's split and merge state, and the unnecessary aerodrome should not be displayed in the video system's menu. Also, 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.	The HMI of the RTC technical system shall be locally assessed and designed in relation to the specific operational environment, depending on the size and type of the RTC Meteo information shall be integrated and displayed in the scan path of the ATCOs and shall be automatically handed over according to the established module configuration after split and merge procedures.	COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode. The deployment the HMI of the technical system shall be locally assessed and designed in relation to the specific operational environment.		When an aerodrome is opened in an MRTM the video system shall automatically display it without the need for additional ATCOs manual actions Meteo information shall be	

						wanted to switch the places within the MRTM, without any split. Indra/Avinor: The HMIs did not fully support ATCOs and SUP teamwork because information was not sufficient to ensure a common shared picture of the situation at the MRTMs. ATCOs needed a clearer visual indication of the transfer status when merging or					integrated and displayed in the scan path of the ATCOs and shall be automatically handed over according to the established module configuration after split and merge procedures.	

						splitting aerodromes . Supervisors missed the possibility to mirror when needed a given MRTM's HMI such as strip bays and out of the window view to be able to understand or monitor the current situation for the ATCO without having to move to the position in order to keep access to their own tools and maintain supervision on the other						

						MRTM/aerodromes. Indra/HC PSM: The technical system (InNOVA) supported the ATCOs during split and merge. However, the IRTOS video system was not connected to the InNOVA system, which led to the situation that even though the aerodrome was not with the MRTM (not even in "view only mode"), the ATCO could						

						still use its IRTOS menu. 2.1 DLR The majority of the ATCOs agreed that the System / HMI supported the transfer of an Aerodrome and was in accordance with the operating methodology. COOPANS: Technical System/HMI supported the ATCOs by being accurate, useful for task execution and well integrated.						

						ENAV: even if it was considered that the technical system/HMI supported the ATCOs in performing their tasks, the ATCOs suggested improvements to the employed HMI, especially in the position of the emergency button and the handover transfer that were located in the border of the head-down display while the ATCOs						

						would have preferred them integrated in the strip bay area. These results are to be interpreted as recommendations for the simulating environment rather than the concept itself and what can be generalised for the concepts is that before the deployment the HMI of the technical system shall be locally assessed and						

						designed in relation to the specific operational environment. Another possible issue was in relation to the fix position of the airports in the out of the window view and CWP head down display. While in the previous phase of the project it was recommended to keep fix position for the airports to help the situation awareness, the collected						

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						feedback was that the fix position had an opposite effect especially when the transferred airport was a third airport in the middle fix position: during the transfer allocating the airport in the middle caused a temporary disorientation of the ATCOs that required a few times to recap the exact position of the airports. They would have preferred to						

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						receive the transferred airport always occupying the last position in all the screen i.e. on the bottom of the displays for the external view and on the right on the head down CWP displays. Finally the ATCOs suggested a line marking the airport area of each displayed airport in the OTW						

				OBJ-PJ05-W2-35-V3-VALP-H01	CRT-PJ05-W2-35-V3-VALP-H01.030	Indra/HC RTS: Every participant agreed that the HMI supported their situational awareness and decision-making process. Indra/Avinor: The user interface design did not support a sufficient level of situation awareness regarding the current traffic situation and workload at the MRTMs. The traffic timeline tool did not always			It is recommended to allow a flexible display of the airports in the OTW view and in head-down display (no fix position, but the new airports always displayed as the last one. The OTW should underline the border of each displayed airport			

						reflect the aircraft movements that the ATCOs had on frequency and that were active on his stripboard. Supervisors also missed information about vehicles movements and runway closure. The need was also raised to show traffic numbers over periods of time and to get capacity threshold alerts to be able to anticipate potential overloads.						

						2.1 DLR The majority of the participants confirms by an above average SASHA score which indicates an above average situation awareness. ENAV Situation awareness was maintained at acceptable level by all the participating test subject. Anyway it was raised a possible issue in relation to the fix						

						position of the airports in the out of the window view and CWP head down display. While in the previous phase of the project it was recommend ed to keep fix position for the airports to help the situation awareness, the collected feedback was that the fix position had an opposite effect especially when the transferred airport was a third						

						airport in the middle fix position: during the transfer allocating the airport in the middle caused a temporary disorientation of the ATCOs that required a few times to recap the exact position of the airports. They would have preferred to receive the transferred airport always occupying the last position in all the screen i.e. on the bottom of						

						the displays for the external view and on the right on the head down CWP displays						
Arg. 1.3. 1: The potential for human error is reduced as far as possible.	W2.PJ 05.35 _Is.1.3 .1-2	Wrong procedures applied to wrong APT. If an ATCO confuses the aero	Closed	OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.040	Indra/HC RTS: ATCOs could maintain their situational awareness in spite of the four different Norwegian airports. They expressed the need for an indication of cardinal	The ATCO should be provided with a clear indication of which aerodrome an incoming radio transmission is related to.		It is recommended to allow a flexible display of the airports in the OTW view and in head-down display (no fix position, but the new airports always displayed as the last one. The OTW should underline the border of each displayed airport		Visual Presentation requirements shall be locally refined to support the deployment of the RTC with	The ATCO should be provided with a visual clear indication de-activable on ATCO

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		dromes she/he may provide erroneous control actions. Safety implications.				directions on the visual panorama (due not being familiar with the airports). Indra/Avinor: ATCOs could maintain an adequate level of SA despite having to divide their attention to several airports with different procedures and characteristics. It was only in the first run that ATCOs experienced difficulties					flexible allocation of airports between modules.	request of which aerodrome an incoming radio transmission is related to in order to quickly distinguish the aerodromes and identify where the call is comi

						identifying runway directions on the different aerodromes. This was due to both unfamiliarity with aerodromes and absence of overlaid information aids, such as compass and/or RWY directions, on the heads-up display aerodrome views. 2.1 DLR The results show that the majority of participants could keep a mental picture of						ng from.

						the different aerodromes and was able to divide their attention if the setting was changing. COOPANS: ATCOs maintained an adequate level of SA, despite having to divide their attention to maximum 3 aerodromes at a time with different procedures and characteristics. No confusion about aerodromes						

						were detected by observers or reported by the ATCOs. All inconsistencies that affect SA are more related to other factors than the differences on procedures and characteristics on itself. ENAV: Situation awareness was always maintained at acceptable level and there was no margin of confusion. Even if it						

						was considered that the technical system/HMI supported the ATCOs in performing their tasks, the ATCOs suggested improvements to the employed HMI, especially in the position of the emergency button and the handover transfer that were located in the border of the head-down display while the ATCOs would have preferred						

						them integrated in the strip bay area. These results are to be interpreted as recommendations for the simulating environment rather than the concept itself and what can be generalised for the concepts is that before the deployment the HMI of the technical system shall be locally assessed and designed in relation to						

						the specific operational environment. Another possible issue was in relation to the fix position of the airports in the out of the window view and CWP head down display. While in the previous phase of the project it was recommended to keep fix position for the airports to help the situation awareness, the collected feedback was that the						

						fix position had an opposite effect especially when the transferred airport was a third airport in the middle fix position: during the transfer allocating the airport in the middle caused a temporary disorientation of the ATCOs that required a few times to recap the exact position of the airports. They would have preferred to receive the transferred						

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						airport always occupying the last position in all the screen i.e. on the bottom of the displays for the external view and on the right on the head down CWP displays. Finally the ATCOs suggested a line marking the airport area of each displayed airport in the OTW						
							The HMI shall support the ATCO to easily distinguish the input/output devices of each aerodrome for vehicles.					

				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.050	Indra/HC RTS: The system behaviour during split and merge increased the potential for human error by not moving the MET window together with the radar map and EFS bay. However, the issue mentioned in column D did not occur during the simulations. Indra/Avinor: The human machine interface sometimes	A harmonised working method for all aerodromes clustered in a multiple remote tower shall be envisaged.		COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode.	When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	When a handover is completed and accepted all systems and information that belongs to the same aerodrome shall be accepted in a single action. When a handover is initiat	

						increased the potential for human error, i.e., action error on flight status update, non-detection of wind variation. Wind variation displayed on the wind information window was not found sufficiently visible, which contributed to the non-detection of significant wind changes that should have led the ATCO to change the runway in					ed or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	

						use. In addition during the first run that ATCOs found difficult to locate the wind information after taking over a new aerodrome since the wind information window(s) did not automatically follow the new layout and could be consequently displayed over the wrong aerodrome display slot. 2.1 DLR For EXE-PJ05-W2-35-V3-2.1.1 again,						

						the SATI scores show that the ATCOs trust the system and the interface. They see the increased human error in the changed role and responsibilities. COOPANS: ATCOs stated that the human machine interface could at sometimes increase the potential for human error. ENAV: overall perception						

						was that human error was not increased in terms of potential and severity respect to the scenario without flexible allocation being the most of the answers above the tolerable threshold of 4, ATCOs commented that there is the need to always properly balance the workload in order to minimise the impact on human error, meaning that the						

						team human error potential is acceptable if the workload of the operators is acceptable.						
Arg. 1.3. 1: The potential for human error is reduced as far as	W2.PJ 05.35 _Is.1.3 .1-4	ATC Os confuse geographical local details of two airports. Pilots refe	Closed	#N/D	#N/D							

possible.		r often to local geographic positions, therefore the ATCO needs to be aware of the local geographical details for all aerodromes										

		they are controlling.										
Arg. 1.3.1: The potential for human error is reduced as far as possible.	W2.PJ05.35_Is.1.3.1-5	ATCO might confuse / have difficulty to find the information for an a/c as some information is displ	Closed	#N/D	#N/D							

		ayed in a combined HMI integrating the different airports or as information is displayed only temporarily										
Arg. 1.3.1: The potential for	W2.PJ05.35_Is.1.3.1-6	Confusion related to phra	Closed	#N/D	#N/D							

human error is reduced as far as possible.		seology										

Arg. 1.3.1: The potential for human error is reduced as far as possible.	W2.PJ05.35_Is.1.3.1-7	ATCO might confuse aerodromes, or aerodromes characteristics, when switching between different aerodromes and/or aerodro	Closed	OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.010	Indra/HCRTS: Situation awareness was at an acceptable level when providing ATS to 3 aerodromes in parallel according to the SASHA-Q scores. ATCOs were aware which aircraft they were communicating with and which a/c or vehicle belonged to which aerodrome. However, the system did not support situation awareness during the split or	The ATCO should be provided with a clear indication of which aerodrome an incoming radio transmission is related to.		To highlight, in the out of the window view, the frame related to the airport where pilots are transmitting.			The ATCO should be provided with a visual clear indication de-activable on ATCO request of which aerodrome an incoming radio transmission is related to in

		mes arra nge men ts with in the RTM				when the ATCOs wanted to flexibly switch the airports within the MRTM (for further details see CRT-PJ05-W2-35-V3-VALP-H02.030) Indra/Avinor: Situation awareness could not always be maintained at a satisfying during the time when the traffic level exceeded the capacity threshold of 8 simultaneous movements						order to quickly distinguish the aerodromes and identify where the call is coming from.

						(where VFR would count as 1,5) . 2.1 DLR The majority of participants stated an above average situation awareness in the PR assessment when working MRTM with a flexible allocation. COOPANS: For majority of ATCOs situation awareness is at an acceptable level when working in a RTC with a flexible allocation of aerodromes between						

						MRTMs. Nevertheless, the SA could be decreased very quickly when controlling three aerodromes with this traffic volume, hence the source of information is slightly larger, the incoming calls from aircraft and vehicles are increased, traffic could become more complex, so that all these factors increase the time needed for scanning of						

						all systems in order to keep SA updated. No confusions about aerodromes, or aerodromes characteristics, when switching between different aerodromes and/or aerodromes arrangements within the RTM were detected. ENAV: Situation awareness was maintained at acceptable level by the majority of ATCOs.						

						Majority of ATCOs confirmed there is no confusion about which aerodromes are displayed on which display; anyway, some ATCOs suggested during the debriefing to highlight, in the out of the window view, the frame related to the airport where pilots are transmitting .						

				OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.030	Indra/HC RTS: Whenever the ATCO received/gave away an aerodrome due to the split and merge (or changed the setup of the MRTM via flexible allocation), there was a short period when most of them lost their situational awareness. It was because of the way the head-down system behaved: the radar maps shifted to a different place on the display with	The HMI shall support the ATCO to easily distinguish the input/output devices of each aerodrome for vehicles.			When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	When a handover is completed and accepted all systems and information that belongs to the same aerodrome shall be accepted in a single action. When a handover is initiat	Pre-sets should be defined for the aerodrome radar maps in order to support the ATCO to efficiently manage flexible allocation.

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						a changing view. To make matters worse, the MET displays remained in the previous positions. This caused major confusion and temporary loss of SA. Essentially the situation awareness ATCOs built for themselves via the head-down display got massively impacted during such a change. It took some time to set the air situation					ed or perfor med all syste ms and inform ation that belon gs to the same aerodr ome shall be transf erred in a synchr onized way.	

						display and the MET windows after the split/merge. Indra/Avinor: The user interface generally supported a sufficient level of situation awareness. However one difficulty impacting SA was both observed and reported: when handing over (i.e., splitting), taking over (i.e., merging) or swapping aerodrome(s) on the same						

						position, the HMI of the heads-down display did not automatically reposition all HMIs elements in the correct place to follow the new aerodrome display slot on the screen. 2.1 DLR For EXE-PJ05-W2-35-V3-2.1.1 this criterion is covered with the SASHA as well as CRT-PJ05-W2-35-V3-VALP-H02.010. The SASHA looks at the system and						

						the SA and therefore the same results apply here. COOPANS: The user interface design supports a sufficient level of situation awareness. All systems and system functionalities were well integrated which contributed to achieve this criterion. ATCOs possibility to self-decide where to allocate taken aerodrome in the						

						MRTM VP was considering as very important feature for the SA. This is especially preferred during realising one of the three aerodromes, which allows ATCOs, the remained two aerodromes to be kept at the same position as prior the transfer occurred. All systems have followed the aerodromes allocation accordingly.						

						ENAV: Situation awareness was always maintained at acceptable level and the ATCOs were always aware to/from which airport they were talking.						
				OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.040	Indra/HC RTS: ATCOs could maintain their situational awareness in spite of the four different Norwegian airports. They expressed the need for an indication of cardinal	A harmonised working method for all aerodromes clustered in a multiple remote tower shall be envisaged.			Cardinal directions on the visual panorama should be displayed	Visual Presentation requirements shall be locally refined to support the deployment of the RTC with	Cardinal directions on the visual panorama should be displayed

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						directions on the visual panorama. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-2 2.1 DLR The results show that the majority of participants could keep a mental picture of the different aerodromes and was able to divide their attention if the setting was changing. COOPANS: ATCOs maintained an					flexible allocation of airports between modules.	

						adequate level of SA, despite having to divide their attention to maximum 3 aerodromes at a time with different procedures and characteristics. All inconsistencies that affect SA are more related to other factors than the differences on procedures and characteristics on itself. ENAV: Situation awareness						

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						was at acceptable level and no issue about the different airports characteristic was raised						

				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.010	Indra/HC RTS: Essential information were missing from the Video Wall, i.e. wind data, PTZ and cardinal directions. The InNOVA contained the most crucial information, however, the design was not the most efficient (i.e. timeline). Also, after an aerodrome switch event, the radar map has shifted to an odd coordinate position,	The ground frequency push buttons have to 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). ATCOs shall be supported by a squelch indication and coloured frames in order to quickly distinguish the aerodromes and identify where the call is coming from. These features shall be integrated both into the Visual Panorama and the head-down display.	The ground frequency push buttons shall be integrated in the CWP coherently with the airports positioning in the CWP to be easily distinguishable between airports (e.g. if airports are represented side by side the push buttons shall be respectively located on each side). The ATCO should be provided with a visual clear indication system (de-)activable on ATCO request of which aerodrome an incoming radio transmission is related to in order to quickly distinguish the aerodromes and identify where the call is coming from.	COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode.	The ATCO displays shall retain the predefined ATCOs Set-up when receiving a new aerodrome for the handover	The ATCO displays shall retain the predefined ATCOs Set-up when receiving a new aerodrome for the handover	

						the EFS layout changed, yet the MET window remained at the same position, so the layout had to be re-arranged and that took valuable time. Indra/Avinor: ATCOs assessed that all required information were easy to access and presented in an effective way. Nevertheless, the need to optimize the "timeline"						

						tool and the presentation of wind information were raised. The timeline was not always reflecting the traffic sequence as executed by the real-time simulation environment. The indication of wind variation was considered as not standing out sufficiently The display of wind information on the heads-up display (in addition to						

						heads-down display) would probably have improved the detection of change in wind direction during the runs. Indra/HC PSM: The frequencies could not be coupled for the passive shadow mode validation, which turned out to be a major inconvenience, especially on Day 1 where there was a lot of overlap						

						between the aerodromes. In line with the findings of the previous wave PJ05-02 outcome, A/G frequencies shall be coupled in order to establish and maintain situational awareness. In addition, squelch indication shall be integrated to visualize where the radio transmission is coming from, supported by coloured frames						

						around the visual panorama monitors and the InNOVA EFS. 2.1 DLR The SATI shows that the ATCOs trust the system, which includes the that the ATCOs trusted the required information. The PE questionnaire also shows that a majority of ATCOs agreed with the visual panorama, radar and strip presentation. This is also						

						reflected in the final comment. COOPANS: ATCOs state the simulator (S-m) provided useful data in an understand able way and that they rarely needed to search for information. ENAV: Most of the controllers agreed or somewhat agreed that they had all the required information to complete their tasks.						

				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.070	Indra/HCRTS: The majority of ATCOs (83.3%) were aware which aerodrome was placed to which positions of the system. Indra/Avinor: ATCOs confirmed that there was generally no confusion about which aerodromes were displayed on which display. It was only during the first run that ATCOs found difficult to locate the wind		Visual Presentation and head down displays shall have the same layout for all the possible aerodrome configurations	It is recommended to allow a flexible display of the airports in the OTW view and in head-down display (no fix position, but the new airports always displayed as the last one. The OTW should underline the border of each displayed airport		Visual Presentation and head down displays shall have the same layout for all the possible aerodrome configurations	

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						information after taking over a new aerodrome since the wind information window(s) did not automatically follow the new layout and could be consequently displayed over the wrong aerodrome display slot. Indra/HC PSM: ATCOs were aware which aerodromes were presented on which parts of the system. 2.1 DLR The results						

						show that the majority of participants was aware of the displayed aerodromes and radar configurations. COOPANS: Majority of ATCOs confirm that there was no confusion regarding where a certain aerodromes was going to be placed in the visual presentation (VP). ENAV: Majority of ATCOs confirm there is no						

						confusion about which aerodromes are displayed on which display, nevertheless they suggested to remark the border of the aerodromes in the OTW and they suggested the aerodromes have no fix position in the OTW and in the Head-down display						

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				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.050	Indra/HC: The system behaviour during split and merge increased the potential for human error by not moving the MET window together with the radar map and EFS bay. This has led to the event when a MET window was next to a different aerodrome' s EFS bay, causing confusion. The handheld mic with its two-button layout also led to	ATCOs shall be supported by a squelch indication and coloured frames in order to quickly distinguish the aerodromes and identify where the call is coming from. These features shall be integrated both into the Visual Panorama and the head-down display. The system behaviour shall be user friendly during an aerodrome switch (i.e. between and within MRTM). The MET window shall be linked to the EFS bay i.e. it should move together with the EFS and radar map during an	The HMI of the RTC technical system shall be locally assessed and designed in relation to the specific operational environment, depending on the size and type of the RTC	COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode.		The HMI of the RTC technical system shall be locally assessed and designed in relation to the specific operational environment, depending on the size and type of the RTC	The RTC Supervisor or similar role should be able to have a view over functional MRTM´s in case of an emergency in order to be able to transfer an airpo

						errors. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-2 2.1 DLR For EXE-PJ05-W2-35-V3-2.1.1 again, the SATI scores show that the ATCOs trust the system and the interface. They see the increased human error in the changed role and responsibilities. COOPANS: ATCOs stated that the human machine interface	aerodrome change.					rt. The ATCO should be provided with a visual clear indication de-activable on ATCO request of which aerodrome an incoming radio transmission is related to

						could at sometimes increase the potential for human error. ATCOs state that appropriate identification means of displayed airport and airport characteristics are in place. ENAV: the overall perception was that human error was not increased in terms of potential and severity respect to the scenario without flexible allocation						in order to quickly distinguish the aerodromes and identify where the call is coming from.

						being the most of the answers above the tolerable threshold of 4, anyway in relation to the HMI ATCOs suggested improvements in the position of the handover system commands and in the emergency communication commands						

				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.080	Indra/HC: It was unanimously agreed that it was clear which aerodrome was transferred between the MRTMs. The Supervisor made sure that ATCOs were aware which aerodromes will be affected by the split. Indra/Avinor: All ATCOs confirmed that there was no confusion about which aerodrome will be transferred between the MRTMs.						

						The supervisor role and the HMI supported ATCOs' awareness about which aerodrome(s) they were about to hand over or take over. When taking over a new aerodrome, ATCOs could setup the new aerodrome in a "view only" mode on the MRTM, allowing them to prepare to open a new aerodrome or receive a handover. Indra/HC						

						PSM: It was unanimously agreed that it was clear which aerodrome was transferred between the MRTMs 2.1 DLR The majority of the ATCOS were aware which airport will be transferred and under which conditions. COOPANS: Majority of the ATCOs confirm they were never confused witch aerodromes that was going to be						

						transferred. ENAV: ATCOs were always aware of which airport was displayed where.						
Arg. 1.3.2: Tasks can be achieved in a timely manner.	W2.PJ05.35_Is.1.3.2-1	SUP tasks can not be achieved in a timely manner. Resulting in operator	Closed	OBJ-PJ05-W2-35-V3-VALP-H01	CRT-PJ05-W2-35-V3-VALP-H01.020	Indra/HCRTS decided not addressed this specifically. Indra/Avinor: It was not always possible for the supervisors to satisfactorily plan the allocation of aerodromes to MRTMs	~~Future validation activities shall assess the timeliness of executing tasks for the supervisor position.~~	ATCOs and SUP tools shall use actual traffic		The HMI of the RTC technical system shall be locally assessed and designed in relation to the specific operational environment, depending on the size and type of the RTC	The HMI of the RTC technical system shall be locally assessed and designed in relation to the	

		stress (with tasks stacking up and requiring recall) leads to increased human error probabilities and consequences. At system level				and ATCOs. The limitations of the traffic timeline tool, the lack of a dedicated planning tool and the incomplete overview on ATCOs availability (i.e., roster), reduced the ability of the supervisors to plan the allocation of aerodromes and prioritize their tasks. 2.1 DLR The results show that the SUP on average was only sometimes able to				ATCOs and SUP tools shall use actual traffic	specific operational environment, depending on the size and type of the RTC ATCOs and SUP tools shall use actual traffic	

		could impact efficiency and safety				"priories task". Considering the final comments from the ATCOs this was mainly due to the new approach of the SUP workplace. ENAV: Supervisors were always able to prioritise tasks and no issue was raised in relation to the task prioritization						
				OBJ-PJ05-W2-35-V3-VALP-H12	CRT-PJ05-W2-35-V3-VALP-H12.050	Indra/HC RTS: The number of errors made in the simulation was negligible	The RTC Supervisor role should be provided with a display presenting an overview of the RTC, including e.g. MRTM status,				The RTC Supervisor role shall access functi	The RTC Supervisor or similar role

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						and was due to the unfamiliarity with the system. There was one time when a Supervisor mistakenly turned off and switched on the airports in one of the active MRTMs, when in fact he wanted to open MRTM4 (dummy MRTM) in the planning tool. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR Even so, the system is	aerodromes allocated to MRTMs, traffic load, etc. to be able to transfer an airport.				ons for communicating the status of RTC and aerodromes and coordinating maintenance (to be carried out by a qualified engineer/technician). Supervisor planning tool HMI	should be able to have a view over functional MRTM´s in case of an emergency in order to be able to transfer an airport. The RTC Supervisor role shoul

						usable above average the participant agreed that changes to the SUP role would significantly contribute to human error. The human error could be decreased with automation in the SUP user interface. ENAV: No critical errors were observed during the simulation execution. Anyway, supervisor planning tool HMI improveme					and ATCO's module HMI shall be locally assessed before the deployment of the RTC with flexible allocation of airports between modules.	d be provided with a display presenting an overview of the RTC, including e.g. MRTM status, aerodromes allocated to MRTMs, traffic load, etc.

						nts were suggested to have the option of multiple windows that could reduce the possibility of human error by having all the needed information displayed at the same time.						to be able to transfer an airport.
							The RTC Supervisor shall be provided with a tool combining the information (aerodromes' status, meteo, forecasted traffic load and capacity) to facilitate decisions regarding how to combine aerodromes in the MRTM				The RTC Supervisor role shall access functions for communicating the status of RTC and	The RTC supervisor role may be provided with a tool combining the information

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											aerodromes and coordinating maintenance (to be carried out by a qualified engineer/technician).	on (aerodromes' status, meteo, forecasted traffic load and capacity) to facilitate decisions regarding how to combine aerodromes in the MRTM

							The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC.				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/te	The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC.

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											chnician).	
				OBJ-PJ05-W2-35-V3-VALP-H18	CRT-PJ05-W2-35-V3-VALP-H18.010	Indra/HC RTS: The HMI supported the SUP to identify peak traffic periods and initiate the split and merge process. On the ATCO side however, the HMI's radar map layout and the EFS bay changed to accommodate the new aerodrome, but the MET window remained at the same	The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine aerodromes in the MRTM.				The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine aerodromes in the MRTM.	

						position which led to confusion. The same happened even if the ATCOs just wanted to switch the places within the MRTM, without any split. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR The majority of the ATCOs agreed that the System / HMI supported the transfer of an Aerodrome and was in accordance with the operating						

						methodology. COOPANS: N/A due to deviation ENAV: No issues raised in relation to the team tasks						
Arg. 1.3.2: Tasks can be achieved in a timely manner.	W2.PJ05.35_Is.1.3.2-3a	ATCO might focus on tasks at one airport neglecting priorities at other airport	Closed	#N/D	#N/D							

Arg. 1.3. 2: Tasks can be achieved in a timely manner.		SUPs might focus on tasks at one airport neglecting priorities at other airport	Closed	OBJ-PJ05-W2-35-V3-VALP-H01	CRT-PJ05-W2-35-V3-VALP-H01.020	Indra/HCRTS decided not addressed this specifically. Indra/Avinor: same as W2.PJ05.35_Is.1.3.2-1 2.1 DLR The results show that the SUP on average was only sometimes able to "priories task". Considering the final comments from the ATCOs this was mainly due to the new approach of the SUP workplace.	~~Future validation activities shall the SUP`s level of situation awareness~~					

						ENAV: Situation awareness was always at acceptable level and no issues were raised in relation to the possibility to the task prioritizatio n						

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				OBJ-PJ05-W2-35-V3-VALP-H12	CRT-PJ05-W2-35-V3-VALP-H12.050	Indra/HC RTS: The number of errors made in the simulation was negligible and was due to the unfamiliarity with the system. The issue mentioned in Column D did not come up during the simulation. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR: same as W2.PJ05.35_Is.1.3.1-1b ENAV: No critical	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.		ENAV: Out of the window view requirements shall be refined finally to support the deployment of the RTC with flexible allocation of airports between modules.		Supervisor planning tool HMI and ATCO's module HMI shall be locally assessed before the deployment of the RTC with flexible allocation of airports between modules.	The RTC Supervisor or similar role should be able to have a view over functional MRTM´s in case of an emergency in order to be able to transfer an airpo

						errors were observed during the simulation execution. Anyway, supervisor planning tool HMI improvements were suggested to have the option of multiple windows that could reduce the possibility of human error by having all the needed information displayed at the same time. No issues were raised in the support to the task prioritization in relation with the						rt. The RTC Supervisor role should be provided with a display presenting an overview of the RTC, including e.g. MRTM status, aerodromes alloc

						potential for human error						ated to MRTMs, traffic load, etc. to be able to transfer an airport.

							The RTC Supervisor shall be provided with a tool combining the information (aerodromes' status, meteo, forecasted traffic load and capacity) to facilitate decisions regarding how to combine aerodromes in the MRTM					The RTC supervisor role may be provided with a tool combining the information (aerodromes' status, meteo, forecasted traffic load and capacity) to

												facilitate decisions regarding how to combine aerodromes in the MRTM
							The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC.					The RTC Supervisor should be provided with the forecasted demand for

												all involved aerodromes part of the RTC.
				OBJ-PJ05-W2-35-V3-VALP-H18	CRT-PJ05-W2-35-V3-VALP-H18.010	Indra/HCRTS: The issue mentioned in column D did not come up in the simulations. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR: same as W2.PJ05.35_Is.1.3.1-1b COOPANS: N/A due to deviation	The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine aerodromes in the MRTM.				The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine aerodromes	

						ENAV: No issues raised in relation to the team situation awareness.					in the MRT M.	
Arg. 1.3. 2: Tasks can be achieved in a timely manner.	W2.PJ 05.35 _Is.1.3 .2-3b	Handover can not be achieved in a timely manner, for example in case of an emergency situation at	Closed	OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.020	Indra/HCRTS: ATCOs were able to prioritise tasks. According to their feedback, they were ahead of traffic and could organise their work as they wanted. Giving away their other aerodrome was generally not their top priority during an emergency, although there were	~~Future validation activities shall assess the timeliness of executing tasks for the supervisor position.~~		ENAV: In case of contingency and in case of emergency it is suggested to delegate to the supervisors all the tasks that can be reduced for the remote tower module ATCO, like coordination tasks with external authorities in case of emergency etc			In case of contingency and in case of emergency part of ATCOs task may be delegated to The RTC supervisor to

		one aerodrome requiring to handover the other aerodrome(s) to another RTM				some exceptions. Regardless of the timings, the aerodrome with emergency aircraft always stayed with them and the other(s) were split. Indra/Avinor: ATCOs could not always prioritize their tasks when the traffic level was too high. 2.1 DLR The participants average answer is 3, indicating that participants had						reduce the workload for the remote tower module ATCO Timing of the handover procedure should be coordinated between SUP and ATCOs as

						difficulties prioritizing task. 22 Times out of 60 participants answered with a 0, 1, or 2, which shows that there is still place for improvement. This is supported by the comments. ENAV: Perceived situational awareness was above the tolerable threshold during all the scenarios, including the simulated emergency scenarios						it's ATCO responsibility to manage the hand over

						and failure scenarios for all the participating ATCOs, also ability to prioritise task was at acceptable level during all the simulated scenarios(nominal, emergency and failure). In case of contingency and in case of emergency it was found useful to delegate to the supervisors all the tasks that can be reduced for the remote tower module ATCO, like coordinatio						

						n tasks with external authorities in case of emergency etc.						
				OBJ-PJ05-W2-35-V3-VALP-H18	CRT-PJ05-W2-35-V3-VALP-H18.010	Indra/HC RTS: ATCOs could efficiently manage the emergency situation. Although handing over their "other" aerodrome was generally not their top priority during an emergency, they managed to do it a timely manner.	Supervisor operating methods for frequently occurring abnormal conditions and emergency situations shall be defined.		COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode. ENAV: Emergency button HMI in the ATCO module CWP shall be reviewed for the deployment of the RTC with flexible allocation of airports between modules.		Supervisor operating methods for frequently occurring abnormal conditions and emergency situations shall be defined.	

						Regardless of the timings, the aerodrome with emergency aircraft always stayed with them and the other(s) were split. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR The majority of the ATCOs agreed that the System / HMI supported the transfer of an Aerodrome and was in accordance with the operating methodology.						

						"It fully supports ATCOs and SUP, but there is still place to make it better and increase the reliability." COOPANS: Technical System/HMI supported the ATCOs by being accurate, useful for task execution and well integrated. This is not seen as a problem for handovers in degraded mode (emergency not tested) ENAV: the overall						

						trend of the answers for the support provided by the ATCO system/HMI is positive, but the difference between the threshold and the mean values is not so distant as the other analysed indicators. This is to be seen mainly in relation to the employed HMI as all the test subjects suggested improvements, especially in the position of the emergency						

						button and the handover transfer that were located in the border of the head-down display while the ATCOs would have preferred them integrated in the strip bay area. No issues were raised from supervisors.						
							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.					The RTC Supervisor role should be provided with a tech

							navigational aids, lights, emergency alerting functions, for all involved aerodromes part of the RTC					nical 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
							In case of 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: • Temporarily stopping/delaying traffic at the other/all airport(s); • Transferring the provisioning of ATS for the airport(s) not affected by the unexpected event to another MRTM; • Requesting the support of another ATCO to be able to continue the service provision for all aerodromes from the existing RTM. Note: The RTC Supervisor may support the controller to					

							apply these procedures.					
				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.020	Indra/HCRTS: Most of the ATCOs (66.6%) agree with the InNOVA being user-friendly. The functionality to perform the split and merge was highly appreciated. ATCOs oftentimes kept the aerodrome in a look-only mode after they handed it over for a short	The ATCO shall be provided with a system enabling to transfer one of the controlled aerodromes to another MRTM		COOPANS: Longer training session with focus on the PTT (Push To Talk) ENAV: Emergency button and transfer acceptance HMI in the ATCO module CWP shall be reviewed for the deployment of the RTC with flexible allocation of airports between modules.			

						period. Indra/Avinor: ATCOs confirm the usability of input devices and HMI controls. Nevertheless, the need to optimize the HMI workflow of the electronic flight strips was raised strips because it often resulted in too many unnecessary clicks. 2.1 DLR The majority of participants agrees that the strip and planning						

						tool was usable. This also applies for the SUS questionnaire score, which is above the medium scale value. This is also reflected in the final comment. COOPANS: Majority of ATCOs confirm the usability of input devices and HMI controls. This is not seen as a problem for handovers in degraded mode (emergency not tested) ENAV: the					

						overall trend of the answers for the support provided by the ATCO system/HMI is positive, but the difference between the threshold and the mean values is not so distant as the other analysed indicators. This is to be seen mainly in relation to the employed HMI as all the test subjects suggested improvements, especially in the position of the						

						emergency button and the handover transfer that were located in the border of the head-down display while the ATCOs would have preferred them integrated in the strip bay area. No issues were raised from supervisors.						
Arg. 1.3.3: The level of workload (induce	W2.PJ05.35_Is.1.3.3-1	Exceeding workload (increased number	Closed	#N/D	#N/D							Handover procedure should be initiated in lowe

d by cognitive and/or physical task demands) is acceptable.		of aerodromes to be controlled) might lead to errors										r traffic period to not affect ATCOs workload and situational awareness in nominal conditions

Arg. 1.3.3: The level of workload (induced by cognitive and/or physical task demands) is acceptable.	W2.PJ05.35_Is.1.3.3-2	Simultaneous activities at different aerodromes may overload the ATCO increasing thus the potential for human errors.	Closed	#N/D	#N/D		The simultaneous control of 3 aerodromes shall ensure the availability of a spare controller or an assistant, in case delay of traffic or the termination of service is not locally acceptable.		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			Handover procedure should be initiated in lower traffic period to not affect ATCOs workload and situational awareness in nominal conditions

							The airport name shall be integrated in the phraseology in order to increase the situational awareness for the ATCOs and pilots.					The airport name should be integrated in the phraseology in order to increase the situational
Arg. 1.3.3: The level of workload (induced by	W2.PJ05.35_Ben.1.3.3-4	Potential benefit of dynamic allocation on the man	Closed	OBJ-PJ05-W2-35-V3-VALP-H04	CRT-PJ05-W2-35-V3-VALP-H04.010	HC/Indra RTS: According to the results ATCOs workload was always at acceptable level. Although	~~Future validation activities shall assess the timeliness of executing tasks for the supervisor position.~~	Fatigue tends to accumulate toward the end of the shift and shall be locally assessed before the deployment to establish proper shift length			Fatigue tends to accumulate toward the end of the shift and	

cognitive and/or physical task demands) is acceptable.		agement of ATCO's workload				the workload increased certain times, especially during the split and merge process, it only lasted for a couple of minutes. ATCOs preferred to work in a 2:2 aerodrome distribution. Avinor/Indra: The workload level was always assessed as tolerable by ATCOs but was not always satisfactory, sometimes resulting in reduced					shall be locally assessed before the deployment to establish proper shift length	

						spare capacity. This was the case when the traffic level exceeded the capacity threshold of 8 simultaneous movements (where VFR would count as 1,5). 2.1 DLR Overall workload remained at a satisfactory or tolerable level. Only in approximately 20% of the scenarios ATCOs reported high or above high						

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						workload for the Bedford Scale. NASA-TLX answers show the same effect for the average NASA-TLX score below 50. This might be mitigated with more time for the allocation process, as stated by the final comment. COOPANS: Majority of ATCOs assess workload at tolerable level for the task. Nevertheless, the workload						

						could rapidly increase from acceptable to non-acceptable level. In situations with increased workload caused by various factors, such as: high traffic volume, high traffic complexity, complexity caused by combining aerodromes with complex layouts, etc. transfer of the aerodromes between the MRTMs can help workload to						

						be balanced/reduced.						
Arg. 1.3.3: The level of workload (induced by cognitive and/or physical task demands) is	W2.PJ05.35_Is.1.3.3-Final-WS_1	Fatigue tends to accumulate toward the end of the shift and might not be properly assessed	Open				-	Fatigue tends to accumulate toward the end of the shift and shall be locally assessed before the deployment to establish proper shift length			Fatigue tends to accumulate toward the end of the shift and shall be locally assessed before the deployment to establi	

acceptable.		in V3									sh proper shift length	
Arg. 1.3.3: The level of workload (induced by cognitive and/or physical task demands) is	W2.PJ05.35_Is.1.3.3-Final-WS_2	Coordination workload especially for VFR ight be simplified in V3 and might need furt	Open				-					

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acceptable.		her assessment in next phases										
Arg. 1.3.3: The level of workload (induced by cognitive and/or physical task demands) is	W2.PJ05.35_Is.1.3.3-3	Potential increase in ATCO workload due to frequent handover of aerodromes between	Closed	OBJ-PJ05-W2-35-V3-VALP-H04	CRT-PJ05-W2-35-V3-VALP-H04.010	HC/Indra RTS: According to the results ATCOs workload was always at acceptable level. Although the workload increased certain times, especially during the split and merge process, it only lasted	~~Future validation activities shall assess the timeliness of executing tasks for the supervisor position.~~					

acceptable.		MRTMs				for a couple of minutes. ATCOs preferred to work in a 2:2 aerodrome distribution. Avinor/Indra: same as W2.PJ05.35_Ben.1.3.3-4 2.1 DLR Overall workload remained at a satisfactory or tolerable level. Only in approximately 20% of the scenarios ATCOs reported high or above high workload for the						

						Bedford Scale. NASA-TLX answers show the same effect for the average NASA-TLX score below 50. This might be mitigated with more time for the allocation process, as stated by the final comment. COOPANS: 47 transfer in total have been initiated and realised during all 24 runs. The ATCOs did not indicate a negative impact on workload						

						due to handover of aerodromes between MRTMs. Transfer of the aerodromes were initiating and realising in order to balance the workload between the MRTMs. Not only increased workload, but also boredom was a cause transfer to be initiated and realised. No frequent handovers were envisaged or performed, instead they						

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						were planned and initiated by ATCOs, in order workload to be balanced/reduced. ENAV: The workload was always maintained at acceptable level and no issues were raised about the frequency of the handover						
Arg. 1.3.3: The level of workload (induce	W2.PJ05.35_Is.1.3.3-3	Potential increase in ATCO workload due	Closed	OBJ-PJ05-W2-35-V3-VALP-H04	CRT-PJ05-W2-35-V3-VALP-H04.010	HC/Indra RTS: According to the results ATCOs workload was always at acceptable level.	~~Future validation activities shall assess the timeliness of executing tasks for the supervisor position.~~			The ATCO should be supported in prioritising tasks (e.g. providing landing clearance or taxi clearance)		The ATCO should be supported in prioritising tasks (e.g.

d by cognitive and/or physical task demands) is acceptable.		to the responsibility of too many simultaneous aerodromes to be controlled				Although the workload increased certain times, especially during the split and merge process, it only lasted for a couple of minutes. ATCOs preferred to work in a 2:2 aerodrome distribution. The traffic level was therefore not high, and there were not too many simultaneous movements. Avinor/Indra: same as W2.PJ05.35				and forecast the traffic demand from a support tool in the tactical short term.		providing landing clearance or taxi clearance) and forecast the traffic demand from a support tool in the tactical short term.

						_Ben.1.3.3-4 2.1 DLR Overall workload remained at a satisfactory or tolerable level. Only in approximately 20% of the scenarios ATCOs reported high or above high workload for the Bedford Scale. NASA-TLX answers show the same effect for the average NASA-TLX score below 50. This might be						

						mitigated with more time for the allocation process, as stated by the final comment. COOPANS: Majority of ATCOs assess workload at tolerable level for the task. Nevertheless, the workload could rapidly increase from acceptable to non-acceptable and this cannot be ignored. Situations with high traffic						

						volume, traffic complexity, complexity caused by the aerodrome being combined at same MRTM, and sometimes transfer execution (initiation and completion) etc. are some of contributing factors workload to be increased. ENAV: In the scenario runs with the flexible allocation the workload was always maintained						

						at acceptable levels. The scenarios with 3 airports without the flexible allocation was overloaded						
							The ATCO shall be provided with a system enabling to transfer one of the controlled aerodromes to another MRTM					
							In case of 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: • Temporarily stopping/delaying traffic at the other/all airport(s); • Transferring the provisioning of ATS for the airport(s) not affected by the unexpected event to another MRTM; • Requesting the support of another ATCO to be able to continue the service provision for all aerodromes from the existing RTM. Note: The RTC Supervisor may support the					

							controller to apply these procedures.					
							The RTC should host a locally determined number of MRTMs to be able to split aerodromes.					The RTC should host a locally determined number of MRTMs to be able to split aerodromes.

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							The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC.					The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC.

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				OBJ-PJ05-W2-35-V3-VALP-H07	CRT-PJ05-W2-35-V3-VALP-H07.030	Indra/HCRTS: ATCOs all agree that providing ATC for the selected aerodromes was feasible, including the number of simultaneous movements. Indra/Avinor: All ATCOs confirmed the feasibility and acceptability of providing ATS services to the assigned number of aerodromes, on condition that clear	~~Future validation activities shall the SUP`s level of situation awareness~~		ENAV: Supervisor role shall assess and balance the workload between the modules		Supervisor role shall assess and balance the workload between the modules	

						capacity rules and procedures were established to prevent overload on the position. When merging a new aerodrome on a position, it is also important to consider the traffic situation to avoid taking over a new aerodrome at a bad moment and maintain situation awareness. 2.1 DLR For PR and PE the majority of						

						participants confirms the feasibility of the assigned number of aerodromes, the amount of traffic and the traffic mix. They also state that this is the maximum number of aerodromes. COOPANS: ATCOs neither agree nor disagree that provision of ATS to three aerodromes at a time is feasible and acceptable. The main contributor						

						to increased workload are the traffic volume and traffic complexity, as well as the amount of communication which potentially can increase the overlapping between the calls, when working simultaneous with three aerodromes at a time. ENAV: The majority of ATCOs responses confirmed the feasibility of providing ATS up to 3						

						aerodromes at the same with the support of the SUP that is in charge of balancing the workload between the modules						
Arg. 1.3.3: The level of workload (induced by cognitive and/or physical task demand	W2.PJ05.35_Is.1.3.3-3	Potential increase in SUP workload due to responsibility of several clusters of airports	Closed	OBJ-PJ05-W2-35-V3-VALP-H05	CRT-PJ05-W2-35-V3-VALP-H05.010	HC/Indra RTS: Supervisor's reported an acceptable level of workload, even during the split and merge process. Indra/Avinor: The majority of SUPs assess that the workload was at an acceptable level when working in a	~~Future validation activities shall assess the timeliness of executing tasks for the supervisor position.~~					

s) is acceptable.		in the MRTMs				RTC with a flexible allocation of aerodromes between MRTMs. The validity of the results is applicable to an assigned number of 4 aerodromes to supervise. 2.1 DLR The majority of participants working at the SUP workstation reported a low workload. Bedford and Nasa-TLX were completed in the PR and therefore no run can						

						be categorized as high workload. Even so, the SUP had to support up to 15 airports. ENAV: Workload was always considered acceptable by all the participating supervisors and no issue was raised in relation to the number of airports to be supervised. The simulation involved 1 cluster of aerodromes with 3 airports and						

						it was considered acceptable						
				OBJ-PJ05-W2-35-V3-VALP-H10	CRT-PJ05-W2-35-V3-VALP-H10.030	Indra/HC RTS: Participating ATCOs (in SUP role) unanimously agree that the assigned number of aerodromes could be handled efficiently from the SUP position. Indra/Avinor: Majority of Supervisors confirmed the feasibility and	Assess Supervisor workload in scenarios addressing the transfer/ assuming of aerodromes.		ENAV: Assessment of ATCOs coordination tasks that can be delegated to SUP shall be locally (specific for the operational environment) conducted to support the deployment of the RTC with flexible allocation of airports between modules.			In case of contingency and in case of emergency part of ATCOs task may be delegated to The RTC super

						acceptability of supervising the assigned number of clusters of aerodromes. The validity of the results is applicable to an assigned number of 4 aerodromes under supervision. 2.1 DLR The majority of participants confirms the feasibility and acceptability of the 15 assigned aerodromes ENAV: All the supervisors agreed that						visor to reduce the workload for the remote tower module ATCO

						the roles and responsibilities were acceptable and it was possible the supervision of the assigned number of airports (3 in 1 cluster) but they raised the possibility of undertaking some of the coordination tasks currently assigned to the ATCOs						
Arg. 1.3.3: The level of workload (ind		SUP tasks cannot be achieved in a	Closed	OBJ-PJ05-W2-35-V3-VALP-H05	CRT-PJ05-W2-35-V3-VALP-H05.010	HC/Indra RTS: Supervisor's reported an acceptable level of workload, even during the split and merge	~~Future validation activities shall assess the timeliness of executing tasks for the supervisor position.~~					

uced by cognitive and/or physical task demands) is acceptable.		timely manner. Resulting in operator stress (with tasks stacking up and requiring recall) leads to increased human error probabili				process. Indra/Avinor: same as W2.PJ05.35_Is.1.3.3-3 2.1 DLR The majority of participants working at the SUP workstation reported a low workload. Bedford and Nasa-TLX were completed in the PR and therefore no run can be categorized as high workload. Even so, the SUP had to support up to 15 airports.						

		ties and consequences. At system level could impact efficiency and safety				ENAV: Workload was considered at acceptable level for all the simulated scenarios by all the test subjects						
				OBJ-PJ05-W2-35-V3-VALP-H10	CRT-PJ05-W2-35-V3-VALP-H10.030	Indra/HC RTS: Participating ATCOs (in SUP role) unanimously agree that the assigned number of aerodromes could be handled efficiently from the SUP position. Indra/Avinor: same as W2.PJ05.35_Is.1.3.3-3	The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine aerodromes in the MRTM.				The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine	

						2.1 DLR: same as W2.PJ05.35 _Is.1.3.3-3 ENAV: All the supervisors agreed that the roles and responsibilities were acceptable and it was possible the supervision of the assigned number of airports (3 in 1 cluster) but they raised the possibility of undertaking some of the coordination tasks currently assigned to the ATCOs and no issue					aerodromes in the MRT M.	

						of human errors were raised in relation to workload						
Arg. 1.3. 4: The level of trust in the new concept /the new procedures is appr	W2.PJ 05.35 _Is.1.3 .4-1a	The level of trust in the new concept and system is not appropriate for the	Closed	#N/D	#N/D							

opriate.		ATCO										
Arg. 1.3.4: The level of trust in the new concept /the new procedures is appropriate.	W2.PJ05.35_Is.1.3.4-1b	The level of trust in the new concept and system is not sufficient for the SUP	Closed	OBJ-PJ05-W2-35-V3-VALP-H14	CRT-PJ05-W2-35-V3-VALP-H14.010	Indra/HCRTS: The reliability of the information provided by the timeline should be further improved, as it was not always precise. Indra/Avinor: Supervisors could not always trust the monitoring and planning tool to give them a correct picture of	~~Future validation activities shall address the level of trust in the operations and the associated system of the SUP~~ ~~The SUP shall be able to identify the traffic peaks, supported by the system. Thus the timeline shall be precise, by marking the real simultaneous traffic based on updates from actual data. The predicted duration of the overload periods should also be transparent.~~					

						the situation at aerodromes /MRTMs. 2.1 DLR The assessed level of trust in the system is above average. This is supported by the answers to the PE questions. ENAV: Level of trust was considered acceptable and no issue was raised about trust						
Arg. 1.3.5: Human actors can	W2.PJ05.35_Is.1.3.5-2	ATCOs/SUPs might not be	Closed	OBJ-PJ05-W2-35-V3-VALP-H01	CRT-PJ05-W2-35-V3-VALP-H01.010	Indra/HCRTS: The mean scores of the China-Lake metric suggest that SUPs'	A harmonised working method for all aerodromes clustered in a multiple remote tower shall be envisaged.					

maintain a sufficient level of situation awareness.		able to maintain Situation awareness if there are various operating conditions.				situational awareness was at acceptable level. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR The majority of participants at the SUP workplace indicates a positive SA. The PE tailor-made questionnaire even indicates so much that the participants thought they could also keep the same SA under abnormal condition.						

						ENAV: Situation awareness was always maintained at acceptable level. Different operating conditions were tested (e.g. 1 airport without GRP) and no issues were raised in relation to situation awareness because of different operating conditions						
							The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine				The RTC Supervisor shall be provided with	

							aerodromes in the MRTM.				information to facilitate decisions regarding how to combine aerodromes in the MRTM.	
							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.					The RTC Supervisor or similar role should be able to have a view over

												functional MRTM´s in case of an emergency in order to be able to transfer an airport. The RTC Supervisor role should be provided with a display prese

												nting an overview of the RTC, including e.g. MRTM status, aerodromes allocated to MRTMs, traffic load, etc. to be able to transfer an airport.

				OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.010	Indra/HC RTS: Situation awareness was at an acceptable level when providing ATS to 3 aerodromes in parallel according to the SASHA-Q scores. The issue mentioned in column D did not come up. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-7 2.1 DLR The majority of participants stated an above average situation awareness in the PR	~~Future validation activities shall the SUP`s level of situation awareness~~					

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						assessment when working MRTM with a flexible allocation. COOPANS: For majority of ATCOs situation awareness is at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs. Nevertheless, the SA could be decreased very quickly when controlling three aerodromes with this traffic volume,						

						hence the source of information is slightly larger, the incoming calls from aircraft and vehicles are increased, traffic could become more complex, so that all these factors increase the time needed for scanning of all systems in order to keep SA updated. ENAV: Situation awareness was always maintained at acceptable level.						

						Different operating conditions were tested (e.g. 1 airport without GRP) and no issues were raised in relation to situation awareness because of different operating conditions						
Arg. 1.3.5: Human actors can maintain a sufficient level of situ	W2.PJ05.35_Is.1.3.5-3	ATCO/ SUPs might not be able to maintain situation awa	Closed	OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.010	Indra/HCRTS: Situation awareness was at an acceptable level when providing ATS to 3 aerodromes in parallel according to the SASHA-Q scores. The SA levels were not	The clustering of aerodromes shall be done taking into account local factors such as runway configurations and prevailing weather conditions					

atio n awa rene ss.		rene ss if ther e are vari ous wea ther con ditio ns (win d or visib ility) at the diffe rent airp orts				significantly lower in the Low Visibility procedures scenario. Indra/Avino r: same as W2.PJ05.35 _Is.1.3.1-7 2.1 DLR same as W2.PJ05.35 _Is.1.3.5-2 COOPANS: ATCOs agreed that the weather conditions should be considered as one of the most important part that can affect both, workload and SA. No severe weather						

						conditions or sudden weather changes was part of the scenarios. A SVFR conditions were applied at one of the combined aerodromes. It was difficult for ATCOs to distinguish if there were VFR or SVFR conditions. Nevertheless, SA was at acceptable level during all 4 scenarios. ENAV: Situation awareness was always maintained						

						at acceptable level. Different weather conditions were tested (e.g. 1 airport with fog) and no issues were raised in relation to situation awareness because of different weather conditions						
							The RTC Supervisor role shall be able to access functions for the monitoring of weather conditions for all aerodromes.				The RTC Supervisor role shall be able to access functions for the monitoring	

											of weather conditions for all aerodromes.	
							The RTC Supervisor shall be provided with a tool combining the information (aerodromes' status, meteo, forecasted traffic load and capacity) to facilitate decisions regarding how to combine aerodromes in the MRTM		An additional Weather Display and Information is recommended on an additional screen if not available on the VP.		The RTC Supervisor role shall access functions for communicating the status of RTC and aerodromes and coordinating maintenanc	The RTC supervisor role may be provided with a tool combining the information (aerodromes' status, mete

											e (to be carried out by a qualified engineer/technician).	o, forecasted traffic load and capacity) to facilitate decisions regarding how to combine aerodromes in the MRTM
							~~Future validation activities shall the SUP`s level of situation awareness~~					

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Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.	W2.PJ05.35_Is.1.3.5-4	ATCOs/SUPs might not be able to maintain Situation awareness if there is a geographical difference between the aerodromes	Closed	OBJ-PJ05-W2-35-V3-VALP-H01	CRT-PJ05-W2-35-V3-VALP-H01.010	Indra/HCRTS: The mean scores of the China-Lake metric suggest that SUPs' situational awareness was at acceptable level. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR The majority of participants at the SUP workplace indicates a positive SA. The PE tailor-made questionnaire even indicates so much that the participants	~~Future validation activities shall the SUP`s level of situation awareness~~					

						thought they could also keep the same SA under abnormal condition. ENAV: Situation awareness was always maintained at acceptable level. Tested environment are geographically located in different area of Italy (North, South) and no issues were raised in relation to situation awareness because of geographical differences						

							~~Future validation activities shall identify system possibilities on the SUP HMI to indicate geographical characteristics and indication of different airports.~~					
							The diversity of the different aerodromes in terms of geographical specifities and procedures have to be included in the training					
							The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine aerodromes in the MRTM.				The RTC Supervisor shall be provided with information to facilitate decisi	

											ons regarding how to combine aerodromes in the MRTM.	
				OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.010	Indra/HCRTS: Situation awareness was at an acceptable level when providing ATS to 3 aerodromes in parallel according to the SASHA-Q scores. The geographical differences did not seem like an issue for the ATCOs.	~~Future validation activities shall identify system possibilities on the SUP HMI to indicate different airports.~~					

						Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR same as W2.PJ05.35_Is.1.3.5-2 COOPANS: The geographical differences did not imposed any issues on SA for the ATCOs. None of them experienced any issues also connected to similarity between the landscapes and buildings at different aerodromes						

						. ENAV: Situation awareness was always maintained at acceptable level. Tested environment are geographically located in different area of Italy (North, South) and no issues were raised in relation to situation awareness because of geographical differences						
Arg. 1.3.5: Human actors	W2.PJ05.35_Is.1.3.5-5	ATCOs/SUPs might be	Closed	OBJ-PJ05-W2-35-V3-VALP-H01	CRT-PJ05-W2-35-V3-VALP-H01.010	Indra/HCRTS: The mean scores of the China-Lake metric suggest that	~~Future validation activities shall the SUP`s level of situation awareness~~					

can maintain a sufficient level of situation awareness.		over looking or missing movements on one APT, while focusing on the other one.				SUPs' situational awareness was at acceptable level. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR The majority of participants at the SUP workplace indicates a positive SA. The PE tailor-made questionnaire even indicates so much that the participants thought they could also keep the same SA under abnormal condition.						

						ENAV: Situation awareness was always maintained at acceptable level for supervisor position.						
				OBJ-PJ05-W2-35-V3-VALP-H03	CRT-PJ05-W2-35-V3-VALP-H03.010	HC/Indra RTS: The system supported the RTC team in establishing and maintaining their situational awareness, and the system worked as expected during the split, supporting the teamwork between MRTMs too.	The pan and tilt functionality or VP shall allow the ATCO to scan the remaining part of the CTR	Out of the window view requirements shall be locally refined to support the deployment of the RTC with flexible allocation of airports between modules.	The ATCO may be supported by the system indicating when clearances can be given.	Required information for ATCOs and SUP should be locally assessed before the deployment		Required information for ATCOs and SUP should be locally assessed before the deployment The ATCO

						The issue mentioned in column D did not come up. Indra/Avinor: The ATCOs HMI generally supported an acceptable level of team situation awareness. The supervisors' HMI did not support an acceptable level of team situation awareness because the information about traffic situation and workload at MRTMs was not						may be supported by the system indicating when clearances can be given. The ATCO should be supported in prioritising tasks (e.g. providing landing clear

						sufficient and not accurate enough. 2.1 DLR The PE questionnaire results show that there is still missing information or information in poor quality which makes the task of splitting and merging less. The comments from the debriefing fill this gap with ideas how the improve the interface. COOPANS: HMI						ance or taxi clearance) and forecast the traffic demand from a support tool in the tactical short term.

						support an acceptable level of team (ATCO and ATCO) situation awareness when working with a flexible allocation of aerodromes between MRTMs. It was not noticed by observers or reported by the ATCOs that this kind of issue has been encountered. The ATCOs agreed that they had a clear mental image about traffic situation at the taken aerodrome						

						prior they confirmed ''my control'' at that aerodrome, which correspond ed with the real traffic situation afterwards. ENAV: There were no issues raised about team situation awareness anyway it was suggested that further technology might improve SUP-ATCOs shared situational awareness by duplicating information						

						in the supervisor working position						
				OBJ-PJ05-W2-35-V3-VALP-H12	CRT-PJ05-W2-35-V3-VALP-H12.050	Indra/HC RTS: The number of errors made in the simulation was negligible and was due to the unfamiliarity with the system. The issue mentioned in Column D did not come up during the simulation. Indra/Avinor: same as W2.PJ05.35	If Radar Labels are to be provided, they shall be available for all aerodromes.			When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	Supervisor planning tool HMI and ATCO's module HMI shall be locally assessed before the deployment of the RTC with flexibl	

						_Is.1.3.1-1b 2.1 DLR Even so, the system is usable above average the participant agreed that changes to the SUP role would significantly contribute to human error. The human error could be decreased with automation in the SUP user interface. ENAV: No critical errors were observed during the simulation execution.					e allocation of airports between modules. When a handover is completed and accepted all systems and information that belongs to the same aerodrome shall be accept	

						Anyway, supervisor planning tool HMI improvements were suggested to have the option of multiple windows that could reduce the possibility of human error by having all the needed information displayed at the same time.					ed in a single action. When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	

				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.050	Indra/HCRTS: The system behaviour during split and merge increased the potential for human error by not moving the MET window together with the radar map and EFS bay. However, the issue mentioned in column D did not occur during the simulations. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-2 2.1 DLR For			COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode. ENAV: there is the need to always properly balance the workload in order to minimise the impact on human error	Cardinal directions on the visual panorama should be displayed		Cardinal directions on the visual panorama should be displayed

						EXE-PJ05-W2-35-V3-2.1.1 again, the SATI scores show that the ATCOs trust the system and the interface. They see the increased human error in the changed role and responsibilities. COOPANS: ATCOs stated that the human machine interface could at sometimes increase the potential for human error. This affects the SA						

						negatively, see recommendation for specific situation. ENAV: the overall perception was that human error was not increased in terms of potential and severity respect to the scenario without flexible allocation being the most of the answers above the tolerable threshold of 4, the ATCOs commented that there is the need to						

						always properly balance the workload in order to minimise the impact on human error, meaning that the team human error potential is acceptable if the workload of the operators is acceptable.						
				OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.010	Indra/HC RTS: Situation awareness was at an acceptable level when providing ATS to 3 aerodromes in parallel according to the SASHA-			ENAV: there is the need to always properly balance the workload in order to minimise the impact on operations	Alerting system to drive the attention of the ATCO to a certain airport under certain conditions (e.g. aerodrome		Alerting system to drive the attention of the ATCO to a certa

						Q scores. The issue defined in Column D was not reported, but the traffic levels were not excessive. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR same as W2.PJ05.35_Is.1.3.5-2 COOPANS: SA remained at acceptable level during all 4 scenarios. ENAV: Situation awareness was always maintained				highlighted in case of communication; alerts for a pre-defined area) should be provided		in airport under certain conditions (e.g. aerodrome highlighted in case of communication; alerts for a pre-defined area) should be provided

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						at acceptable level and in the solutions scenario no issues were raised about the possibility of missing movements. Missing of movements were observed in the reference scenario with 3 airports allocated to 1 module due to over workload						
Arg. 1.3.5: Human actors can mai	W2.PJ05.35_Is.1.13.5-11	Switching between different aero	Closed	OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.010	Indra/HCRTS: Situation awareness was at an acceptable level when providing ATS to 3	The ATCO display should allow a flexible allocation of the position of the transferred aerodromes		ENAV: Position of displayed airports in the out of the window view and in the CWP head down displays shall be flexible, i.e. transferred airport always displayed as last one: in the bottom for the OTW	When a handover is initiated or performed all systems and information that belongs	When a handover is completed and accepted all	

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ntain a sufficient level of situation awareness.		dromes allocation in an RTM could impact negatively the SA (e.g., if the transfer of information during the handover is not complet				aerodromes in parallel according to the SASHA-Q scores. There were some occasions when the information passed on during handover was not complete, but the difficulties ATCO had with the system during split and merge had the biggest impact on situational awareness reduction/loss. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b			and on the right in the head down CWP/Strip bay.	to the same aerodrome shall be transferred in a synchronized way. When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	systems and information that belongs to the same aerodrome shall be accepted in a single action.	

		e; if there are confusions between aerodromes or aerodromes characteristics etc.)				2.1 DLR same as W2.PJ05.35_Is.1.3.5-2 COOPANS: SA remained at acceptable level during all 4 scenarios. ENAV: Situation awareness was always maintained at acceptable level, nevertheless the ATCOs complained about the fix position of the airports in the OTW and in the CWP that could affect						

						their situational awareness during the handover if the the transferred airport had the "MIDDLE" fix position. Position of displayed airports in the out of the window view and in the CWP head down displays shall be flexible, i.e. transferred airport always displayed as last one: in the bottom for the OTW and on the right in the head down CWP/Strip bay.						

							The airport name should be integrated in the phraseology in order to increase the situational		The ATCO may be supported by the system indicating when clearances can be given.	Cardinal directions on the visual panorama should be displayed		Cardinal directions on the visual panorama should be displayed The airport name should be integrated in the phraseology in order to increase the

												situational The ATCO may be supported by the system indicating when clearances can be given. The ATCO should be supported in prioritising tasks

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												(e.g. providing landing clearance or taxi clearance) and forecast the traffic demand from a support tool in the tactical short term.

							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.				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.	
							Transfer procedures (for the transfer of an aerodrome between MRTMs) shall be locally			Visual Presentation and head down displays shall have	Transfer procedures (for the	

							defined with a clear description of the associated roles and responsibilities and corresponding coordination procedures.			the same layout for all the possible aerodrome configurations	transfer of an aerodrome between MRTMs) shall be locally defined with a clear description of the associated roles and responsibilities and corresponding coordination procedures.	

											Visual Presentation and head down displays shall have the same layout for all the possible aerodrome configurations	
							The HMI shall support the ATCO to easily distinguish the input/output devices of each aerodrome for vehicles.					

Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.	W2.PJ05.35_Ben.1.3.5-12	The support of the supervisor can improve ATCO SA because future workload is better anticipated and more efficiently managed by	Closed	OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.010	Indra/HCRTS: Situation awareness was at an acceptable level when providing ATS to 3 aerodromes in parallel according to the SASHA-Q scores. It stands to reason that the support of the SUP (and the SUP planning tool) came handy for the ATCOs to manage their workload and thus situational awareness. Indra/Avinor: same as W2.PJ05.35	~~Future validation activities shall involve the Supervisor position~~		ENAV: there is the need to always properly balance the workload in order to minimise the impact on situation awareness			

		dynamic allocation of aerodromes				_Is.1.3.1-1b 2.1 DLR same as W2.PJ05.35 _Is.1.3.5-2 COOPANS: SUP was not part of the validation. (probably will improve). ENAV: situation awareness was always maintained at acceptable level in the scenario with flexible allocation and the supervisor position had a key role in the support of an adequate						

						situation awareness level. In the scenario without flexible allocation with 3 airports on 1 module the ATCO situation awareness could not be maintained at acceptable levels.						
							~~Future validation activities shall identify system possibilities on the SUP HMI to indicate geographical characteristics and indication of different airports.~~					

Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.	W2.PJ05.35_Is.1.13.5-13	SA is not sufficient because the number of aerodromes to monitor and/or the number of tasks to manage are too important, and/or	Closed	OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.010	Indra/HCRTS: Situation awareness was at an acceptable level when providing ATS to 3 aerodromes in parallel according to the SASHA-Q scores. The issue mentioned in column D did not come up. ATCOs mostly worked with 2 aerodromes in parallel, only because they had the (human) resources to split 4 aerodromes in a 2:2 manner.	~~Future validation activities shall involve the Supervisor position~~		ENAV: there is the need to always properly balance the workload in order to minimise the impact on situation awareness	When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	When a handover is completed and accepted all systems and information that belongs to the same aerodrome shall be accepted in a single action. When a handover is initiat	

		because information/functions available to the SUP are not sufficient.				However, ATCOs did state that in this simulation setup it would have been difficult to manage 3 aerodromes for a long period of time. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR same as W2.PJ05.35_Is.1.3.5-2 COOPANS: For majority of ATCOs situation awareness is at an acceptable level when working in a					ed or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	

						RTC with a flexible allocation of aerodromes between MRTMs. Nevertheless, the SA could be decreased very quickly when controlling three aerodromes with this traffic volume, hence the source of information is slightly larger, the incoming calls from aircraft and vehicles are increased, traffic could become more complex, so that all these						

						factors increase the time needed for scanning of all systems in order to keep SA updated. ENAV: There was no issue raised for situational awareness in relation with the number of assigned airports in the scenarios with flexible allocation. This was not the case in the scenarios without flexible allocation were due to overloads						

						there were issue it was not possible to keep the situation awareness at acceptable level when 3 airports were assigned to 1 module						
				OBJ-PJ05-W2-35-V3-VALP-H12	CRT-PJ05-W2-35-V3-VALP-H12.010	Indra/HC RTS: The majority of ATCOs did not report anything missing from the SUP system. There was one idea however that is	The RTC Supervisor role shall be provided with an overview of ATCO availability and their valid endorsements			Required information for ATCOs and SUP should be locally assessed before the deployment	Supervisor planning tool HMI and ATCO's module HMI shall be	Required information for ATCOs and SUP should be locally

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						worth to consider, i.e. to have a quick access for view only of any airport, so that the SUP in a RTC environment could follow an emergency situation without bothering the ATCO in the MRTM. Indra/Avinor: Supervisors assessed that they did not always have all required information available to monitor the traffic situation and workload at					locally assessed before the deployment of the RTC with flexible allocation of airports between modules. Supervisor tool HMI shall display the status of the MRTM and the traffic	assessed before the deployment

						MRTMs and to plan the allocation of aerodromes. The traffic information presented in the "timeline" tool were not always reliable. Information presented in the "timeline" tool were not sufficient for the supervisors to assess the traffic situation and workload at MRTMs. A roster to see ATCOs availability was missing, and it was					load expected at each single aerodrome under his/her supervision to properly establish the flexible allocation of aerodromes to the available RTC Modules The RTC supervisor	

						difficult to get an overview of ATCOs endorsements. 2.1 DLR The results show that all information's are available but they are difficult to acquire, especially at a fitting time ENAV: For both the questions "I had all the information I needed to perform my tasks" and "I found the information provided in the SUP Working					role shall be provided with ATCOs availability and their valid endorsements	

						Position" one answer is somewhat disagree and the other one is agree. The reason for not achieving a conclusive result is behind the technical limitation of the supervisor planning tool that due to time and resources constraint was not linked to the simulation platform and thus all the calculation were based on a						

						planned traffic sample rather than the live traffic managed in the simulation experiment. For one of the SUP this was a big issue that was affecting the level of information provided to him, while the other supervisor easily adequate his working method to deal with the limitation of the supervisor tool.						

				OBJ-PJ05-W2-35-V3-VALP-H01	CRT-PJ05-W2-35-V3-VALP-H01.030	Indra/HC RTS: Every participant agreed that the HMI supported their situational awareness and decision-making process. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR The majority of the participants confirms by an above average SASHA score which indicates an above average situation awareness.	The RTC Supervisor shall be provided with a tool combining the information (aerodromes' status, meteo, forecasted traffic load and capacity) to facilitate decisions regarding how to combine aerodromes in the MRTM				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/technici	The RTC supervisor role may be provided with a tool combining the information (aerodromes' status, meteo, forecasted traffic load and capacity) to

						ENAV: Situation awareness was always maintained at acceptable levels					an). 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	facilitate decisions regarding how to combine aerodromes in the MRTM

											allocation of aerodromes to the available RTC Modules	
							The ATCO shall be provided with a system enabling to transfer one of the controlled aerodromes to another MRTM		The ATCO may be supported by the system indicating when clearances can be given.	The RTC Supervisor or similar role should be able to have a view over functional MRTM´s in case of an emergency in order to be able to transfer an airport.	Supervisor tool HMI shall display the status of the MRTM and the traffic load expected at each single aerodrome under his/her super	The ATCO may be supported by the system indicating when clearances can be given. The ATCO should be

											vision to properly establish the flexible allocation of aerodromes to the available RTC Modules	supported in prioritising tasks (e.g. providing landing clearance or taxi clearance) and forecast the traffic demand from a support tool in the tactical

												short term.
							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	Visual Presentation and head down displays shall have the same layout for all the possible aerodrome configurations			Supervisor tool HMI shall display the status of the MRTM and the traffic load expected at each single aerodrome under his/her supervision to prope	The RTC Supervisor role should be provided with a technical overview of all systems e.g. the MRTM, camera functionality

											rly establish the flexible allocation of aerodromes to the available RTC Modules Visual Presentation and head down displays shall have the same layout for all the possible aerodr	etc. in the RTC and of the aerodrome systems e.g. navigational aids, lights, emergency alerting functions, for all involved aerodromes part

											ome configurations	of the RTC
							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.	The HMI of the RTC technical system shall be locally assessed and designed in relation to the specific operational environment, depending on the size and type of the RTC			The HMI of the RTC technical system shall be locally assessed and designed in relation to the specific operational environment, depen	The RTC Supervisor or similar role should be able to have a view over functional MRTM´s in case of an emergency in order

											ding on the size and type of the RTC	to be able to transfer an airport. The RTC Supervisor role should be provided with a display presenting an overview of the RTC, including e.g. MRT

												M status, aerodromes allocated to MRTMs, traffic load, etc. to be able to transfer an airport.
							The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC.	ATCO Planning too shall provide accurate and reliable traffic information				The RTC Supervisor should be provided with the

												forecasted demand for all involved aerodromes part of the RTC.
				OBJ-PJ05-W2-35-V3-VALP-H01	CRT-PJ05-W2-35-V3-VALP-H01.010	Indra/HC RTS: The mean scores of the China-Lake metric suggest that SUPs' situational awareness was at acceptable level. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b	The ATCO shall be able to take over an aerodrome to one MRTM.	ATCOs and SUP tools shall use actual traffic			ATCOs and SUP tools shall use actual traffic	

						2.1 DLR The majority of participants at the SUP workplace indicates a positive SA. The PE tailor-made questionnaire even indicates so much that the participants thought they could also keep the same SA under abnormal condition. ENAV: Situation awareness was always maintained at acceptable levels						

Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.	W2.PJ05.35_Is.1.3.5-6	ATCO ability to judge distance/separation may be impacted by compressed OTW presentation.	Closed	OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.030	Indra/HCRTS: The issue mentioned in column D did not come up in the simulations. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-7 2.1 DLR same as W2.PJ05.35_Is.1.3.1-7 COOPANS: ATCOs had a possibility to choose if they want to work in single, double or triple mode of presentation, in order to allow them as	~~Future validation activities shall the SUP`s level of situation awareness~~		ENAV: ARWY Automated scan tool that checks the runway is clear could further enhance ATCOs' situation awareness and possibly reduce the workload Out of the window view requirements shall be refined finally to support the deployment of the RTC with flexible allocation of airports between modules.			The ATCO should be supported in monitoring the runway ARWY automated scan tool that checks the runway is clear may support ATCOs in the RTC with

						much as possible flexibility how aerodromes to be allocated within the VP. Compression of the aerodromes in double mode felt fine, while compression in triple mode (regardless the number of presented aerodromes), started feeling quite small. ENAV: Situation awareness was always maintained at acceptable						flexible allocation between modules

						levels. 2 OTW were assessed: 120° and 180°. The 120° required too many interaction with the PTZ system to check the runway was clear, while the 180° improved the situation awareness as there was no need of interaction with the PTZ to check the runway. Anyway the ATCOs suggested an automated tools to check the						

						runway is clear						
				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.020	Indra/HC RTS: Most of the ATCOs (66.6%) agree with the InNOVA being user-friendly. The issue mentioned in column D did not come up. Indra/Avinor: same as W2.PJ05.35_Is.1.3.2-3b Indra/HC PSM: With regards to the Visual Panorama (OTW), the sharpness and			COOPANS: Longer training session with focus on the PTT (Push To Talk) ENAV: Visual panorama view requirements shall be refined finally to support the deployment of the RTC with flexible allocation of airports between modules.			

						resolution of the camera images were positively regarded, even though it was quite visible that Pápa aerodrome only had Full HD cameras, and not 4K like those other two aerodromes (Nyíregyháza and Győr-Pér). It would have been useful if the labels had worked as needed. There were a lot of labels that connected to unconcerne						

						d overflights, yet due to radar coverage limitations some of the arrivals/departures had no labels. Without labels it was extremely difficult to spot the small VFRs, which are visible in the actual TWR building. On the other hand, if the labels worked for the arriving VFRs, it would be a major benefit, as VFRs from a certain distance are not visible						

						from the TWR either. The “box and follow” functionality (i.e. moving target indicator) is also an improvement compared to the conventional TWR operation, as this augmented reality solution helps to detect movements on any area of the aerodrome that is selected. 2.1 DLR Same as W2.PJ05.35_Is.1.3.2-3b						

						COOPANS: Majority of ATCOs confirm the usability of input devices and HMI controls. ENAV: The Remote Tower Module ATCOs didn't like a dedicated monitor for PTZ function and would have preferred to have a picture in the picture function with command integrated in the strip bay to facilitate the						

						interactions with the OTW and the zoom functions. Also, Remote Tower Module ATCOs suggested improvements to the OTW: to mark the line between the airports in the OTW to make more visible the borders between airports and to provide the aircraft labels on the OTW only for active flights. Also they suggested to avoid fix						

						position for the airports						
				#N/D								

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Arg. 1.3. 5: Hu man acto rs can mai ntai n a suffi cien t leve l of situ atio n awa rene ss.	W2.PJ 05.35 _Is1.3. 5-10	Vari ous simil ariti es on the airp orts cont rolle d (lan dsca pe, buil ding s, run way conf igur atio n etc.) indu ce a risk to mis mat ch sign al/c	Closed	OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.070	Indra/HC RTS: The majority of ATCOs (83.3%) were aware which aerodrome was placed to which positions of the system. The issue mentioned in column D did not come up. Indra/Avino r: same as W2.PJ05.35 _Is.1.3.1-7 2.1 DLR The results show that the majority of participants was aware of the displayed aerodromes and radar	~~Future validation activities shall the SUP`s level of situation awareness~~		ENAV: Emergency button and transfer acceptance HMI in the ATCO module CWP shall be reviewed for the deployment of the RTC with flexible allocation of airports between modules.			

		ue and relate that to the wrong airport. (configuration of airport)				configurations. COOPANS: Majority of ATCOs confirm that there was no confusion regarding where a certain aerodromes was going to be placed in the visual presentation (VP). ENAV: no issues of mismatching signal/cue were raised in relation to the Human machine interface, anyway the ATCOs mentioned that						

						Emergency button and transfer acceptance HMI should be improved for both the positions.						
							The diversity of the different aerodromes in terms of geographical specifities and procedures have to be included in the training					
				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.080	Indra/HC RTS: The issue mentioned in column D did not come up in the simulations. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-7	~~Future validation activities shall identify system possibilities on the SUP HMI to indicate different airports.~~		ENAV: Emergency button and transfer acceptance HMI in the ATCO module CWP shall be reviewed for the deployment of the RTC with flexible allocation of airports between modules.	An additional Weather Display and Information is recommended on an additional screen if not available on the VP.		

						2.1 DLR The majority of the ATCOS were aware which airport will be transferred and under which conditions. COOPANS: Majority of the ATCOs confirm they were never confused witch aerodromes that was going to be transferred. ENAV: no issues of mismatching signal/cue were raised in relation to the Human						

						machine interface, anyway the ATCOs mentioned that Emergency button and transfer acceptance HMI should be improved for both the positions.						
Arg. 2.1.6: The level of trust in automated functions is appropriate.	W2.PJ05.35_Is.2.1.6-1	ATCOs might not trust in the system if: - the reliability of the support	Closed	OBJ-PJ05-W2-35-V3-VALP-H13	CRT-PJ05-W2-35-V3-VALP-H13.010	No issues raised about level of trust in the different validation exercises	~~Future validation activities shall address the level of trust in the operations and the associated system of the SUP~~					
				OBJ-PJ05-W2-35-V3-VALP-H13	CRT-PJ05-W2-35-V3-VALP-H13.020	ATCOs trusted in the reliability of the conformance monitoring provided by the events in the DFS exercise	The training curricula shall familiarize the ATCOs with the new concept and the corresponding tools (e.g. binoculars), in order to ensure they have an adequate level of trust					

		ed task priorities is too low - the reliability of the conformance monitoring is too low				In the DFS exercise ATCOs rated the trust in the automation support provided by the events as being quite helpful. Alarms and alerts were provided for conflicting clearances as well as for non-conformances (as defined in the airport safety nets).						

Arg. 2.3.1: The type of information provided satisfies the information requirements of the human.	W2.PJ05.35_Is.2.3.1-1	The type of information provided does not satisfy the information requirements of the ATCOs (and SUP).	closed	OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.010	Indra/HCRTS: Same as W2.PJ05.35_Is.1.3.1-7 Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-7 2.1 DLR Same as W2.PJ05.35_Is.1.3.1-7 COOPANS: ATCOs state the simulator (S-m) provided useful data in an understandable way and that they rarely needed to search for information. ENAV: ATCOs did	The ATCO shall, from the remote location, apply ICAO Doc 4444 - 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. - 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. ATCOs shall be		ATCOs should be able to move aerodromes also to the C-slot (upper right side), even if there are only two aerodromes (Indra specific recommendation). COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode.	The binocular functionality should include predefined and user-definable automatic scanning patterns, such as runway sweeps.		

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						not raise any issue in relation to the level of information that were provided	able to read the MET data from the Visual Panorama (wind, RVR in LVP).					

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							The RTC Supervisor shall be provided with a tool combining the information (aerodromes' status, meteo, forecasted traffic load and capacity) to facilitate decisions regarding how to combine aerodromes in the MRTM			The binocular functionality should include automatic tracking of moving aircraft, vehicles or obstructions (e.g. personnel or large animals).	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/te	The RTC supervisor role may be provided with a tool combining the information (aerodromes' status, meteo, forecasted traffic load and capacity) to

											chnician).	facilitate decisions regarding how to combine aerodromes in the MRTM
							The information on the status of the lights and no-visual aids should be always visible for the controller, making it easy to identify to what aerodrome they correspond to.					

							The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine aerodromes in the MRTM.				The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine aerodromes in the MRTM.	

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				OBJ-PJ05-W2-35-V3-VALP-H12	CRT-PJ05-W2-35-V3-VALP-H12.010	Indra/HC RTS: The majority of ATCOs did not report anything missing from the SUP system. There was one idea however that is worth to consider, i.e. to have a quick access for view only of any airport, so that the SUP in a RTC environment could follow an emergency situation without bothering the ATCO in the MRTM. Indra/Avinor: same as	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 or transfer of the merged aerodromes SUP position should have a quick access for a „view only" radar+visual+voice function of any airport. In an emergency situation there would be no time to walk to the MRTM position (also leaving the others without SUP is not an option) so there should be a way for the SUP to get				Supervisor planning tool HMI and ATCO's module HMI shall be locally assessed before the deployment of the RTC with flexible allocation of airports between modules.	

						W2.PJ05.35_Is.1.13.5-13 2.1 DLR The results show that all information's are available but they are difficult to acquire, especially at a fitting time ENAV: For both the questions "I had all the information I needed to perform my tasks" and "I found the information provided in the SUP Working Position" one answer is	as much information as possible about the situation without putting extra workload on the ATCO.				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	

						somewhat disagree and the other one is agree. The reason for not achieving a conclusive result is behind the technical limitation of the supervisor planning tool that due to time and resources constraint was not linked to the simulation platform and thus all the calculation were based on a planned traffic sample					aerodromes to the available RTC Modules	

						rather than the live traffic managed in the simulation experiment. For one of the SUP this was a big issue that was affecting the level of information provided to him, while the other supervisor easily adequate his working method to deal with the limitation of the supervisor tool.						

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							~~Future validation activities shall identify system possibilities on the SUP HMI to indicate different airports.~~					
Arg. 2.3.1: The type of information provided satisfies the information requirements of the human.	W2.PJ05.35_Is.2.3.1-2	ATCOs are not aware of the traffic forecast and thus expected workload level at the different airports in	Closed	OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.030	Indra/HCRTS: The information on the arrivals was not as efficiently presented as it could have been, thus the timeline was oftentimes switched off. ATCOs turned to the strips instead as it contained discrete and more precise data. Indra/Avinor: same as	The ATCO shall be provided with the traffic forecast, including vehicles, at the different airports in the MRTM				ATCO shall be provided with accurate and reliable traffic and planning information through the ATCO Planning tool.	

		the short term execution phase negatively affecting ATCOs' situation awareness				W2.PJ05.35_Is.1.3.1-7 2.1 DLR same as W2.PJ05.35_Is.1.3.1-7 COOPANS: ATCOs were aware mostly for the traffic forecast. It was achieved through the system (EFS, RDP, ATCO planning tool). VFR and vehicle traffic were not presented at the ATCO planning tool, so that complaints were mainly based on this disadvantage. This could						

						increase the workload in a very short period, so the ATCOs SA, might also be reduced. Nevertheless, the SA was on an acceptable level for all four scenarios. ENAV: Situation awareness was always maintained at acceptable level and no issues were raised about the traffic forecast and expected workload levels in the solution scenarios						

						with flexible allocation						

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				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.060	HC/Indra RTS: The timeline used as a short-term planning tool was not preferred. ATCOs turned to the strips instead as it contained discrete and more precise data. Indra/Avinor: ATCOs could not always rely on the traffic forecast tool to anticipate the traffic sequence or assess the future traffic load. The timeline was not			COOPANS: Further development of the ATCO planning tool with focus on reliability, accuracy and complex traffic is needed. ENAV: Emergency button and transfer acceptance HMI in the ATCO module CWP shall be reviewed for the deployment of the RTC with flexible allocation of airports between modules.	ATCO Planning too shall provide accurate and reliable traffic information		

						always accurate in reflecting the traffic sequence as executed by the simulator environment. In addition, when the number of simultaneous movements was high it was not possible to see all flights at the same time without scrolling. 2.1 DLR The majority of the ATCOs found the tool useful in terms of short-term planning						

						and its different aspects. COOPANS: ATCOs state that the ATCO planning tool was useful, it is however in need of further developmen t in order to be a reliable and trustful tool. ENAV: Overall usability and utility was considered acceptable, and no issues were raised for traffic forecast.						

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Arg. 2.3.2: Input devices (e.g. keyboard, mouse, touch screen) correspond to HF principles. [V1: AIR only]	W2.PJ05.35_Is.2.3.2-1	Wrong APT input device is used to control function in the different APT. Some errors would be readily identified and corrected,	Closed	#N/D	#N/D							

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		others not. If ATCOs are controlling more than one APT they may have different input devices for different APT, these may lead to										

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		the wrong input device being used to control a function in a different APT. This may affect the efficiency with end user can execute										

		a task.										
Arg. 2.3. 3: Visu al displ ays and othe r type s of out put devi ces adh ere to HF prin	W2.PJ 05.35 _Is.2.3 .3-1	Visu al displ ays and othe r outp ut devi ces usab ility lack, for exa mpl e ther e can	Closed	OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.070	INDRA OSED Discussion: There were some concerns raised by ATCOs when working on the OSED as it could increase workload and impact situational awareness if the aerodromes are allocated so flexibly. A	~~The ATCO shall observe visual communication from aircraft that are within the ATCO visual range, i.e.~~		The RTC Supervisor or similar role should be able to have a view over functional MRTM´s in case of an emergency in order to be able to transfer an airport.	The visual panorama and the ATCO head-down display shall allow a user-friendly flexible allocation of the position of the transferred aerodromes established by ATCOs	The visual panor ama and the ATCO head-down displa y shall allow a user-friendl y flexibl e allocat ion of the	

ciples. [V1: AIR only]		be a confusion with regards to which aerodrome is displayed on which visual display.				risk mitigation proposal was to enable the ATCO to place the aerodromes in the MRTM as s/he sees fit. Furthermore, basic rules that the busiest aerodrome should be placed in the middle row in the exercise might mitigate the issue. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-7 2.1 DLR The results show that					positi on of the transferred aerodromes established by ATCOs	

						the majority of participants was aware of the displayed aerodromes and radar configuratio ns. COOPANS: Majority of ATCOs confirm that there was no confusion regarding where a certain aerodromes was going to be placed in the visual presentatio n (VP). ENAV: No issues were raised about possible confusion of which						

						aerodrome was displayed on which display						
				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.080	Indra/HC RTS: It was unanimously agreed that it was clear which aerodrome was transferred between the MRTMs. The Supervisor made sure that ATCOs were aware which aerodromes will be affected by the split. Indra/Avinor: same as	The possibility to visually distinguish which aerodromes are active shall be available (e.g. grey out, removing the inactive one).		ENAV: Out of the window view requirements shall be refined finally to support the deployment of the RTC with flexible allocation of airports between modules.			

						W2.PJ05.35 _Is.1.3.1-7 2.1 DLR The majority of the ATCOS were aware which airport will be transferred and under which conditions. COOPANS: Majority of the ATCOs confirm they were never confused witch aerodromes that was going to be transferred. ENAV: Remote Tower Module ATCOs suggested						

						improvements to the OTW: to mark the line between the airports in the OTW to make more visible the borders between airports and to provide the aircraft labels on the OTW only for active flights. Also they suggested to avoid fix position for the airports						

				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.020	Indra/HC RTS: Most of the ATCOs (66.6%) agree with the InNOVA being user-friendly. The issue mentioned in column D did not come up. ATCOs were always aware which airport is being displayed on which monitor. However, it would be easier to draw a coloured frame around the airport radar map, EFS bay and visual	The ATCO should be provided with an indication of a radio transmission related to an aerodrome, e.g. either in in the visual presentation or the flight strip system ATCOs shall be supported by a squelch indication and coloured frames in order to quickly distinguish the aerodromes and identify where the call is coming from. These features shall be integrated both into the Visual Panorama and the head-down display (i.e. this is a solution for the requirement above-AF01.0001).		COOPANS: Longer training session with focus on the PTT (Push To Talk) ENAV: Out of the window view requirements shall be refined finally to support the deployment of the RTC with flexible allocation of airports between modules.	When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	When a handover is completed and accepted all systems and information that belongs to the same aerodrome shall be accepted in a single action. When a handover is initiat	The border of each displayed aerodrome should be marked in the Visual Panorama and head-down displays with possible colour coding for the differ

						panorama displays, so that it's easier to create a mental model about the aerodrome placement on the monitors. Indra/Avinor: same as W2.PJ05.35_Is.1.3.2-3b 2.1 DLR Same as W2.PJ05.35_Is.1.3.2-3b COOPANS: Majority of ATCOs confirm the usability of input devices and HMI controls. No confusion regarding					ed or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	ent positions or aerodromes. The ATCO should be provided with a visual clear indication de-activable on ATCO request of which aerodrome an incoming

						where which aerodrome was placed. ENAV: the overall trend of the answers for the support provided by the ATCO system/HMI is positive, but the difference between the threshold and the mean values is not so distant as the other analysed indicators. This is to be seen mainly in relation to the employed HMI as all the test						radio transmission is related to in order to quickly distinguish the aerodromes and identify where the call is coming from.

						subjects suggested improvements, especially in the position of the emergency button and the handover transfer that were located in the border of the head-down display while the ATCOs would have preferred them integrated in the strip bay area. ATCOs also suggested to mark the boarder between the displayed airports in						

						the OTW and to avoid fix position for the airports in the OTW and in the CWP. Anyway ATCos were never confused with regards to which airport is displayed on which visual displays						
				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.060	Indra/HCRTS: The system behaviour during split and merge increased the potential for human error by not moving the MET window together	The display of aerodromes shall allow the ATCO to easily distinguish which information is related to which aerodrome (VP, radar, EFSS etc.) ATCOs shall be supported by a squelch indication and coloured frames in order to		COOPANS: Further development of the ATCO planning tool with focus on reliability, accuracy and complex traffic is needed. ENAV: the prioritization tool algorithm itself would need to be enriched with as many cases as possible in order to be able to perform its task in most situations, perhaps by	Required information for ATCOs and SUP should be locally assessed before the deployment		Required information for ATCOs and SUP should be locally assessed

						with the radar map and EFS bay. This has led to the event when a MET window was next to a different aerodrome' s EFS bay, causing confusion. The handheld mic with its two-button layout also led to errors. Indra/Avinor: same as W2.PJ05.35 _Is.2.3.1-2 2.1 DLR The majority of the ATCOs found the tool useful in terms of short-term	quickly distinguish the aerodromes and identify where the call is coming from. These features shall be integrated both into the Visual Panorama and the head-down display (i.e. this is a solution for the requirement above-HPdesign_3).		associating artificial intelligence and machine learning technology with this tool.			before the deployment

						planning and its different aspects. COOPANS: ATCOs state that the ATCO planning tool was useful, it is however in need of further developmen t in order to be a reliable and trustful tool. ENAV: ATCOs confirm the adequacy of the usability and utility of flight list traffic forecast and prioritisatio n function integrated in the EFPS						

						system for the next action to be performed. Despite most of the answers are positive, there were some scenarios that does not reach a satisfactory value. Indeed, during the debriefing, the ATCOs were not really enthusiastic about the provided support and even if they judged it as useful there was not so much interest in it. This comment can also						

						explain the answers to the post simulation questions provided below. It has to be considered, when reading these results, that ATCOs involved in the exercise were not familiar with the EFSP system, so the HMI indication processed by the ATCO Planning Tool algorithm was not always obvious as supporting information. Moreover,						

						the algorithm itself would need to be enriched with as many cases as possible in order to be able to perform its task in most situations, perhaps by associating artificial intelligence and machine learning technology with this tool.						
				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.050	Indra/HC RTS: The system behaviour during split and merge increased the potential for human error by not	If Radar Labels are to be provided, they shall be available for all aerodromes.		COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode. ENAV: Out of the window view requirements shall be refined finally to support the	When a handover is initiated or performed all systems and information that belongs to the same aerodrome	EFS shall be provided to support ATCOs managing the	

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						moving the MET window together with the radar map and EFS bay. This has led to the event when a MET window was next to a different aerodrome' s EFS bay, causing confusion. The handheld mic with its two-button layout also led to errors. Indra/Avinor: same as W2.PJ05.35 _Is.1.3.1-2 2.1 DLR For EXE-PJ05-W2-35-V3-			deployment of the RTC with flexible allocation of airports between modules.	shall be transferred in a synchronized way.	remote tower module When a handover is completed and accepted all systems and information that belongs to the same aerodrome shall be accepted in a single action.	

						2.1.1 again, the SATI scores show that the ATCOs trust the system and the interface. They see the increased human error in the changed role and responsibilities. COOPANS: ATCOs stated that the human machine interface could at sometimes increase the potential for human error. ENAV: the overall perception					When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	

						was that human error was not increased in terms of potential and severity respect to the scenario without flexible allocation being the most of the answers above the tolerable threshold of 4, anyway in relation to the HMI ATCOs suggested improvements in the position of the handover system commands and in the emergency communicat						

						ion commands						
							The HMI shall support the ATCO to easily distinguish the input/output devices of each aerodrome for vehicles.			Required information for ATCOs and SUP should be locally assessed before the deployment		Required information for ATCOs and SUP should be locally assessed before the deployment
				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.040	2.1 DLR For EXE-PJ05-W2-35-V3-2.1.1 the majority of the ATCOs	The ground frequency push buttons have to be integrated in the CWP in a way that they are		COOPANS: Further development of the colour scheme for alerts ENAV: Emergency	The ATCO may be supported in monitoring conformanc		The ATCO may be supported

						confirms that the alarms and alerts were applicable in the situations. But additional features for the safety net are essential. COOPANS: Partially covered as only alerts was used during validation. ATCOs confirmed the usability and utility of the alerts. However the ATCOs wanted to change the runway alert from red to some	easily distinguishable between airports (e.g. if airports are represented side by side the push buttons shall be respectively located on each side).		button and transfer acceptance HMI in the ATCO module CWP shall be reviewed for the deployment of the RTC with flexible allocation of airports between modules.	e to clearances on ground		in monitoring conformance to clearances on ground The ATCO may be supported by the system, indicating situations when contradictive (incompat

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						other colour. This based on that the alert only stated that a vehicle or aircraft was on the runway and not that there was a direct risk for a conflict. ENAV: About the alarms and alerts, there were different perception: 1 ATCO agreed that alarms and alerts were effective and not intrusive, one somewhat agreed and a last one						ible) clearances are delivered.

						Neither agreed nor disagreed. ATCOs raised during the debriefing that the emergency button location and HMI could be improved to avoid any confusion						
							~~Future validation activities shall involve the Supervisor position~~					
							When ATS is performed to more than one aerodrome simultaneously from one MRTM, the ATCO shall be able to listen to all aeronautical mobile service (air-ground communications) communication			The ATCO may be warned by the surveillance system about an aircraft or vehicle entering the runway without clearance.		The ATCO may be warned by the surveillance system abou

							channels for all aerodromes being served.					t an aircraft or vehicle entering the runway without clearance.
Arg. 2.3.3: Visual displays and other types of output devices adhere to HF	W2.PJ05.35_Is.2.3.3-1	The visual displays do not sufficiently support the accomplishment of approac	Closed	OBJ-PJ05-W2-35-V3-VALP-H18	CRT-PJ05-W2-35-V3-VALP-H18.010	Indra/HCRTS: Approach tasks were not simulated in the HC exercise. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR: same as W2.PJ05.35_Is.1.3.1-1b	When Tower and Approach services are combined within the same MRTM, the tools for each service shall be easily available.		COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode.		When Tower and Approach services are combined within the same MRTM, the tools for each service shall be	

principles. [V1: AIR only]		h tasks when providing ATS to multiple aerodromes				COOPANS: Technical System/HMI supported the ATCOs by being accurate, useful for task execution and well integrated. ENAV: Approach tasks not simulated					easily available.	

Arg. 2.3.3: Visual displays and other types of output devices adhere to HF principles. [V1: AIR	W2.PJ05.35_Is.2.3.3-2	The visual presentation does not contain complete information and therefore impacting the detectio	Closed	#N/D	#N/D		~~The current MET report, actual wind information, actual QNH and, if measured for the particular airport and relevant, RVR values shall continuously be presented to the ATCO for all aerodromes being controlled from the MRTM.~~		An additional Weather Display and Information is recommended on an additional screen if not available on the VP.			
				#N/D	#N/D		The ATCO shall have access to a visual presentation of flight operations on and in the vicinity of the aerodrome as well as vehicles and personnel on the manoeuvring area. Note					

only]		n, recognition, identification and ranging of objects relevant for service provision		#N/D	#N/D		The ATCO shall observe visual communication from aircraft that are within visual range on the aerodrome manoeuvring area, i.e.		If the pan and tilt functionality is available then a feature that would allow the camera to return to a "fixed" position should be available.	The information on the status of the lights and no-visual aids should be always visible for the controller, making it easy to identify to what aerodrome they correspond to.		
				#N/D	#N/D		~~The visual presentation shall provide a smooth and regular impression of moving objects to the human eye.~~		~~The binocular functionality should include predefined and user-definable automatic scanning patterns, such as runway sweeps~~			
				#N/D	#N/D		~~the ATCO's ability to perform the ATS service shall not be affected by the time delay between image/data capture and~~		~~The binocular functionality should include automatic tracking of moving aircraft, vehicles or obstructions (e.g. personnel or large animals).~~			

							~~presentation on the visual presentation~~					
				#N/D	#N/D		The visual reproduction may be augmented with additional (digital) information to provide the ATCO a greater level of situational awareness.		If the automatic binocular function is available, an indication should be visible to show which a/c or vehicle is selected on the automatic binoculars.	The visual presentation should include meteorological and other operationally relevant overlaid information.		
							The filtering option shall ensure the provided image remains realistic and does not mislead the ATCOs.			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		The RTC Supervisor role should be provided with a technical overview of all

										systems e.g. navigational aids, lights, emergency alerting functions, for all involved aerodromes part of the RTC		systems e.g. the MRTM, camera functionality etc. in the RTC and of the aerodrome systems e.g. navigational aids, lights, emergency alerti

												ng functions, for all involved aerodromes part of the RTC
							The ATCO shall be provided with a functionality corresponding to the binoculars in a traditional Tower, giving the possibility to zoom/enlarge specific areas and objects in the visual presentation.					
							~~The visual presentation provided by the binocular functionality shall be of sufficient quality (image~~					

							~~sharpness, magnification, contrast) to support the related ATCO tasks.~~					
							~~The binocular functionality shall be as simple, quick and easy to use as manually operated binoculars (in a local tower).~~					
							The pan and tilt functionality or VP shall allow the ATCO to scan the remaining part of the CTR					
							~~All MRTMs in a RTC shall be unified harmonised in terms of HMI and equipment (in order to contribute to the overall improvement of~~					

							~~uniformity of ATM services).~~					
				#N/D	#N/D		The RTC Supervisor or similar role shall be able to access functions for the monitoring of weather conditions for all aerodromes.					
				#N/D	#N/D		The RTC Supervisor or similar role shall access functions for communicating the status of RTC and aerodromes and coordinating maintenance (to be carried out by a qualified engineer/technician).					

Arg. 2.3.3: Visual displays and other types of output devices adhere to HF principles. [V1: AIR only]	W2.PJ05.35_Is.2.3.3-3	The visual presentation for multiple aerodromes should incorporate overlaid information to indicate / highlight specific parts of the aerodro	Closed	#N/D	#N/D		The overlay options shall be embedded on the VP using HF design principles. The overlays need a toggle on/off functionality.			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.		The RTC Supervisor role should be provided with a display presenting an overview of the RTC, including e.g. MRTM status, aerodromes allocated to

		me, such as runways, taxiways, in order to enhance the ATCO (and SUP) situational awareness, specifically in darkness and low visibility con										MRTMs, traffic load, etc. to be able to transfer an airport.
				#N/D	#N/D		The ATCO shall be provided with UTC clock in the MRTM. The UTC clock might be presented in the visual presentation.					
				#N/D	#N/D		It shall be possible for the ATCO to toggle on/off as well as adjust in light intensity any overlaid information in the visual					

		ditio ns					reproduction for each aerodrome separately toggle on/off.					
				#N/D	#N/D		Wind indication shall be presented as an overlay in relation to the operating directions in use for each RWY and/or both RWY directions					

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Arg. 2.3.3: Visual displays and other types of output devices adhere to HF principles. [V1: AIR only]	W2.PJ05.35_Is.2.3.3-4	Situation awareness negatively affected by the flexible positioning of aerodromes in the visual display (In RTC where there is	Closed	OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.030	Indra/HC RTS: Flexible allocation was not preferred due to system behaviour (see CRT-PJ05-W2-35-V3-VALP-H02.030 for more detail). Because the HMI got mixed up once ATCOs had modified the layout of the MRTM, they decided to keep aerodromes where they originally appeared on the screens. Thus it was often the case that a	The ATCO display should allow a flexible allocation of the position of the transferred aerodromes or The system behaviour should be user friendly during an aerodrome switch (i.e. between and within MRTM). The MET window should be linked to the EFS bay i.e. it should move together with the EFS and radar map during an aerodrome change.		ENAV: Out of the window view requirements shall be refined finally to support the deployment of the RTC with flexible allocation of airports between modules.			

		the need to allocate more than 3 airports (e.g. 4) it is not possible to maintain the same position of the aerodromes in the visu				bigger aerodrome was displayed on a smaller screen on the Visual Panorama. However, ATCOs suggested that they rather have this setup than having their head-down display mixed up, which negatively affected their situational awareness. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-7 2.1 DLR same as W2.PJ05.35							

		al displ ay)				_Is.1.3.1-7 COOPANS: Not more than three aerodromes have been simultaneou sly presenting in the VP. The system allowed ATCOs to self-decide where to allocate the taken aerodrome in the MRTM VP. During releasing of one of the three aerodromes , the system allowed ATCOs (optional), the remained two aerodromes						

						to be kept at the same position as prior the transfer occurred. All other systems automatically have followed the current aerodrome allocation. This was considering as very important feature with positive impact on SA. ENAV: fix position was considered as an issue rather than a support of the situation awareness. The					

						collected feedback was that the fix position had an opposite effect, especially when the transferred airport was a third airport in the middle fix position: during the transfer allocating the airport in the middle caused a temporary disorientation of the ATCOs that required a few times to recap the exact position of the airports. They would have						

						preferred to receive the transferred airport always occupying the last position in all the screen i.e. on the bottom of the displays for the external view and on the right on the head down CWP displays.						

				OBJ-PJ05-W2-35-V3-VALP-H18	CRT-PJ05-W2-35-V3-VALP-H18.010	Indra/HCRTS: Whenever the ATCO received/gave away an aerodrome due to the split and merge (or changed the setup of the MRTM via flexible allocation), there was a short period when most of them lost their situational awareness. It was because of the way the head-down system behaved: the radar maps shifted to a different place on the display with	The system behaviour shall be user friendly during an aerodrome switch (i.e. between and within MRTM). After switch/split/merge, the new head-down display setup shall not cover important information on the radar map. The MET window shall be linked to the EFS bay i.e. it should move together with the EFS and radar map during an aerodrome change. ATCOs shall be supported by a squelch indication and coloured frames in order to quickly distinguish the aerodromes	Supervisor planning tool shall use up-to-date and real time data to proper support the short term workload assessment.	Pre-sets should be defined for the aerodrome radar maps in order to support the ATCO to efficiently manage flexible allocation. COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode.		EFS shall be provided to support ATCOs managing the remote tower module Supervisor planning tool shall use up-to-date and real time data to proper suppo	The ATCO should be provided with a visual clear indication de-activable on ATCO request of which aerodrome an incoming radio transmission is related to in

						a changing view. To make matters worse, the MET displays remained in the previous positions. This caused major confusion and temporary loss of SA. Essentially the situation awareness ATCOs built for themselves via the head-down display got massively impacted during such a change. It took some time to set the air situation	and identify where the call is coming from. These features shall be integrated both into the Visual Panorama and the head-down display.				rt the short term workload assessment.	order to quickly distinguish the aerodromes and identify where the call is coming from. Pre-sets should be defined for the aerodrome radar maps in order

						display and the MET windows after the split/merge. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-1b 2.1 DLR: same as W2.PJ05.35_Is.1.3.1-1b COOPANS: Technical System/HMI supported the ATCOs by being accurate, useful for task execution and well integrated. ENAV: fix position was considered as an issue						to support the ATCO to efficiently manage flexible allocation.

						rather than a support of the situation awareness. The collected feedback was that the fix position had an opposite effect, especially when the transferred airport was a third airport in the middle fix position: during the transfer allocating the airport in the middle caused a temporary disorientation of the ATCOs that required a few times to						

						recap the exact position of the airports. They would have preferred to receive the transferred airport always occupying the last position in all the screen i.e. on the bottom of the displays for the external view and on the right on the head down CWP displays.						

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Arg. 2.3.4: Alarms and alerts have been developed according to HF principles. [V1: AIR only]	W2.PJ05.35_Is.2.3.4-1	ATCO do not notice or wrongly interpret alarms and alerts provided by the system	Closed	OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.040	2.1 DLR For EXE-PJ05-W2-35-V3-2.1.1 the majority of the ATCOs confirms that the alarms and alerts were applicable in the situations. But additional features for the safety net are essential. COOPANS: Partially covered as only alerts was used during validation. ATCOs confirmed the usability and utility of the alerts. However	~~The ATCO shall 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.~~		The ATCO may be warned by the surveillance system about an aircraft or vehicle entering the runway without clearance. COOPANS: Further development of the colour scheme for alerts ENAV: Emergency button and transfer acceptance HMI in the ATCO module CWP shall be reviewed for the deployment of the RTC with flexible allocation of airports between modules.	The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC. If any Safety net is available in current tower environment (e.g. conflicting clearances alerts etc.) it shall be available in the RTC.	If any Safety net is available in current tower environment (e.g. conflicting clearances alerts etc.) it shall be available in the RTC.	The ATCO may be warned by the surveillance system about an aircraft or vehicle entering the runway without clearance. The ATCO may be supported

						the ATCOs wanted to change the runway alert from red to some other colour. This based on that the alert only stated that a vehicle or aircraft was on the runway and not that there was a direct risk for a conflict. ENAV: About the alarms and alerts, there were different perception: 1 ATCO agreed that alarms and alerts were effective						by the system, indicating situations when contradictive (incompatible) clearances are delivered. The RTC Supervisor should be provided with the forecasted

						and not intrusive, one somewhat agreed and a last one Neither agreed nor disagreed. ATCOs raised during the debriefing that the emergency button location and HMI could be improved to avoid any confusion						dem and for all invol ved aero drom es part of the RTC.
							Alarms and alerts shall be developed in line with HF design principles.		In case stop bars and/or ground sensors are available, there should be a visual indication when stop bar overrun occurs.			

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							The same type of alarms and alerts used shall be available on all aerodromes clustered for multiple remote tower operations.					
							~~Future validation activities shall involve the Supervisor position~~					
Arg. 2.3.4: Alarms and alerts have been developed according to HF principl	W2.PJ05.35_Is.2.3.4-2	SUP do not notice or wrongly interpret alarms and alerts provided by the system	Closed	OBJ-PJ05-W2-35-V3-VALP-H12	CRT-PJ05-W2-35-V3-VALP-H12.040	ENAV: Supervisor was informed about emergency situation through the handover system addressed in criteria CRT-PJ05-W2-35-V3-VALP-H12.020. This system was judged as adequate and usable	Alarms and alerts shall be presented in the same way for all aerodromes available within the same MRTM.					

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es. [V1: AIR only]												
Arg. 2.3. 6: The usa bilit y of the user inte rfac e (inp ut devi ces, visu al disp lays /out put devi ces, alar m& alert s) is acce	W2.PJ 05.35 _Is.2.3 .6-1	The usab ility of the user inter face is not acce ptab le (e.g. displ ay of two APT on one scre en at the sam e time is	Closed	~~#N/D~~	~~#N/D~~		Working Environment (noise, temperature etc.) shall be according to national regulations for normal office establishments.		The information on the status of the lights and no-visual aids should be always visible for the controller, making it easy to identify to what aerodrome they correspond to.			
				~~#N/D~~	~~#N/D~~		~~Future validation activities shall involve the Supervisor position~~					

ptable. [V1: AIR only]		not acceptable)										
Arg. 2.3.6: The usability of the user interface (input devices, visual displays /output devices, alarm& alerts) is	W2.PJ05.35_Is.2.3.6-2	The handling of input devices for more than one airport is not acceptable	Closed	~~#N/D~~	~~#N/D~~				The possibility to create flight strips (e.g. with electronic pen) should be available.			
				~~#N/D~~	~~#N/D~~				The ATCO may be supported in monitoring conformance to clearances on ground			The ATCO may be supported in monitoring conformance to clearances on ground The

acceptable. [V1: AIR only]												ATCO may be supported by the system, indicating situations when contradictive (incompatible) clearances are delivered.
				~~#N/D~~	~~#N/D~~				The ATCO may be supported in monitoring conformance to clearances for airborne movements			The ATCO may be supported in monitorin

												g conformance to clearances for airborne movements The ATCO may be supported by the system, indicating situations when contradictive (incompat

												ible) clearances are delivered.
									The ATCO may be supported in conflict detection			

Arg. 2.3.6: The usability of the user interface (input devices, visual displays /output devices, alarm& alerts) is acceptable. [V1: AIR	W2.PJ05.35_Is.2.3.6-3	Input devices and HMI controls usability do not support ATCOs in the smooth and efficient execution of tasks	Closed	OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.020	Indra/HCRTS: Most of the ATCOs (66.6%) agree with the InNOVA being user-friendly. However, there were functions they had difficulties with. Similarly, the two-button design of the mic was unfamiliar and not intuitive, which paved the way for unnoticed errors. Indra/Avinor: same as W2.PJ05.35_Is.1.3.2-3b	The HMI shall support the ATCO to easily distinguish the input/output devices of each aerodrome for vehicles. The next one is already a requirement from Wave 1 (HPdesign_10): ATCOs should be able to transmit to individual aerodromes (G/G comm) in an intuitive and efficient manner. This could be achieved by having the ground frequency push buttons 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		COOPANS: Longer training session with focus on the PTT (Push To Talk) ENAV: Out of the window view requirements shall be refined finally to support the deployment of the RTC with flexible allocation of airports between modules.		Visual Presentation requirements shall be locally refined to support the deployment of the RTC with flexible allocation of airports between modules.	The ATCO should be provided with a visual clear indication de-activable on ATCO request of which aerodrome an incoming radio transmission is related to in

only]						Indra /HC PSM: 66% of the ATCOs agreed that the IRTOS video functionalities were user-friendly. A number of design issues have been mentioned, and potential solutions have been discussed. The biggest concern was the way ATCOs had to go back to 'airport selection' whenever they wanted to work with any of the video	buttons shall be respectively located on each side). The ground bay of the head-down display shall not contain aircraft that just received their ATC Clearance. The system behaviour shall be user friendly during an aerodrome switch (i.e. between and within MRTM). After switch/split/merge, the new head-down display setup shall not cover important information on the radar map. The MET window shall be linked to the EFS bay i.e. it should move					order to quickly distinguish the aerodromes and identify where the call is coming from.

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						system functions at another airport, and this issue was even more pronounced when the activity was imminent. The following steps describe what the ATCO had to do when s/he was looking at the video wall and decided to focus on an area/flight with the PTZ at one aerodrome (e.g. Pápa). Importantly, the PTZ function was active at another	together with the EFS and radar map during an aerodrome change. ATCOs shall be supported by a squelch indication and coloured frames in order to quickly distinguish the aerodromes and identify where the call is coming from. These features should be integrated both into the Visual Panorama and the head-down display. ATCOs shall not be required to explicitly select between aerodromes to access the particular aerodrome's HMI controls. Therefore no					

						airport, e.g. Nyíregyháza. The ATCO had to 1. first look down at the InNOVA screen, select Pápa, 2. then select the PTZ function, 3. and then move the cursor up to the video wall, 4. and select the area s/he wanted to zoom in. The integrated IRTOS (video system) window was huge and covered a considerable part of the	dedicated window is needed.					

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						InNOVA radar display when it was opened. There were other HMI issues that are detailed in the VALR, but those are not specific to the flexible allocation of aerodromes . 2.1 DLR Same as W2.PJ05.35 _Is.1.3.2-3b COOPANS: Majority of ATCOs confirm the usability of input devices and HMI controls. ENAV: The							

						Remote Tower Module ATCOs didn't like a dedicated monitor for PTZ function and would have preferred to have a picture in the picture function with command integrated in the strip bay to facilitate the interactions with the OTW and the zoom functions. Also, Remote Tower Module ATCOs suggested improveme						

						nts to the OTW: to mark the line between the airports in the OTW to make more visible the borders between airports and to provide the aircraft labels on the OTW only for active flights.						

Arg. 2.3.7: The user interface design reduces human error as far as possible. [V1: AIR	W2.PJ 05.35 _Is.2.3 .7-1	Confusion of which information (e.g. strips, meteo etc.) is linked to which APT. This coul	Closed	#N/D	#N/D		The ATCO shall be provided with the Airport name (spelled out or designator or both) for each aerodrome in operation in the MRTM.	ATCOs shall be trained in order to achieve familiarity with the RTC systems and operational environment	The full airport name should be displayed both in the Visual Presentation (VP) and the radar display in order to easily link OTW view, radar display and EFSS info.			ATCOs shall be trained in order to achieve familiarity with the RTC systems and operational environment	The airport name should be integrated in the phraseology in order to increase the situational

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only]		d increase the potential for human error, as ATCOs may give the wrong information, instruction to wrong a/c at another aerodrome.		#N/D	#N/D		The ground frequency push buttons have to 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).		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			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

		Therefore, this could have a potential negative impact on system safety.										aerodrome systems e.g. navigational aids, lights, emergency alerting functions, for all involved aerodromes part of the RTC

				#N/D	#N/D		~~Sufficient writing space shall be available in the MRTM to the ATCO in order to make manual notes.~~	ATCOs shall be trained in order to achieve familiarity with the RTC systems and operational environment			ATCOs shall be trained in order to achieve familiarity with the RTC systems and operational environment	
				#N/D	#N/D		The RTC Supervisor role shall access functions for the planning, coordination and monitoring of the upcoming and present traffic flow, in the purpose of tactical opening and closure of					

							MRTMs and allocation of airports to them.					
Arg. 2.3.8: The user interface supports a sufficient level of individual situation awarene	W2.PJ05.35_Is.2.3.8-2	Simultaneous radio calls on different frequencies (decoupled) might lead to the loss of infor	Closed	#N/D	#N/D		The ATCO shall be able to listen to all surface movement control service (communications for the control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes) communication channels for all aerodromes being served.					

ss. [V1: AIR only]		mation.										
Arg. 2.3. 8: The user interface supports a sufficient level of	W2.PJ 05.35 _Is.2.3 .8-3	Coupling of frequencies might lead to ATCO, pilot and vehicle	Closed	#N/D	#N/D		When ATS is performed to more than one aerodrome simultaneously from one MRTM, the ATCO shall for the aeronautical mobile service (air-ground communications), be able to transmit to “all aerodromes” being served from the MRTM,					

individual situation awareness. [V1: AIR only]		driver`s confusion. (refer to Arg. 1.3.1)		#N/D	#N/D		When ATS is performed to more than one aerodrome simultaneously from one MRTM, aeronautical mobile service (air-ground communications) shall be retransmitted / relayed between all aerodromes being served from that MRTM.					
				#N/D	#N/D		The ATCO shall use aeronautical fixed service (ground-ground communications) extended to cover communications with all units relevant for all aerodromes being served.					

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				#N/D	#N/D		The ATCO shall, for the surface movement control service (communications for the control of vehicles other than aircraft on manoeuvring areas at controlled aerodromes), be able to transmit to individual aerodromes.					
Arg. 2.3. 8: The user interface supports a sufficient level of individual	W2.PJ 05.35 _Is.2.3 .8-4	Confusion relating to which pilot at which APT, ATCO is communicating /	Closed	#N/D	#N/D							

situation awareness. [V1: AIR only]		How to ensure that the ATCO understand which aircraft is calling.										
Arg. 2.3.8: The user interface supports a sufficient level of	W2.PJ05.35_Is.2.3.9-1	The supervisor is not aware of the task load of the ATCO informati	Closed	OBJ-PJ05-W2-35-V3-VALP-H01	CRT-PJ05-W2-35-V3-VALP-H01.040	Indra/HC decided not addressed this specifically. Regarding the actual issue defined here, the SUP was aware of the ATCOs' task load as s/he had the SUP	~~Future validation activities shall involve the Supervisor position~~		The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC. ENAV: The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC based on latest available data	When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	Supervisor tool HMI shall display the status of the MRTM and the traffic load expected at	

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individual situation awareness. [V1: AIR only]		on available to the SUP is not sufficient or not presented in a suitable way)				Planning system. If the SUP had any doubts about the traffic situation, he walked over to the MRTM to check on the ATCO's system. Indra/Avinor: W2.PJ05.35_Is.1.3.1-1b 2.1 DLR China Lake and tailor-maid results show that that the participants were able to divide their attention and keep SA on an adequate level.					each single aerodrome under his/her supervision to properly establish the flexible allocation of aerodromes to the available RTC Modules When a handover is completed and	

						ENAV: SUPs state that situation awareness was at an acceptable level when working in a RTC with a flexible allocation of aerodromes between MRTMs, nevertheless they but ,margin of improvements were suggested for the supervisor tool. Although it was considered a powerful mean to assess the workload for the ATCOs module, the					accepted all systems and information that belongs to the same aerodrome shall be accepted in a single action. When a handover is initiated or performed all systems and	

						tool was not integrated in the simulation platform and thus providing the forecast and computation of workload on the planned traffic rather than the real time traffic					information that belongs to the same aerodrome shall be transferred in a synchronized way.	
							The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine aerodromes in the MRTM.			Required information for ATCOs and SUP should be locally assessed before the deployment	The RTC Supervisor shall be provided with information to facilitate decisions regard	Required information for ATCOs and SUP should be locally assessed before the

											ing how to combine aerodromes in the MRTM.	deployment
							The RTC Supervisor shall be provided with a tool combining the information (aerodromes' status, meteo, forecasted traffic load and capacity) to facilitate decisions regarding how to combine aerodromes in the MRTM				The RTC Supervisor role shall access functions for communicating the status of RTC and aerodromes and coordinating maintenanc	The RTC supervisor role may be provided with a tool combining the information (aerodromes' status, mete

											e (to be carried out by a qualified engineer/technician).	o, forecasted traffic load and capacity) to facilitate decisions regarding how to combine aerodromes in the MRTM
				OBJ-PJ05-W2-35-V3-VALP-H12	CRT-PJ05-W2-35-V3-VALP-H12.010	Indra/HCRTS: The majority of ATCOs did not report anything missing from the	The ATCO/RTC Supervisor shall be able to verify the status of an aerodrome and its related systems, before taking on				The ATCO/RTC Supervisor shall be able	

						SUP system. There was one idea however that is worth to consider, i.e. to have a quick access for view only of any airport, so that the SUP in a RTC environment could follow an emergency situation without bothering the ATCO in the MRTM. Indra/Avinor: same as W2.PJ05.35_Is.1.13.5-13 2.1 DLR The results show that all	responsibility for providing ATS to the aerodrome.				to verify the status of an aerodrome and its related systems, before taking on responsibility for providing ATS to the aerodrome.	

						information' s are available but they are difficult to acquire, especially at a fitting time ENAV: For both the questions "I had all the information I needed to perform my tasks" and "I found the information provided in the SUP Working Position" one answer is somewhat disagree and the other one is agree. The reason for not achieving a						

						conclusive result is behind the technical limitation of the supervisor planning tool that due to time and resources constraint was not linked to the simulation platform and thus all the calculation were based on a planned traffic sample rather than the live traffic managed in the simulation experiment. For one of						

						the SUP this was a big issue that was affecting the level of information provided to him, while the other supervisor easily adequate his working method to deal with the limitation of the supervisor tool.						
							The RTC Supervisor or similar role shall be provided an overview of ATCO availability and their valid endorsements					

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				OBJ-PJ05-W2-35-V3-VALP-H12	CRT-PJ05-W2-35-V3-VALP-H12.030	Indra/HC RTS: Whilst the utility of the SUP planning tool is unquestionable, there were some issues with the reliability of the timeline data. The interaction with the system was regarded as intuitive. Indra/Avinor: Improvements were considered necessary to make the planning tool more useful. The traffic timeline was found useful to	There needs to be a local assessment to determine the number of endorsements an ATCO working in an MRTM can have, taking into account the split/ merge and transfer possibilities. The SUP shall be able to identify the traffic peaks, supported by the system. Thus the timeline shall be precise, by marking the real simultaneous traffic based on updates from actual data. The predicted duration of the overload periods shall also be transparent.		ENAV: Supervisor planning tool shall use up-to-date and real time data to proper support the short term workload assessment. Supervisor planning tool HMI and ATCO's module HMI shall be reviewed for the deployment of the RTC with flexible allocation of airports between modules.		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/technici	There needs to be a local assessment to determine the number of endorsements an ATCO working in an MRTM can have, taking into account the split/

						anticipate the future traffic load at MRTMs, even though improvements were considered necessary as mentioned in the results of CRT-PJ05-W2-35-V3-VALP-H12.010. The possibility in the "planning" view to simulate clusters of aerodromes and visualize what the traffic timelines would look like, was found					an). Supervisor planning tool shall use up-to-date and real time data to proper support the short term workload assessment.	merge and transfer possibilities. The RTC supervisor role may be provided with a tool combining the information (aerodromes' status, meteo, forec

						useful. The “planning” view was lacking functionalities for the supervisor to be able to schedule the future allocation of aerodromes to MRTMs and ATCOs. A roster to see ATCOs availability was also missing, and it was difficult to get an overview of ATCOs endorsements. 2.1 DLR The majority of the participants confirmed that the						asted traffic load and capacity) to facilitate decisions regarding how to combine aerodromes in the MRTM

						SUP HMI supported them in split/merge procedures. ENAV: the supervisor planning tool resulted easy to use considering that most of the responses are positive. Nevertheless, several improvements were recommended for the supervisor planning tool in order to achieve a better HMI and an improved interaction and a satisfactory user						

						experience. This is also understand able looking at the contradictor y answers of the post simulation result. The supervisors during the debriefing complained about the HMI of the supervisor planning tool that could be enhanced displaying multiple windows, which currently was not the case, and using a more friendly and intuitive code for understandi						

						ng the airports displayed in the traffic sample plots.						
Arg. 2.3. 9: The user Interface design support	W2.PJ 05.35 _Is.2.3 .9-1	The flexible frequent allocation of aerodromes gen	Closed	OBJ-PJ05-W2-35-V3-VALP-H03	CRT-PJ05-W2-35-V3-VALP-H03.010	HC/Indra RTS: The system supported the RTC team in establishing and maintaining their situational awareness,	~~Future validation activities shall involve the Supervisor position~~		The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC.	When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be	When a handover is completed and accepted all systems and	

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s a sufficient level of team situational awareness. [V1: AIR only]		erates confusion affecting the team situation awareness with a possible increase of human error and workload				and the system worked as expected during the split, supporting the teamwork between MRTMs too. The only downside was the ATCO's HMI: the layout changed unexpectedly during a switch, but the MET windows remained in the previous positions. This led to confusion, error and significant increase in workload, loss of situational				transferred in a synchronized way.	information that belongs to the same aerodrome shall be accepted in a single action. When a handover is initiated or performed all systems and information that belongs to	

						awareness. Indra/Avinor: same as W2.PJ05.35_Is.1.3.5-5 2.1 DLR The PE questionnaire results show that there is still missing information or information in poor quality which makes the task of splitting and merging less. The comments from the debriefing fill this gap with ideas how the improve the interface.					the same aerodrome shall be transferred in a synchronized way.	

						COOPANS: Check W2.PJ05.35 _Is.2.3.3-4 ENAV: No issues were raised for team situation awareness in relation with the frequency of the handover that was considered adequate						
				OBJ-PJ05-W2-35-V3-VALP-H03			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.			Required information for ATCOs and SUP should be locally assessed before the deployment	The ATCO/ RTC Super visor shall be able to verify the status of an aerodr	Requ ired infor mati on for ATCO s and SUP shoul d be locall y asses

											ome and its related systems, before taking on responsibility for providing ATS to the aerodrome.	sed before the deployment
							The HMI shall support the ATCO to easily distinguish the input/output devices of each aerodrome for vehicles.			The ATCO should be provided with a visual indication of which aerodrome an incoming radio transmission is related to. The visual indications may be		The ATCO should be provided with a visual clear indication de-activable

										customisable and switched on-off on ATCO's request		on ATCO request of which aerodrome an incoming radio transmission is related to in order to quickly distinguish the aerodromes and identify where the call is

												coming from.
				OBJ-PJ05-W2-35-V3-VALP-H18	CRT-PJ05-W2-35-V3-VALP-H18.020		The RTC Supervisor or similar role shall be provided an overview of ATCO availability and their valid endorsements					
							There needs to be a local assessment to determine the number of endorsements an ATCO working in an MRTM can have, taking into account the split/ merge and transfer possibilities.					There needs to be a local assessment to determine the number of endorsements an

												ATCO working in an MRTM can have, taking into account the split/merge and transfer possibilities.
Arg. 3.2.2: The proposed task allocation bet	W2.PJ05.35_Is.3.2.2-1	The task allocation for the SUP/ATCO is not sup	Closed	OBJ-PJ05-W2-35-V3-VALP-H18	CRT-PJ05-W2-35-V3-VALP-H18.010	COOPANS: Technical System/HMI supported the ATCOs by being accurate, useful for task execution and well integrated.	~~Future validation activities shall involve the Supervisor position~~		COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode.	Handover procedure may be supported by the technical system in silent transfer and acceptance		Handover procedure may be supported by the tech

ween human actors is supported by technical systems /the HMI.		ported by technical systems / the HMI				ENAV: no issues raised in relation to task allocation and the support provided by the technical system.				of the split and merge		nical system in silent transfer and acceptance of the split and merge
							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.				Transfer procedures (for the transfer of an aerodrome between MRTMs) shall be locally define	

											d with a clear description of the associated roles and responsibilities	
Arg. 3.2.2: The proposed task allocation between human actors is supported by	W2.PJ05.35_Is.3.3.2-1	APTs having the same or similar RWY designators could lead to confusion. (the inclu	Closed	#N/D	#N/D		Coordination procedures between the TWR ATCO and the aerodrome personnel shall be locally defined. (linked to REQ-05.00-SPRINTEROP-CO03.0004/ SR12, SR 13, SR14)					

technical systems /the HMI.		sion of airport names in clearances / radio transmissions shall be considered as a standard procedure) (Arg. 1.3.1)										

Arg. 3.3.2: The phraseology supports communication in all operating conditions.	W2.PJ05.35_Is.3.3.2-2	Not clear on which airport is the flight that is receiving clearances (Also affecting Arg. 1.3.5)	Closed	OBJ-PJ05-W2-35-V3-VALP-H02	CRT-PJ05-W2-35-V3-VALP-H02.010	Indra/HCRTS: Situation awareness was at an acceptable level when providing ATS to 3 aerodromes in parallel according to the SASHA-Q scores. The issue mentioned in column D was not prominent, however, it was explicitly suggested to include the squelch indication as a system requirement when the solution gets deployed. It is for the opposite	The HMI shall support the ATCO to easily distinguish the input/output devices of each aerodrome for vehicles. ATCOs shall be supported by a squelch indication and coloured frames in order to quickly distinguish the aerodromes and identify where the call is coming from. These features shall be integrated both into the Visual Panorama and the head-down display.				Visual Presentation requirements shall be locally refined to support the deployment of the RTC with flexible allocation of airports between modules.	The ATCO should be provided with a visual indication of which aerodrome an incoming radio transmission is related to. The visual indications may

						reason- the squelch could indicate where the transmission is coming from. Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-7 2.1 DLR same as W2.PJ05.35_Is.1.3.5-2 COOPANS: ATCOs were aware about to which A/c they were giving instructions to, which A/c belonged to which aerodrome and to what aerodrome						be customisable and switched on-off on ATCO's request

						they were giving instructions to. ENAV: ATCOs did not raise any issue in relation with the ability to distinguish with which aircraft, vehicle at which aerodrome the ATCO is communicating with						
				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.070	Indra/HC: The majority of ATCOs (83.3%) were aware which aerodrome was placed to which positions of the system (but see the	The airport name should be integrated in the phraseology in order to increase the situational					The airport name should be integrated in the phraseolog

						evidence gathered for Arg. 1.3.5) Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-7 2.1 DLR The results show that the majority of participants was aware of the displayed aerodromes and radar configurations. COOPANS: Majority of ATCOs confirm that there was no confusion regarding where a certain aerodromes						y in order to increase the situational

						was going to be placed in the visual presentation (VP). ENAV :ATCOs did not raise any issue in relation with the ability to distinguish with which aircraft, vehicle at which aerodrome the ATCO is communicating with						

				OBJ-PJ05-W2-35-V3-VALP-H08	CRT-PJ05-W2-35-V3-VALP-H08.010	Indra/HCRTS: Based on the feedback the phraseology is acceptable for the ATCO in normal and abnormal operating conditions and degraded modes Indra/Avinor: All ATCOs confirmed that the phraseology when providing ATS services to multiple aerodromes was efficient under both normal and abnormal operating	The airport name should be integrated in the phraseology in order to increase the situational					The airport name should be integrated in the phraseology in order to increase the situational

						conditions. A method, consisting of systematically including the aerodrome name in the callsign of vehicles during communications, was used to avoid confusion when a same vehicle callsign number was in use on two different aerodromes. Since air frequency were coupled, it was discussed that adding						

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						aerodrome name for take-off and landing clearances could be a need to avoid any risk of confusion for pilots. 2.1 DLR The ATCOs agreed that they were able to apply the phraseology independent from the operating conditions. This is only ok with the adaption that no abnormal and degraded modes were part of the validation.						

						COOPANS: This criteria was partly covered by the validation exercise, since there were not tested any abnormal situation. The ATCOs agreed that phraseology was acceptable when providing simultaneous ATS to three aerodromes in normal and degraded operating conditions. They also agreed that phraseology worked well while performing						

						transfer of aerodromes between the modules. They clearly confirm ''my control at (aerodrome name)'' when they took control over an aerodrome after completing the transfer. ENAV: No issues neither specific comments were raised about the current employed phraseology						

				OBJ-PJ05-W2-35-V3-VALP-H11	CRT-PJ05-W2-35-V3-VALP-H11.010	Indra/HCRTS: Same as W2.PJ05.35_Is.1.3.1-7 Indra/Avinor: same as W2.PJ05.35_Is.1.3.1-7 2.1 DLR Same as W2.PJ05.35_Is.1.3.1-7 COOPANS: ATCOs state the simulator (S-m) provided useful data in an understandable way and that they rarely needed to search for information. ENAV :ATCOs did			COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode.			The ATCO should be provided with a visual indication of which aerodrome an incoming radio transmission is related to. The visual indications may

						not raise any issue in relation with the ability to distinguish with which aircraft, vehicle at which aerodrome the ATCO is communicating with						be customisable and switched on-off on ATCO's request
Arg. 3.3.4: The communication load of team members is acceptable in normal	W2.PJ05.35_Is.3.3.4-1	The amount of communication and time on the frequency can be a bottleneck in	Closed	OBJ-PJ05-W2-35-V3-VALP-H04	CRT-PJ05-W2-35-V3-VALP-H04.020	HC/Indra RTS: The amount of communication was judged to be acceptable. Indra/Avinor: All participants confirmed that the amount of communication and time on the frequency were			The overlapping of air-ground communication shall be minimized for the ATCO.	Ground vehicles should be properly trained to become familiar with the fact that the ATCO is communicating also with other aerodromes including ground vehicles	The overlapping of air-ground communication shall be minimized for the ATCO.	Ground vehicles should be properly trained to become familiar with the fact that the ATCO

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and abnormal conditions and degraded mode of operations.		situations with high task load, rather than workload or situation awareness and should be further evaluated at V3 level				acceptable. 2.1 DLR: The results show that the majority of the ATCOs working MRTM find the different types of communication and the frequency acceptable, even in situations with 3 active airports on one MRTM. COOPANS: The workload is negatively impacted by the amount of simultaneous calls. This increase the						is communicating also with other aerodromes including ground vehicles

						potential for misunderstandings caused by the overlapping calls. Communication with VFR traffic and vehicles was appointed as much more challenging than communication with the IFR traffic. ENAV: R/T load was considered acceptable in the solution scenario. It was not acceptable in the reference scenario with 3						

						airports allocated and without the flexible allocation						
Arg. 4.1.1: Changes in roles and responsibilities are acceptable to the affected human actors.	W2.PJ05.35_Is.4.1.1-1	The concept and resulting changes in roles & responsibilities are not acceptable to the affected actors	Closed	OBJ-PJ05-W2-35-V3-VALP-H07	CRT-PJ05-W2-35-V3-VALP-H07.010	Indra/HC RTS: See W2.PJ05.35_Is.1.1.2-1. ATCOs can accept the suggested roles and responsibilities, based on the outcomes of the simulation. Indra/Avinor: Same as W2.PJ05.35_Is.1.1.2-1 2.1 DLR The results show that the majority of participants finds the	~~Future validation activities shall involve the Supervisor position~~		Number of aerodromes in the RTC and allocated to each supervisor shall be locally assessed as it depends on the complexity of the aerodromes		Number of aerodromes in the RTC and allocated to each supervisor shall be locally assessed as it depends on the complexity of the aerodromes	

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						changes clear, consistent, acceptable, and applicable. COOPANS: ATCOs roles and responsibilities introduced by the multiple remote tower concept when working with a flexible allocation of aerodromes between the modules do not change, only the amount of areas in which the roles and						

						responsibilities are executed multiply with each tower. ENAV: Changes and concept were found feasible and acceptable						
				OBJ-PJ05-W2-35-V3-VALP-H09	CRT-PJ05-W2-35-V3-VALP-H09.010	Indra/HCRTS: Same as in W2.PJ05.35_Is.1.2.1-1 Indra/Avinor: Same as W2.PJ05.35_Is.1.2.1-1 2.1 DLR Same as W2.PJ05.35_Is.1.2.1-1 ENAV: Changes and concept were found						

						feasible and acceptable						

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Arg. 4.2.1: Knowledge, skill and experience requirements for human actors have been identified.	W2.PJ05.35_Is.4.2.1-1	New MRTM system might require new knowledge, skills and experience	Closed	OBJ-PJ05-W2-35-V3-VALP-H15	CRT-PJ05-W2-35-V3-VALP-H15.010	Indra/HC RTS: Some ATCOs also mentioned that it hurt their pride that an aerodrome has been taken away from them, even though they felt that they could have continued to provide ATS for that one as well. Thus ATCOs should bear in mind that the split and merge is there for optimising workload. Only the Supervisor has all the RTC-related information in his/her	~~Future validation activities shall involve the Supervisor position~~		COOPANS:A understanding and familiarity of the system as well as knowledge about the different aerodromes such as geography, gates, stands etc. was seen by ATCOs as important skills and knowledge in order to be able to operate multiple aerodromes simultaneously. 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 is also seen as a requirement in order to safely operate multiple aerodromes.	Capacity of MRTM shall be locally assessed as it depends on the complexity of the aerodromes in the RTC	Capacity of MRTM shall be locally assessed as it depends on the complexity of the aerodromes in the RTC	Additional skills may be needed: • Teamwork skills (TRM), depending on the context • SUP should have a background in control tower

						possession, so ATCOs should not question his/her decision. In terms of the role of the SUP, the first group pointed out that sectorisation is not part of the (HungaroControl) Tower Supervisor's current duties, so this task was a little unusual. They also suggested that motivation and affinity are the key skills and requirements for becoming a Centre SUP.						

						The SUP should be confident in "ordaining" the split, yet s/he should explain the reason for a split briefly just as a SUP would do in ACC, so that ATCOs also understand that it is due to e.g. a predicted traffic levels and not due their performanc e. As one of the participatin g ATCO put it, by so doing the SUP would not "trample on the ATCO's feelings".						

						Indra/Avinor: Some knowledge and skills needs could be identified for ATCOs. The familiarity with the system and a very good local knowledge about each aerodrome characteristics were cited as important skills/training requirements to be able to operate multiple aerodromes. Cognitive skills such as visual scanning of information						

						or multitasking are also important to build up to ensure human performanc e in a multi context. However, they were considered by ATCOs as to already be a part of their tasks in today's tower. Clear rules regarding maximum capacity at MRTMs need to be established and known by both ATCOs and supervisors to prevent overloads and anticipate						

						when split of aerodromes should be performed. COOPANS: Knowledge, skills and experience requirements was identified both from ATCOs and also from observers. ENAV: It's not fully clear from the conducted discussion and the collected responses if skill and recruitment requirements need to be adapted to handle the new						

						concept of the flexible allocation, as not all the answers are aligned on the positive or negative responses for the supervisors and the ATCOs. The overall trend in the discussion was that no real new requiremen t or skill is needed, but adaptation to the new way of working would be required						

Arg. 4.3.2: The impact on shift organisation is identified.	W2.PJ05.35_Is.4.3.2-1	The maximum shift length of an ATCO might be reduced with Multiple Remote Tower compared to single remote tower	Closed	#N/D	#N/D		Local assessment shall be done to determine shift lengths					

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Arg. 4.5. 1: The content of training for each actor group is specified. (V3 only)	W2.PJ 05.35 _Is.4.5 .1-1	The training does not sufficiently contain a technical part on the new MRTM The ATCOs/ SUPs are not sufficiently familiarised with the aerodro	Closed	OBJ-PJ05-W2-35-V3-VALP-H15	CRT-PJ05-W2-35-V3-VALP-H15.020	HC/Indra: No special training need was identified for the SUP role. Regarding the ATCO role, after four days ATCOs shared that they needed this time to get comfortable with the simulated environment (four airports and the system). It is important to bear in mind that the civilian ATCOs at HungaroControl are used to providing ATS at	The diversity of the different aerodromes in terms of geographical specifities and procedures have to be included in the training		COOPANS: An understanding and familiarity of the system as well as knowledge about the different aerodromes such as geography gates, stands etc. was seen by ATCOs as important skills and knowledge in order to be able to operate multiple aerodromes simultaneously.			

		me (physical characteristics, procedures, operating conditions etc.) The ATCO/SUPs is not sufficiently familiarised with the technical beh				Budapest, which is a medium-sized airport. Therefore they felt that it may have been easier for them to adjust to the simulated traffic level- albeit it wasn't too high for their standards-, then for someone who comes from a small aerodrome with 1-2 VFRs/day. In terms of training on the system, it is easier to get accustomed to a system						

		avio ur of the cam era and othe r RT spec ific tech nical com pon ents .				which was tailored to the given context of use. The system used in this validation was designed to the needs of the Avinor end-users. Whilst the behaviour of the system may have been intuitive for that group of users, the same design did not meet the mental model of the Hungarian ATCOs. Indra/Avino r: Some training						

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						needs could be identified for ATCOs. The familiarity with the system and the local knowledge of each aerodrome characteristics were mentioned as important skills/training to ensure human performance when operating multiple aerodromes. The need for dedicated training on ATCO/SUP teamwork to deal with abnormal						

						situation or degraded modes was also raised by both ATCOs and supervisors. COOPANS: Training needs was identified by both ATCOs and observers. ENAV: Both the supervisors and the ATCOs agreed that the ATCOs and supervisor should be extensively trained to undertake the new role for the supervisor and the new responsibilit						

						ies for the ATCOs						
							Local assessment shall be done to determine shift lengths					

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							Split and merge procedures shall be locally defined with a clear description of the associated roles and responsibilities and corresponding coordination					
							The training curricula shall familiarize the ATCOs with the new concept and the corresponding tools (e.g. binoculars), in order to ensure they have an adequate level of trust					
							~~Future validation activities shall involve the Supervisor position~~					

Table 17: Summary of the HP results and recommendations/ requirements for each identified issue & related argument

4.4.2 Maturity of the Solution

Maturity checklist for finalising the V3 assessment			
ID	**Question**	**Answer**	**Comments**
1	Has a Human Performance Assessment Report been completed? Have all relevant arguments been addressed and appropriately supported?	Yes	See sections 4.1.5, 4.2.1 and 4.4.1
2	Are the benefits and issues in terms of human performance and operability related to the proposed solution sufficiently assessed (i.e. on the level required for V3)?	Yes	See sections 4.2.1 and 4.4.1
3	Have all the parts of the solution/concept been considered?	Yes	See sections 4.1.1, 4.1.2, 4.1.5, 4.2.1 and 4.4.1
4	Have potential interactions with related projects/concepts been considered and addressed?	Yes	No interactions identified; previous solution have been considered in the change assessment.
5	Is the level of human performance needed to achieve the desired system performance for the proposed solution consistent with human capabilities?	Yes	See section 4.4.1, but recommendations and requirements have been identified for the system performances
6	Are the assessments results in line with what is targeted for that concept? If not, has the impact on the overall strategic performance objectives/targets been analysed?	Yes	- See section 4.4.1
7	Has the proposed solution been tested with end-users and under sufficiently realistic conditions, including abnormal and degraded conditions?	Yes	See section 4.3.1
8	Do validation results confirm that the interactions between human and technology are operationally feasible, and consistent with agreed human performance requirements?	Yes	- See section 4.4.1

9	Have all relevant SESAR documentation been updated according to the HP activities outcomes (OSED, SPR)?	Yes	OSED and SPR are updated to take into account HPAR results
10	Do the outcomes satisfy the HP issues/benefits in order to reach the expected KPA?	Yes	See Section 4.4.1
11	Have HP recommendations and HP requirements correctly been considered in HMI design, procedures/documentation and training?	Yes	See Section 4.4.1 Appendix B and C
12	Have the major factors that can influence the transition feasibility (e.g. changes in competence requirements, recruitment and selection, training needs, staffing requirements, and relocation of the workforce) been addressed? Are there any ideas on how to overcome any issues?	Yes	See Section 4.4.1 Appendix B and C
13	Have any impacts been identified that may require changes to regulation in the area of HP/ATM? This includes changes in roles & responsibilities, competence requirements, or the task allocation between human & machine.	Yes	See Section 4.4.1 Appendix B and C
14	Has the next V-phase sufficiently been prepared (additional testing conditions, open HP issues to be addressed)?	Yes	See Section 4.4.1 Appendix B and C All issues are considered as closed

5 References

Human Performance

[1] Human Performance Assessment Process V1 to V3 – including VLDs

[2] SESAR Solution PJ05-03 Validation Plan (VALP) Template for V2 - Part IV - Human Performance Assessment Plan

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

[4] SESAR Solution 05-03 SPR/INTEROP-OSED V2 - Part IV - Human Performance Assessment Report

[5] 06.09.03 D28 Remotely Provided Air Traffic Services For Two Low Density Airports Appendix F: HP Assessment Report

[6] SESAR Solution PJ05.02 SPR-INTEROP/OSED for V3 - Part I

[7] SESAR Solution PJ05.02 SPR-INTEROP/OSED for V3 - Part IV

[8] SESAR Solution PJ05_02-V3 VALR (3_13)

[9] SESAR Solution PJ05_03 - D3_1_007 - VALR (2_24)

[10]SESAR PJ05_03 - D3_1_005 - HP assessment plan (1_2)

[11]SESAR Solution Wave 2 PJ05 35- D2.7.020 VALP Part IV

[12]SESAR Solution Wave 2 PJ05 35--D2.1.060 V 3 VALR

[13]SESAR Solution Wave 2 PJ05 35--D2.1 OSED Part I

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Appendix A – Additional HP activities conducted

None

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Appendix B – HP Recommendations Register

This section includes the final recommendations identified to mitigate the issues and benefits identified for the solution. These recommendations have been identified considering the results of the conducted HP related activities. Most of them are then moved to the Part I SPR-INTEROP/OSED. Recommendations that are left only in the HPAR are intended to drive the further assessment needed at human performance level during a local deployment for a RTC with flexible allocation of aerodromes between MRTMs, this as support when performing the mandatory Safety Assessment according to 373 regulation with support of EASA guidance Material for Remote Towers.

Recommendations validated at V3 level in previous phase have not been included in this HPAR, but for traceability reasons they can be found in the HP-Log.

The following Recommendations scope is related to “Ground” and are relevant to Pj05.35 concept:

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_1 became OSED REQ-05.35-SPRINTEROP-AL01.0001	Y	Human Performance	The ATCO should be supported in monitoring the runway	The ATCO should be supported in monitoring the runway. *How* this support should be provided, should be locally assessed. If available, a ground surveillance system is desirable.	Workshop W2	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_10	N	Human Performance	The border of each displayed aerodrome should be marked in the Visual Panorama and head-down displays with possible colour coding for the different positions or aerodromes.	Borders between the displayed airports should be highlighted to easily distinguish the frame related to each aerodrome in the visual panorama and in the head down displays	W2 RTS/Workshop	Accepted		It is recommended to allow a flexible display of the airports in the OTW view and in head-down display (no fix position, but the new airports always displayed as the last one. The OTW should underline the border of each displayed airport

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_11	N	Human Performance	The ATCO should be provided with a visual clear indication de-activable on ATCO request of which aerodrome an incoming radio transmission is related to in order to quickly distinguish the aerodromes and identify where the call is coming from.	ATCOs should be supported by a visual indication and coloured frames in order to quickly distinguish the aerodromes and identify where the call is coming from. These features shall be integrated both into the Visual Panorama and the head-down display and activable on request by ATCO. It could be useful especially at the beginning when the concept is introduced as ATCOs are still getting used to it and pilots might not be used yet to	W2 RTS/Workshop	Rejected		Already addressed in HP_116

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				always identifying the airport they are calling to in any call.				
PJ05.35_HP_114 became OSED REQ-05.35-SPRINTEROP-SR01.0003	Y	Human Performance	The RTC Supervisor or similar role should be able to have a view over functional MRTM´s in case of an emergency in order to be able to transfer an airport.	Emergency situations should be known by the role responsible of the allocation of aerodromes between modules in order to be able to transfer the airport interested by the emergency	W2 RTS/Worksh op	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_116	N	Human Performance	The ATCO should be provided with a visual indication of which aerodrome an incoming radio transmission is related to. The visual indications may be customisable and switched on-off on ATCO's request	To prevent the flexible frequent allocation of aerodromes generates confusion affecting the team situation awareness with a possible increase of human error and workload	W2 RTS/Workshop	Accepted		To highlight, in the out of the window view, the frame related to the airport where pilots are transmitting.

PJ05.35_HP_12	N	Human Performance	In case of contingency and in case of emergency part of ATCOs task may be delegated to The RTC supervisor to reduce the workload for the remote tower module ATCO	E.g. like coordination tasks with external authorities in case of emergency might be delegated to the supervisor to reduce ATCo workload in case of emergency	W2 RTS/Workshop	Accepted		ENAV: In case of contingency and in case of emergency it is suggested to delegate to the supervisors all the tasks that can be reduced for the remote tower module ATCO, like coordination tasks with external authorities in case of emergency etc

PJ05.35_HP_15	N	Human Performance	A RWY automated scan tool that checks the runway is clear may support ATCOs in the RTC with flexible allocation between modules	A RWY Automated scan tool that checks the runway is clear could further enhance ATCOs' situation awareness and possibly reduce the workload	W2 RTS/Workshop	Accepted		ENAV: ARWY Automated scan tool that checks the runway is clear could further enhance ATCOs' situation awareness and possibly reduce the workload Out of the window view requirements shall be refined finally to support the deployment of the RTC with flexible allocation of airports between modules.

PJ05.35_HP_16	N	Human Performance	Visual Presentation and head down displays shall have the same layout for all the possible aerodrome configurations	To avoid confusion the displayed layout shall be consistent among possible aerodrome configurations in the head up and head down visual displays	W2 RTS/Workshop	Accepted		ATCOs should be able to move aerodromes also to the C-slot (upper right side), even if there are only two aerodromes (Indra specific recommendation). COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode.

PJ05.35_HP_18 became OSED REQ-05.35-SPRINTEROP-TM01.0009	Y	Human Performance	Pre-sets should be defined for the aerodrome radar maps in order to support the ATCO to efficiently manage flexible allocation.	Pre-sets should be defined for the aerodrome radar maps in order to support the ATCO to efficiently manage flexible allocation.	W2 RTS/Workshop	Accepted		Pre-sets should be defined for the aerodrome radar maps in order to support the ATCO to efficiently manage flexible allocation. COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode.

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_23 became OSED REQ-05.35-SPRINTEROP-SR01.0002	Y	Human Performance	The handover procedure initiation should be responsibility of the RTC supervisor role.	Supervisor should be responsible of initiating the handover 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	W2 RTS/Workshop	Accepted		The handover procedure initiation should be responsibility of the supervisor role.
PJ05.35_HP_24	N	Human Performance	A local assessment should be conducted to establish supervisor and ATCOs responsibilities in the remote tower centre with the	Local assessment is recommended to establish if part of ATCOs task of coordination with other entities can be delegated to the supervisor e.g. the	W2 RTS/Workshop	Accepted		

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Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
			flexible allocation depending on the available level of automation and the RTC size	coordination with other entities might be delegated to the supervisor rather than the ATCOs.				
PJ05.35_HP_25 became OSED REQ-05.35-SPRINTEROP-TM01.0001	Y	Human Performance	ATCO shall be able to request a transfer even if he/she is not holding the RTC supervisor role	If an ATCOs need a transfer he/she needs to be allowed to request it	W2 RTS/Workshop	Accepted		
PJ05.35_HP_26 became OSED REQ-05.35-SPRINTEROP-TM01.0010	Y	Human Performance	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.	As the ATCOs have different endorsements in order to work in the RTC, there is the need to automatically check the number of hours worked on each aerodrome in order to ensure the endorsements are maintained	W2 RTS/Workshop	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_27 became OSED REQ-05.35-SPRINTEROP-TM01.0005	Y	Human Performance	Operating procedure for the handover should foresee a period dedicated to the monitoring including frequency monitoring before the actual handover and a coordination between the ATCOs	There is the need to dedicate a time period to building-up the situational awareness before finalising the split and merge procedure	W2 RTS/Workshop	Accepted		
PJ05.35_HP_28	N	Human Performance	Handover procedure should be initiated in lower traffic period to not affect ATCOs workload and situational awareness in nominal conditions	Handover should happen in a lower traffic period, when the ATCOs have spare capacity for the handover process and to build up the situational awareness.	W2 RTS/Workshop	Accepted		
PJ05.35_HP_30	N	Human Performance	Cardinal directions on the visual panorama should be displayed	The aerodromes layout and runways geography of the different aerodromes	W2 RTS/Workshop	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				assigned to each module can have different directions even if displayed at the same way. There is the need for the ATCOs to always know where the cardinal directions are in order to avoid any misleading interpretation of the visual panorama displays				
PJ05.35_HP_32	N	Human Performance	Required information for ATCOs and SUP should be locally assessed before the deployment	High level requirements for RTC information to be provided to both ATCOs and SUP positions are defined at solution level, but they need to be locally assessed and customised based	W2 RTS/Workshop	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				on the specific environment needs				
PJ05.35_HP_33	N	Human Performance	Alerting system to drive the attention of the ATCO to a certain airport under certain conditions (e.g. aerodrome highlighted in case of communication; alerts for a pre-defined area) should be provided	Additional alerting system to catch ATCOs attention might further support ATCOs situation awareness considering they need to divide the attention to different aerodromes	W2 RTS/Workshop	Accepted		Alerting system to draw the attention of the ATCO to a certain airport under certain conditions (e.g. aerodrome highlighted in case of communication; alerts for a pre-defined area) should be provided

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_36 became OSED REQ-05.35-SPRINTEROP-CO01.0003	Y	Human Performance	Ground vehicles should be properly trained to become familiar with the fact that the ATCO is communicating also with other aerodromes including ground vehicles	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	W2 RTS/Workshop	Accepted		Ground vehicles should have their own frequency and should be trained on the fact that the ATCO is communicating also with other airports
PJ05.35_HP_4	N	Human Performance	The ATCO may be warned by the surveillance system about an aircraft or vehicle entering the runway without clearance.	It would be beneficial for the situation awareness of ATCO to have a warning for aircraft or vehicles entering the runway	W2 RTS/Workshop	Accepted		

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Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_43 became OSED REQ-05.35-SPRINTEROP-TM01.0007	Y	Human Performance	The ATCO displays shall retain the predefined ATCOs Set-up when receiving a new aerodrome for the handover	If the ATCO has customised his/her displays (e.g. radar map, Visual Presentation etc.) this should be maintained also after the handover for the aerodromes that are under control.	W2 RTS/Workshop	Accepted		The ATCO display should retain the predefined ATCOs Set-up after the switch and merge
PJ05.35_HP_47 became OSED REQ-05.35-SPRINTEROP-TR01.0002	Y	Human Performance	Additional skills may be needed: • Teamwork skills (TRM), depending on the context • SUP should have a background in control tower	Working in a RTC with flexible allocation may be very different by working in a very small airport and this might require additional skills	W2 RTS/Workshop	Accepted		
PJ05.35_HP_48	N	Human Performance	Handover procedure may be supported by the technical system in silent transfer and acceptance of the split and merge	The handover procedure may not need phone call confirmation but may be completed and confirmed via system interaction	W2 RTS/Workshop	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_53	N	Human Performance	The RTC supervisor role may be provided with a tool combining the information (aerodromes' status, meteo, forecasted traffic load and capacity) to facilitate decisions regarding how to combine aerodromes in the MRTM	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 supervisor shall be supported by a tool providing the required information in order to establish the aerodrome allocation	W2 RTS/Workshop	Accepted		
PJ05.35_HP_6 became OSED REQ-05.35-SPRINTEROP-CO01.0001	Y	Human Performance	The airport name should be integrated in the phraseology in	Airport name is to be used in the communication exchange to	W2 RTS/Workshop	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
			order to increase the situational	enhance situational awareness				
PJ05.35_HP_9 became REQ-05.35-SPRINTEROP-TM01.0003	Y	Human Performance	Timing of the handover procedure should be coordinated between SUP and ATCOs as it's ATCO responsibility to manage the handover	It should be the ATCOs' responsibility to manage the handover between themselves, thus the timing of the split should be coordinated between SUP and ATCOs.	W2 RTS/Workshop	Accepted		It should be the ATCOs' responsibility to manage the handover between themselves, thus the timing of the split should be coordinated between SUP and ATCOs.
REQ.05.03_HPops_4	N	Operational	There needs to be a local assessment to determine the number of endorsements an	To ensure rostering is acceptable and feasible for the control of multiple aerodromes (take	Previous wave - Activities	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
			ATCO working in an MRTM can have, taking into account the split/ merge and transfer possibilities.	into account the possibility of split and merge)				
~~REQ.05.03_HPval_02~~	~~N~~	~~Validation~~	~~Assess Supervisor workload in scenarios addressing the transfer/ assuming of aerodromes.~~	~~The workload of the supervisor has to be further evaluated.~~	~~Previous wave - Activities~~	~~Rejected~~	~~Assessed in Wave 2~~	-
~~REQ.05.03_HPval_03~~	~~N~~	~~Validation~~	~~Assess Supervisor acceptance of operating methods in scenarios addressing transferring of aerodromes.~~	~~The acceptance of operating methods shall be further evaluated.~~	~~Previous wave - Activities~~	~~Rejected~~	~~Assessed in Wave 2~~	-
REQ-05.02-SPRINTEROP-CO01.0005	Y	Operational, Safety	The RTC should host a locally determined number of MRTMs to be able to split aerodromes.	Splitting of aerodromes to separate MRTMs as a backup procedure allows safe provision of ATS in case that traffic or	Previous wave - Activities	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				other factors increase workload to an amount that does not allow provision of ATS to multiple aerodromes. Assessments at local level, based on complexity/volumes of traffic, simultaneity of movements, etc. should be done to confirm the appropriate number of modules to be considered in a RTC.				

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Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
REQ-05.03-SPRINTEROP-AF01.0002	Y	design	The ATCO may be supported in monitoring conformance to clearances on ground	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. 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:	Previous wave - Activities	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				REC.05.00_HPdesign13: The indication could be either in the panorama and/or 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). The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-36, SR-37. Initially addressed in SESAR1 REQ-06.09.03-OSED-FN03.3006 & REQ-06.09.03-OSED-FN03.3007.				

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
REQ-05.03-SPRINTEROP-AF01.0003	Y	Operational	The ATCO may be supported in monitoring conformance to clearances for airborne movements	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.	Previous wave - Activities	Accepted		
REQ-05.03-SPRINTEROP-AF01.0004	Y	Operational	The ATCO may be supported by the system, indicating situations when contradictive (incompatible) clearances are delivered.	Conflicting clearance alerts for controllers (CATC) can support the ATCO to be warned if contradictive (incompatible) clearances are given.	Previous wave - Activities	Accepted		

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Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
REQ-05.03-SPRINTEROP-AF01.0005	Y	Human Performance	The ATCO may be supported by the system indicating when clearances can be given.	Situation awareness may be increased and potential conflicting situations may be avoided if the system indicated when clearances can be given. This helps if the ATCO is focussing on one aerodrome while a clearance can be given at another aerodrome.	Previous wave - Activities	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
REQ-05.03-SPRINTEROP-AP01.0002	Y	Human Performance	The ATCO should be supported in prioritising tasks (e.g. providing landing clearance or taxi clearance) and forecast the traffic demand from a support tool in the tactical short term.	A task prioritisation tool can support ATCO in Human Performance working in a complex Multiple Remote Tower environment.	Previous wave - Proposed rewording to be discussed	Accepted		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.
REQ-05.03-SPRINTEROP-SP02.0004	Y	Design	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	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	Previous wave - Activities	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
			e.g. navigational aids, lights, emergency alerting functions, for all involved aerodromes part of the RTC	allocated to. The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-27. Initially addressed in SESAR1 <<partly>> REQ-06.09.03-OSED-SUP3.0012				
REQ-05.03-SPRINTEROP-SP03.0002	Y	Human Performance	The RTC Supervisor should be provided with the forecasted demand for all involved aerodromes part of the RTC.	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. The following safety requirement(s) of	Previous wave - Activities	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				[SAR] comply with this OSED requirement: SR-27. Initially addressed in SESAR1 REQ-06.09.03-OSED-SUP3.0010				
REQ-05.03-SPRINTEROP-TM03.0002	Y	Design	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.	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.	Previous wave - Activities	Accepted		

Table 18: HP recommendations

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Appendix C – HP Requirements Register

This section includes the final requirements identified to mitigate the issues and benefits identified for the solution. These requirements have been identified considering the results of the conducted HP related activities. Most of them are then moved to the Part I SPR-INTEROP/OSED. Requirements that are left only in the HPAR are intended to drive the further assessment needed at human performance level during a local deployment for a RTC with flexible allocation of aerodromes between MRTMs, this as support when performing the mandatory Safety Assessment according to 373 regulation with support of EASA guidance Material for Remote Towers.

Requirements validated at V3 level in previous phase have not been included in this HPAR, but for traceability reasons they can be found in the HP-Log.

The following Requirements scope is related to “Ground” and are relevant to Pj05.35 concept:

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
REQ-05.03-SPRINTEROP-TM03.0007	Y	Design	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.	The validation activities- up to date have not included the supervisor position. The V3 validation activities shall clarify the roles and responsibilities and corresponding tasks for the supervisor position,	Previous wave	Accepted		

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Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				in normal, abnormal and degraded modes of operations.				
REQ-05.03-SPRINTEROP-TM02.0005	Y	<Operational>,<Safety>, <Human Performance>	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.	To ensure all actors involved are aware of their responsibilities and associated tasks. This REQ originates from [HPAR] REQ.05.00_HPtraining_32. The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-20.	Previous wave	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
REQ-05.03-SPRINTEROP-TM02.0004	Y	operational	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.	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. The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-20.	Workshop/ SESAR I	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				Initially addressed in SESAR1 REQ-06.09.03-OSED-RTC3.0007				
REQ-05.03-SPRINTEROP-TA01.0001	Y	Operational, Safety	When Tower and Approach services are combined within the same MRTM, the tools for each service shall be easily available.	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. It is also important that the ATCO can keep track of traffic	Previous wave	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				on the aerodrome(s) and in the APP area simultaneously.				
REQ-05.03-SPRINTEROP-SP02.0003	Y	Design	The RTC Supervisor role shall be able to access functions for the monitoring of weather conditions for all aerodromes.	The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-29. Initially addressed in SESAR1 REQ-06.09.03-OSED-SUP3.0013	Workshop/ SESAR I	Accepted		
REQ-05.03-SPRINTEROP-SP01.0001	Y	Design	The RTC Supervisor role shall access functions for communicating the status of RTC and aerodromes and coordinating maintenance (to	Initially addressed in SESAR1 REQ-06.09.03-OSED-SUP3.0014	Workshop/ SESAR I	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
			be carried out by a qualified engineer/technician).					
REQ-05.03-SPRINTEROP-TM03.0003	Y	<Operational>,<Safety>	The RTC Supervisor shall be provided with information to facilitate decisions regarding how to combine aerodromes in the MRTM.	RTC supervisor need an overview over capacity and demand at the connected aerodromes in order to find a suitable balance for the ATCOs in the different MRTMs. Considerations shall be done regarding e.g. traffic levels, traffic complexity, airport layout, geographical difference, daylight conditions, weather conditions, work in progress on the	Previous wave	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				airport, etc. The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-27.				
~~REQ.05.03_HPval_08~~	~~N~~	~~Validation~~	~~Future validation activities shall address the level of trust in the operations and the associated system of the SUP~~	~~The trust of the SUP shall be assess in validation activities~~	~~Previous wave~~	~~Rejected~~	~~Assessed in W2~~	-
~~REQ.05.03_HPval_07~~	~~N~~	~~Validation~~	~~Future validation activities shall the SUP`s level of situation awareness~~	~~The SA of the SUP shall be assess in validation activities~~	~~Previous wave~~	~~Rejected~~	~~Assessed in W2~~	-

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Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
~~REQ.05.03_HPval_07~~	~~N~~	~~Human Performance~~	~~Future validation activities shall the SUP`s level of situation awareness~~	~~Future validation activities shall the SUP`s level of situation awareness~~	~~Previous wave~~	~~Rejected~~	~~Assessed in W2~~	~~PJ05.35 part of validation exercises included RTC supervisor role~~
~~REQ.05.03_HPval_06~~	~~N~~	~~Validation~~	~~Future validation activities shall assess the timeliness of executing tasks for the supervisor position.~~	~~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.~~ ~~The following safety requirement(s) of [SAR] comply with this OSED~~	~~Workshop/ SESAR I~~	~~Rejected~~	~~Assessed in W2~~	~~-~~

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				~~requirement: SR-06. 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.~~				
~~REQ.05.03_HPval_06~~	~~N~~	~~Human Performance~~	~~Future validation activities shall assess the timeliness of executing tasks for the supervisor position.~~	~~Future validation activities shall assess the timeliness of executing tasks for the supervisor position.~~	~~Previous wave~~	~~Rejected~~	~~Assessed in W2~~	~~PJ05.35 part of validation exercises included RTC supervisor role~~
~~REQ.05.03_HPval_05~~	~~N~~	~~Validation~~	~~Future validation activities shall identify system possibilities on the SUP HMI to~~	~~System possibilities for the SUP position shall be investigated.~~	~~Previous wave~~	~~Rejected~~	~~Assessed in W2~~	~~-~~

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
			~~indicate geographical characteristics and indication of different airports.~~					
~~REQ.05.03_HPval_05~~	~~N~~	~~Human Performance~~	~~Future validation activities shall identify system possibilities on the SUP HMI to indicate geographical characteristics and indication of different airports.~~	~~Future validation activities shall identify system possibilities on the SUP HMI to indicate geographical characteristics and indication of different airports.~~	~~Previous wave~~	~~Rejected~~	~~Assessed in W2~~	~~PJ05.35 part of validation exercises included RTC supervisor role~~
~~REQ.05.03_HPval_05~~	~~N~~	~~Human Performance~~	~~Future validation activities shall identify system possibilities on the SUP HMI to indicate geographical characteristics and indication of different airports.~~	~~Future validation activities shall identify system possibilities on the SUP HMI to indicate geographical characteristics and indication of different airports.~~	~~Previous wave~~	~~Rejected~~	~~Assessed in W2~~	~~PJ05.35 part of validation exercises included RTC supervisor role~~

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
REQ.05.03_HPval_04	N	Validation	Supervisor operating methods for frequently occurring abnormal conditions and emergency situations shall be defined.	The supervisor related operating methods shall be defined.	Previous wave	Accepted		
~~REQ.05.03_HPval_01~~	~~N~~	~~Human Performance~~	~~Future validation activities shall involve the Supervisor position~~	~~Future validation activities shall involve the Supervisor position~~	~~Previous wave~~	~~Rejected~~	~~Assessed in W2~~	~~PJ05.35 part of validation exercises included RTC supervisor role~~
~~REQ.05.03_HPval_01~~	~~N~~	~~Human Performance~~	~~Future validation activities shall involve the Supervisor position~~	~~Future validation activities shall involve the Supervisor position~~	~~Previous wave~~	~~Rejected~~	~~Assessed in W2~~	~~PJ05.35 part of validation exercises included RTC~~

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
								~~supervisor role~~
~~REQ.05.03_HPval_01~~	~~N~~	~~Validation~~	~~Future validation activities shall involve The RTC supervisor position~~	~~The validation activities up to date have not included the supervisor position. The V3 validation activities shall clarify the roles and responsibilities and corresponding tasks for the supervisor position, in normal, abnormal and degraded modes of operations.~~	~~Previous wave~~	~~Rejected~~	~~Assessed in W2~~	~~Future validation activities shall involve the Supervisor position~~

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Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_8	N	Human Performance	Checklist for the handover shall be defined	The transfer procedure shall be defined locally and a checklist is needed to support the handover phase and to conclude the split and merge	Workshop W2	Accepted		
PJ05.35_HP_7	Y	Human Performance	When an aerodrome is opened in an MRTM the video system shall automatically display it without the need for additional ATCOs manual actions	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.	Workshop W2	Accepted		

PJ05.35_HP_51	N	Human Performance	Meteo information shall be integrated and displayed in the scan path of the ATCOs and shall be automatically handed over according to the established module configuration after split and merge procedures.	The MET window shall be linked to the EFS bay i.e. it should move together with the EFS and radar map during an aerodrome change.	W2 RTS/Workshop	Accepted		The ATCO display should allow a flexible allocation of the position of the transferred aerodromes or The system behaviour should be user friendly during an aerodrome switch (i.e. between and within MRTM). The MET window should be linked to the EFS bay i.e. it should

								move together with the EFS and radar map during an aerodrome change.

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_5	N	Human Performance	Supervisor planning tool HMI and ATCO's module HMI shall be locally assessed before the deployment of the RTC with flexible allocation of airports between modules.	High level requirements for RTC HMI for both ATCOs and SUP positions are defined at solution level, but they need to be locally assessed and customised based on the specific environment needs	RTS/ Workshop V3	Accepted		
PJ05.35_HP_49	N	Human Performance	The visual panorama and the ATCO head-down display shall allow a user-friendly flexible allocation of the position of the transferred aerodromes established by ATCOs	Position of displayed airports in the Visual Panorama and in the CWP head down displays shall be flexible, established by ATCO. The flexible positioning shall be user-friendly e.g. avoiding complex interactions to	W2 RTS/Workshop	Accepted		The ATCO display should allow a flexible allocation of the position of the transferred aerodromes

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
				positioning a specific aerodrome in the desired position; automatic resize according to the available screen.				
PJ05.35_HP_44 became OSED REQ-05.35-SPRINTEROP-TM01.0011	Y	Human Performance	Fatigue tends to accumulate toward the end of the shift and shall be locally assessed before the deployment to establish proper shift length	Local assessment of fatigue is required to establish the shift length	W2 RTS/Workshop	Accepted		Fatigue tends to accumulate and toward the end of the shift and shall be locally assessed before the deployment

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_42	N	Human Performance	The HMI of the RTC technical system shall be locally assessed and designed in relation to the specific operational environment, depending on the size and type of the RTC	High level requirements for RTC HMI for both ATCOs and SUP positions are defined at solution level, but they need to be locally assessed and customised based on the specific environment needs	RTS/ Workshop V3	Accepted		The HMI of the RTC technical system shall be locally assessed and designed in relation to the specific operational environment, depending on the size and type of the RTC.
PJ05.35_HP_41	N	Human Performance	Supervisor tool HMI shall display the status of the MRTM and the traffic load expected at each single aerodrome	The supervisor is responsible of the allocation of the aerodromes between the modules. The allocation shall be	RTS/ Workshop V3	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
			under his/her supervision to properly establish the flexible allocation of aerodromes to the available RTC Modules	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				
PJ05.35_HP_40	N	Human Performance	The receiving ATCO shall be responsible to finalise the transfer of control and complete the handover procedure	While Supervisor and ATCO can initiate the handover procedure, it's ATCO responsibility to establish when completing the Handover procedure and finalise the split and merge	W2 RTS/Workshop	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_39 became OSED REQ-05.35-SPRINTEROP-TM01.0004	Y	Human Performance	Handover Operational procedures and check lists for nominal conditions, abnormal and degraded mode shall be locally established to support the RTC.	Handover Operational procedures and check lists for nominal conditions, abnormal and degraded mode shall be locally established to support the RTC.	W2 RTS/Workshop	Accepted		
PJ05.35_HP_38	N	Human Performance	The RTC supervisor role shall monitor the RTC aerodromes conditions and traffic load to establish the aerodromes allocation to the RTC modules	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.)	W2 RTS/Workshop	Accepted		The supervisor shall monitor the RTC traffic load to establish the aerodromes allocation to the RTC modules

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_37	N	Human Performance	Capacity of MRTM shall be locally assessed as it depends on the complexity of the aerodromes in the RTC	Number of aerodromes that can be assigned to each module shall be locally assessed as it depends on the complexity and size of airports. Number of endorsements for each ATCO is also affecting the number of aerodromes that can be allocated to each module	W2 RTS/Workshop	Accepted		
PJ05.35_HP_35 became OSED REQ-05.35-SPRINTEROP-AL01.0002	Y	Human Performance	If any Safety net is available in current tower environment (e.g. conflicting clearances alerts etc.) it shall be available in the RTC.	Safety net already in place in standard tower and in single remote tower environment are a pre-requisite of the RTC.	W2 RTS/Workshop	Accepted		

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_34	N	Human Performance	ATCO shall be provided with accurate and reliable traffic and planning information through the ATCO Planning tool.	Further development of the ATCO planning tool with focus on reliability and accuracy is needed.	W2 RTS/Workshop	Accepted		ATCO Planning too shall provide accurate and reliable traffic forecast

PJ05.35_HP_3 became OSED REQ-05.35-SPRINTEROP-TM01.0006	Y	Human Performance	When a handover is completed and accepted all systems and information that belongs to the same aerodrome shall be accepted in a single action.	he video system shall follow the ATM system's split and merge state, and the unnecessary aerodrome should not be displayed in the video system's menu.	Previous wave	Accepted		The video system shall follow the ATM system's split and merge state, and the unnecessary aerodrome should not be displayed in the video system's menu. Also, 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.

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Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_29	N	Human Performance	When a handover is initiated or performed all systems and information that belongs to the same aerodrome shall be transferred in a synchronized way.	The ATCOs HMI shall allow automatic transfer of all the displays and information during the split and merge	RTS/ Workshop V3	Accepted		The ATCO HMI shall automatically fit all the information in the display during the handover of the airports between the modules

PJ05.35_HP_22	N	Human Performance	ATCOs shall be trained in order to achieve familiarity with the RTC systems and operational environment	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 is also seen as a requirement in order to safely operate multiple aerodromes.	W2 RTS/Workshop	Accepted		COOPANS: An understanding and familiarity of the system as well as knowledge about the different aerodromes such as geography gates, stands etc. was seen by ATCOs as important skills and knowledge in order to be able to operate multiple aerodromes simultaneously.

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_21	N	Human Performance	Number of aerodromes in the RTC and allocated to each supervisor shall be locally assessed as it depends on the complexity of the aerodromes	Number of aerodromes in the RTC and allocated to each supervisor is dependent on the complexity and size of the operating environment and it needs to be assessed locally	W2 RTS/Workshop	Accepted		
PJ05.35_HP_20 became OSED REQ-05.35-SPRINTEROP-CO01.0002	Y	Human Performance	The overlapping of air-ground communication shall be minimized for the ATCO.	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.	W2 RTS/Workshop	Accepted		The overlapping of air-ground communication shall be minimized for the ATCO.

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_2	N	Human Performance	The RTC supervisor role shall be provided with ATCOs availability and their valid endorsements	RTC Supervisor need an overview of ATCO availability and their endorsements at the aerodromes connected to the RTC to enable the allocation of ATCOs. The following safety requirement(s) of [SAR] comply with this OSED requirement: SR-27.	W2 RTS/Workshop	Accepted		The RTC Supervisor role shall be provided with ATCO availability and their valid endorsements

PJ05.35_HP_19 became OSED REQ-05.35-SPRINTEROP-SP01.0001	Y	Human Performance	Supervisor planning tool shall use up-to-date and real time data to proper support the short term workload assessment.	Supervisor planning tool shall use up-to-date and real time data to proper support the short term workload assessment.	W2 RTS/Workshop	Accepted		ENAV: Supervisor planning tool shall use up-to-date and real time data to proper support the short term workload assessment. Supervisor planning tool HMI and ATCO's module HMI shall be reviewed for the deployment of the RTC with flexible allocation of airports

								between modules.

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Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_17	N	Human Performance	Visual Presentation requirements shall be locally refined to support the deployment of the RTC with flexible allocation of airports between modules.	Size, type and quantity of information to be displayed in the MRTM shall be locally defined as it depends on the complexity and size of the local environment	W2 RTS/Workshop	Accepted		ENAV: Out of the window view requirements shall be refined finally to support the deployment of the RTC with flexible allocation of airports between modules.

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Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_14 became OSED REQ-05.35-SPRINTEROP-SR01.0001	Y	Human Performance	Supervisor role shall assess and balance the workload between the modules	There is the need to always properly balance the workload in order to minimise the impact on situation awareness	W2 RTS/Workshop	Accepted		ENAV: there is the need to always properly balance the workload in order to minimise the impact on situation awareness

PJ05.35_HP_13 became OSED REQ-05.35-SPRINTEROP-TM01.0008	Y	Human Performance	Visual Presentation and head down displays shall have the same layout for all the possible aerodrome configurations	To avoid confusion the displayed layout shall be consistent among possible aerodrome configurations in the head up and head down visual displays	W2 RTS/Workshop	Accepted		COOPANS: Having same layout on the WACOM screen for e-strips for single, double and triple aerodrome mode. ENAV: Emergency button HMI in the ATCO module CWP shall be reviewed for the deployment of the RTC with flexible allocation of airports

								between modules.

Reference	Included in the OSED Y/N	Type of requirement	Consolidated Requirement description/Rewording or New Requirement	Rationale	Assessment source + Reference report	Requirement status	Rationale in case of rejection	Comments
PJ05.35_HP_113	Y	Human Performance	ATCOs and SUP tools shall use actual traffic	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	W2 RTS/Workshop	Accepted		

Table 19: HP Requirements

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Appendix D – HP Log

All the HP-Log information have been included in the word document. For traceability purposes HP-Log is also included.

W2_PJ05_35_HP_Log_v_Final.xlsx

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