RMT.0624 – Objectives, Set-up, Deliverables & Rulemaking Group

NPA 2017-21 Consultation workshop

Cologne 19 March 2018

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RMT.0624 – Objectives

➤ EASA Rulemaking Task initiated 2014 to address:

  ➤ SESAR developments

  ➤ Expectations on EASA from the ATM community.

  ➤ Support implementation initiatives within Europe (and worldwide)

  ➤ Support technological development and a cost-efficient and proportionate ATS

  ➤ Facilitate harmonised implementation

  ➤ Provide a level playing field

  ➤ Support and recognise the standardisation activities of EUROCAE.

RMT.0624 – Objectives

➤ Overall objectives as stated in the Terms of Reference:

   ➤ *'Develop necessary guidance and possibly means of compliance to ensure that the applicable EU and ICAO requirements are met and to ensure, at least, a maintained level of safety.'*

   ➤ *'The implementation of the concept would be based on the premise of a change in the ATM functional system'*

RMT.0624 – Set-up & deliverables

➤ **Phase 1, 2014-2015**

- ➤ Scope limited to 'single mode of operation low density aerodromes'
- ➤ **Completed summer 2015** via the publication of:
  - ⟫ **EDD 2015/014/R**: 'GM on the implementation of the RT concept for single mode of operation'
  - ⟫ **EDD 2015/015/R**: AMC & GM to Reg. (EU) 2015/340
    'Requirements on ATCO Licensing regarding remote tower operations'
    (EDD = EASA Executive Director Decision, GM = Guidance Material, AMC = Acceptable Means of Compliance)
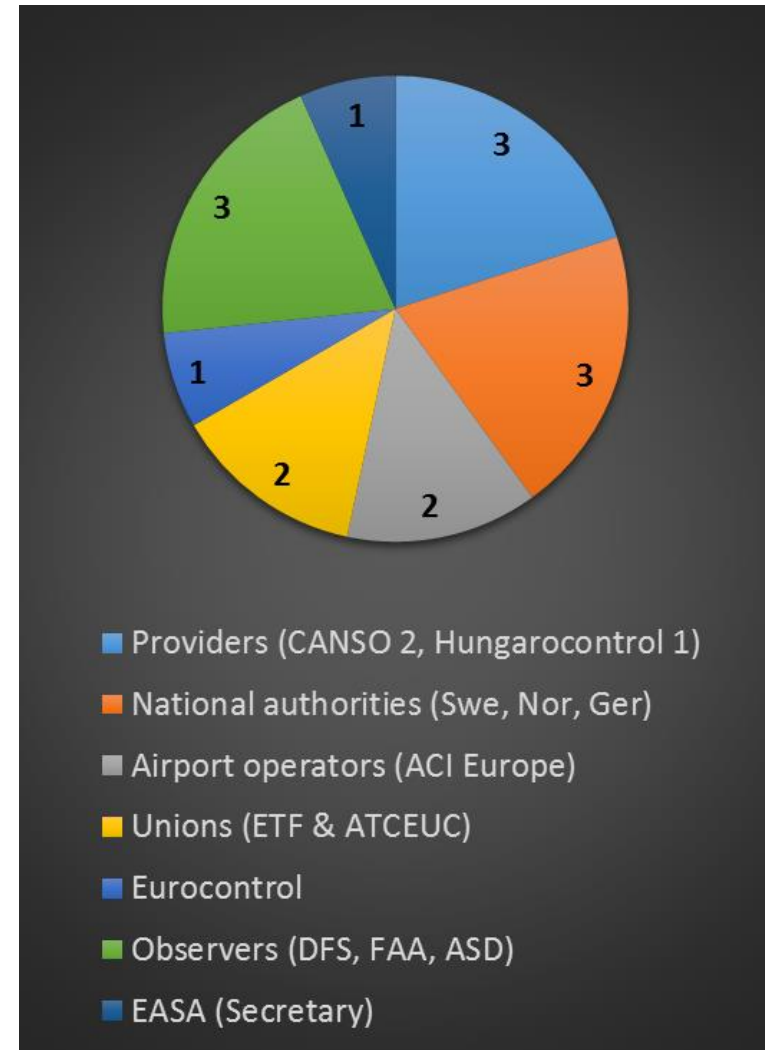
➤ **Phase 2, 2016-2018**

- ➤ RMT.0624 re-launched summer 2016, under the existing Terms of Reference (ToR).
- ➤ Extended scope to expand into more complex mode of operations, taking into account
  - ⟫ the latest results stemming from SESAR,
  - ⟫ other available research/validation activities,
  - ⟫ as well as operational experiences.
- ➤ Consider adoption of industry standards (EUROCAE ED-240, ED-240A when available).
- ➤ New Notice of Proposed Amendments (**NPA**) was **published** for consultation: **20 Dec 2017**
- ➤ End public consultation / last day for comments: **3 April 2018**
- ➤ Expected publication of the expanded EASA material/revised ED Decisions: **Summer 2018**

RMT.0624 – Rulemaking Group

➤ This RMT has been supported by a RMG

➤ 15 members (12 full members + 3 observers)

➤ Chairman phase 2: *Peter Nowiszewski, BAF*

➤ Representation from a broad variety of stakeholders from around Europe + 1 from US:

  ➤ ATS providers
  ➤ National Supervisory Authorities (NSAs)
  ➤ Airport operators (ACI Europe represented by Avinor & Munich airport)
  ➤ Trade Unions
  ➤ The industry, via ASD* *(added for phase 2)*
  ➤ Eurocontrol
  ➤ FAA

  * *AeroSpace and Defence Industries Association of Europe*

■ Providers (CANSO 2, Hungarocontrol 1)
■ National authorities (Swe, Nor, Ger)
■ Airport operators (ACI Europe)
■ Unions (ETF & ATCEUC)
■ Eurocontrol
■ Observers (DFS, FAA, ASD)
■ EASA (Secretary)

RMT.0624 – Work of the RMG in phase 2

➤ The group have held in total 9 face to face RMG meetings, between July 2016 and September 2017.

➤ The NPA represents the outcome of the work and the consensus of the RMG (except the 2 diverging opinions of the ETF and ATCEUC members).

End slide.

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NPA 2017-21 structure & regulatory approach/framework

NPA 2017-21 Consultation workshop

Cologne 19 March 2018

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Approach & NPA contents

➤ **NPA 2017-21 consists of the following main parts:**

➤ "Explanatory Note" *(NPA chapters 1, 2, 4)*

The regulatory proposals *(NPA chapter 3)*

➤ Proposed 'Guidelines on Remote Aerodrome Air Traffic Services (ATS)' *(3.1)*
- ⟩ Will replace the existing EASA GM on Single Remote Tower.
- ⟩ Extended in scope, covering also more complex mode of operations (e.g. 'multiple mode of operation' and "contingency solutions") and the use of new technical enablers.
- ⟩ It is also enhanced/improved, taking into consideration gained operational experiences and new R&D results stemming mainly from SESAR.

➤ Proposed AMC & GM to the ATCO training and licensing Regulation *(3.2)*
- ⟩ This new set of AMC & GM will replace the existing corresponding AMC & GM.
- ⟩ Refined as well as extended in scope.

(AMC = Acceptable Means of Compliance, GM = Guidance Material)

Scope of the NPA / regulatory proposals

➤ Generic guidelines (not limited to specific operational applications) (Q)

➤ Main target audience;
  ➤ ATS providers / aerodrome operators,
  ➤ NSAs/competent authorities,
  ➤ *(Also a foreseen interest to the manufacturing industry.)*

➤ Addressing operational, procedural and technological aspects of remote aerodrome ATS, in order to help;
  ➤ ensure safe operations,
  ➤ ensure that the ATS objectives are fulfilled,
  ➤ facilitate and harmonise implementation & provide a level playing field.

➤ Social and economic aspects are <u>not</u> in the scope.
  ➤ These aspects are hugely depending on the individual case of implementation and need to be addressed at a local level.

Structure of Guideline document

1. General document introduction
2. Definitions
3. Introduction to remote aerodrome ATS
   1. Concept overview
   2. Single mode of operation
   3. Multiple mode of operation
   4. Remote Tower Centre (RTC)
   5. Technical enablers for remote aerodrome ATS
4. Operational context/applications and related recommendations
5. Operational and system considerations
6. Management of change
   1. Safety assessment
   2. Human Factors assessment
   3. Transition/Implementation plan
   4. Information and cyber security assessment
   5. Contingency planning
   6. Remote tower system constituents
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8. Possible impact on airspace users
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Related rulemaking/standardisation activities

➤ **ICAO State Letter 2017/23**

  ➤ Proposed amendments to Doc 4444(PANS-ATM) to fully enable remote aerodrome ATS.

  ➤ A new definition for 'visual surveillance/presentation system'

  ➤ A new chapter 7.1.1.2.1 stating that visual observation can be achieved through:
    » direct out-of-the-window observation, OR
    » through indirect observation utilizing a visual surveillance system.

  ➤ A new "Note" referring to the EASA guidelines, thereby giving it global status.

  ➤ Envisaged applicability date for the new edition of Doc 4444: 8 November 2018.

Related rulemaking/standardisation activities

- **EUROCAE**

  - WG-100 "Remote and Virtual Towers"

  - ED-240 published September 2016:
    - First 'Minimum Aviation System Performance Specification (MASPS) for Remote Tower Optical Systems'
    - Specifying the end-to-end performance of the optical system
    - Did/do not consider augmentation functions or sensors.

  - Continued work ongoing to include "visual tracking technologies".
    - Extended MASPS, ED-240A, expected 2nd half 2018.

  - To be followed by a further extension to include also information from non-optical sensors, e.g. "radar tracking".
    - ED-240B, anticipated 2020

Reasoning for the regulatory approach

➤ Why producing guidelines/GM/AMC instead of hard law?

➤ Need to go to **performance-based regulatory environment**, in particular when addressing a very fast evolving technology. The tendency is to rely on industry standards and soft law for supporting and enabling safe implementation of new technology.

➤ There shall **not be a change in the service provision** neither in the requirements for assessment of change to functional systems by ATS service providers, therefore the high level regulations are not impacted.

➤ Easier, more useful for the ATSP and their CA to have a **single source of information** encompassing all the aspects together, rather than specific AMC or GM to higher level regulations, which would make the overall application more complex.

➤ As technical solutions and implementations are so different, there are no common elements for a common rating endorsement in the ATCO licensing, therefore the unit endorsements can sufficiently cover the training of ATCOs

End slide.

Proposed guidelines – chapters 1-4

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Guidelines document structure

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Definitions

➤ Changes compared to the existing GM:

➤ 7 new definitions, mainly due to the extended scope.

➤ 5 definitions changed/simplified

➤ 5 definitions unchanged (only editorial changes for some)

➤ (1 definition removed, superfluous in the new doc)

Definitions

- **'Remote aerodrome ATS'**– provision of aerodrome ATS based on a view of the aerodrome and its vicinity through the means of a visual presentation system. *(New definition compared to existing GM)*

- **'Visual presentation system'** means of a number of integrated elements, normally consisting of optical sensor(s), data transmission links, data processing systems and situation displays. *(New)*

- **'Conventional tower'** – a facility at an aerodrome from which ATS can be provided to aerodrome traffic mainly through direct visual observation of the area of responsibility. *(Same)*

- **'Remote tower'** – a facility from which aerodrome ATS can be provided to aerodrome traffic through real-time visual presentation of the elements contained in its area of responsibility. *(Same)*

  - *A 'remote tower' can be located at the aerodrome or away from the aerodrome.*

Definitions

High-level example overview graphic
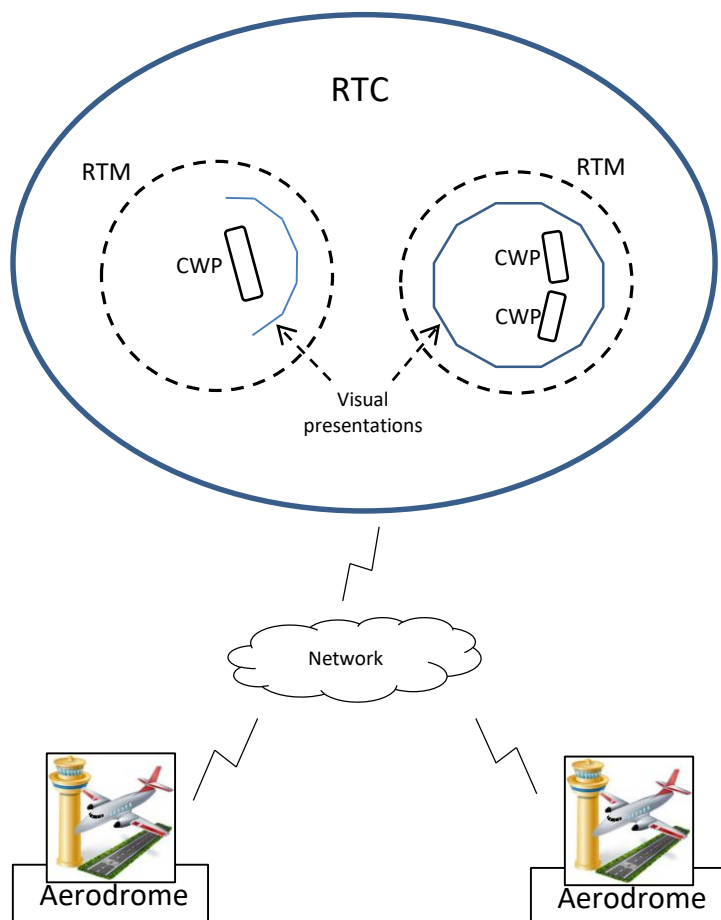
▶ **'Controller working position'** – the ATCO/AFISO workstation. *(New)*

▶ **'Visual presentation'** – a view of the areas of responsibility of the aerodrome ATS unit, provided by a visual display. *(Simplified)*

▶ **'Remote tower module'** – the combination of one or more CWPs and the visual presentation. *(Changed)*

▶ **'Remote tower centre'** – a facility housing one or more RTM(s). *(Simplified)*

➤ **'Single mode of operation'** – provision of ATS from one remote tower module for one aerodrome at a time. *(same, editorial changes only)*

➤ **'Multiple mode of operation'** – provision of ATS from one remote tower module for two or more aerodromes at the same time (i.e. simultaneously). *(New)*

Definitions *(all new)*

- **'Detect'** – to visually be able to see that there is something.

- **'Recognise'** – to visually be able to determine the class/category/type of an object.

- **'Identify'** – the ability to couple a detected or recognised object with a specific individual aircraft/vehicle.

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➤ To provide a general overview of the concept of remote aerodrome ATS

- Provision of ATS to one aerodrome from one RTM (at a time); on a permanent basis or in alternation with a conventional tower

- Provision of ATS during planned or unplanned contingency situations, as a dedicated backup solution for a conventional tower

- The provision of ATS to distant areas of an aerodrome from which the view from an existing aerodrome tower is inadequate or non-existent, by implementing remote tower system elements into the existing aerodrome tower. (This could therefore be in lieu of building a second aerodrome tower.)

➤ Provision of ATS to more than one aerodrome simultaneously from one RTM.

➤ Provision of ATS to a remote aerodrome from a conventional tower, in combination with the (simultaneous) provision of ATS to the local aerodrome.

➤ The simultaneous provision of service to a specific area or a specific function for more than one aerodrome, e.g. a clearance delivery position for more than one aerodrome.

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- To describe the operational context and applications that have been validated or introduced into operation to date

- To provide related recommendations

Single mode of operation

- Envisaged to have the potential to be implemented for aerodromes of all sizes.

- Three 'SESAR solutions' published by SJU to date.

- Three operational approvals to date

- Some factors to consider:
  - Traffic density and complexity
  - Aerodrome layout
  - Local weather characteristics

- All will drive the requirements on the visual presentation (system) + binocular functionality

➤ Remote tower as a backup facility:

- ➤ In case the conventional tower is "out of service"

➤ Recommended to define/assess:

- ➤ Level of HMI commonality vs. the ordinary tower

- ➤ The use of new technical enablers..

- ➤ Split of infrastructure (robustness)

- ➤ Requirements on <u>capacity</u>, <u>duration of service</u> & <u>switchover time</u>

➤ **Multiple mode of operation:**

➤ EASA acknowledge that the concept is less mature then 'single mode of operation'.

➤ No operational implementation/approval to date.

➤ One 'SESAR solution' published by SJU to date.

➤ The aim is to provide the best guidance possible for implementation initiatives, based on existing available information and data.

➤ Overarching recommendation:

➤ To be used only when the operational circumstances allows.

➤ It is the responsibility of the ATS provider to define the suitable operational circumstances as well as to provide sufficient evidence for an acceptable level of safety.

➤ **Further recommendations:**

➤ Number and appropriate combination of aerodromes in multiple mode of operation to be carefully assessed, based on factors such as;

  ≫ traffic levels and how the traffic schedule at each aerodrome intersects with the others,
  ≫ meteorological conditions at the aerodromes,
  ≫ geographical locations, runway orientations, etc,
  ≫ technical configuration, support functions, etc.

➤ Validation results reveal that the total traffic level and complexity may have a greater impact on ATCO/AFISO workload than the number of aerodromes combined.

➤ To be used mainly when certainty exists that the instances of simultaneous aircraft movements on the different aerodromes is minimal.

➤ Recommended to only combine the same type of service provision, e.g. ATC+ATC or AFIS+AFIS

➤ Recommended to implement 'multiple' only as part of an extension to an already existing single mode of operation implementation, to first gain operational experiences.

➤ **Recommended limitations and mitigation measures:**

➤ The ATS provider should establish procedures to manage capacity peaks or high ATCO/AFISO workload for any other reason. (E.g., when and how to open an additional position in the RTM, or when and how to split aerodromes into separate RTMs.)

➤ All mechanisms implemented should be validated, approved by the competent authority and documented in the operations manual.

➤ Specifically, the ATS provider should put in place procedures and contingency plans clearly defining how to deal with unexpected events, such as an emergency situation, affecting the ATCO/AFISO's capability to continue to provide ATS to all aerodromes under responsibility.

➤ Such procedures and situations should be adequately and recurrently trained.

➤ Such procedures may stipulate that the ATCO/AFISO could perform one of the actions:
  » temporarily delay or stop traffic at the other aerodrome(s);
  » isolate the abnormal/emergency situation on a RTM dealing with only this issue;
  » request another ATCO/AFISO to support her/him, in order to be able to continue the provision of ATS for all aerodromes under responsibility of the same RTM.

Communication aspects in 'multiple' (detailed in chapter 5.14):

➤ Aerodrome mobile service (air–ground communications)

   ➤ Based on existing validation data, preferred method seems to be cross-coupling of frequencies across aerodromes

   ➤ Recommendation to include aerodrome/ATS unit call sign for all transmissions, especially in the case of RWY with same designators.

➤ Surface movement control service (communications for the control of vehicles)

   ➤ Based on existing validation data, preference to keep frequencies across aerodromes separate.

   ➤ Recommended to introduce different call sign/number series for the vehicles at the respective aerodrome.

End slide.

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AMC & GM related to the qualification and training of ATCOs

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ATCO training & licensing AMC & GM

- **AMC**
  - clarifying the use of unit endorsements in case of remote aerodrome ATS

- **GM**
  - clarifying the use of separate unit endorsements in case service is provided alternately from conventional/remote TWR
  - on unit training plan
  - proposing a set of items to be addressed during unit endorsement courses
  - on additional training items in case of multiple mode of ops
  - on refresher training
  - on conversion training (including conversion single -> multiple)

1. Terminology/wordings updated for clarity and to be in line with the remote aerodrome ATS guidelines

I'm using technical enablers such as overlaid information
~~advanced visual features~~
to enhance my situational awareness
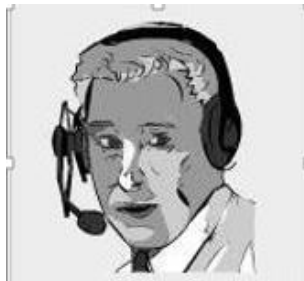
2. Unit endorsement course "items to be addressed" instead of subjects, subject objectives, topics and subtopics

- in order not to copy the initial training structure

TOPIC ATMB 9 — BASIC PRACTICAL SKILLS

| Subtopic ATMB 9.1 — Traffic management process			
BASIC ATMB 9.1.1	Consider h~~ation~~g in the provision of ~~a~~	2	Situational detection, prioritisatio
BASIC	Consider the need for verification that	2	Monitoring

- in order to correct the current situation where some of the subtopics (lists) are rather subtopic contents
- in order to avoid the use of action verbs

3. New GM introduced to address multiple mode of operation

- Purpose to address the issues raised by the RMG in the licensing questionnaire

prioritisation

human limitations

Merging/ splitting
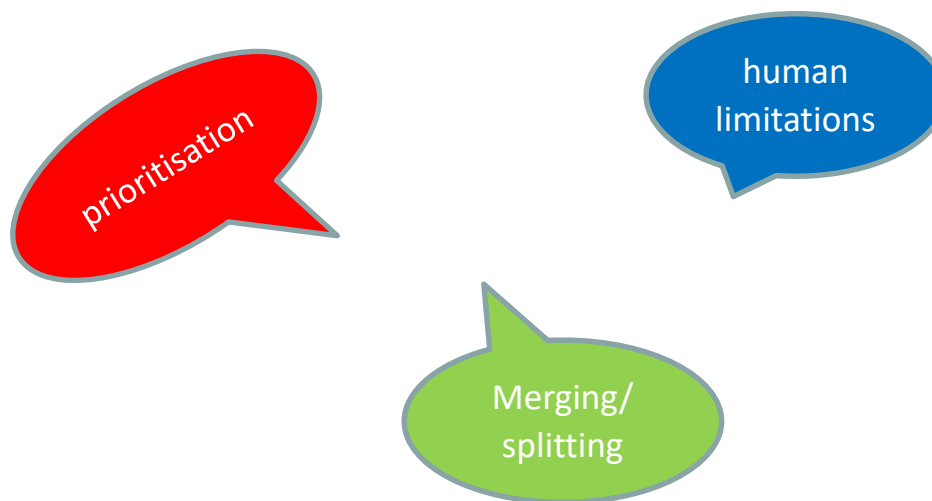
AMC1 ATCO.B.020(a) Unit endorsements

➤ When aerodrome control service is provided by 'remote aerodrome ATS', each aerodrome for which the service is provided should constitute its own unit endorsement

➤ No change in the content (editorial changes)

Unit (ICAO indicator) (*)	Sector/ Position (*)	Rating/Endorsement	Expiry date (*)	
LHXX	RTC LHZZ	ADI/TWR	dd.mm.yy	
LHYY	RTC LHZZ	ADI/TWR	dd.mm.yy	

Please note

ATCO.D.055 Unit training plan

(b) The unit training plan shall contain at least:

> (7) process for adapting the unit endorsement course(s) to <u>take due account of the acquired ratings and/or rating endorsements and experience</u> of applicants, when relevant;

GM1 ATCO.B.025(a)(3) Unit competence scheme

MINIMUM NUMBER OF HOURS

<u>For licence holders holding more than one unit endorsement in the same ATC unit, the minimum number of hours may be defined as a combined value</u> based on the assessment provided by the ANSP.

Nevertheless, maintaining competence should be appropriately ensured for all valid unit endorsements.

GM1 to AMC1 ATCO.B.020(a) Unit endorsements

➤ In cases where, for a given aerodrome, ATS is provided from a 'conventional tower' during certain time periods and from a 'remote tower' at other times the unit endorsement(s) should indicate the working position(s) (conventional and/or remote tower) from which the licence holder is authorised to provide the service.

Unit (ICAO indicator) (*)	Sector/ Position (*)	Rating/Endorsement	Expiry date (*)
EDXX	EDXX LOC	ADI/TWR	dd.mm.yy

Unit (ICAO indicator) (*)	Sector/ Position (*)	Rating/Endorsement	Expiry date (*)
EDXX	EDZZ RTC	ADI/TWR	dd.mm.yy

➤ for shorter/limited periods (e.g. validation or transition) different unit endorsements for conventional and remote tower may not be considered necessary.

GM1 ATCO.D.055(a)
Unit training plan

- When establishing a UTP, a Remote Tower Center may be considered as one ATC unit

UTP RTC ESZZ

STRUCTURE OF UNIT TRAINING
Transitional, pre-OJT...

UNIT ENDORSEMENT COURSES
ESXX ADI/TWR, ESYY ADI/TWR

TRAINING METHODS

TRAINING FOR TWO UNIT ENDORSEMENT COURSES
process for adapting the courses to take due account of the acquired experience

Should enable ATCOs to

➤ acquire knowledge of the concept of remote aerodrome ATS

➤ consider the specific human factors influence

➤ recognise specific abnormal situations and to manage their impact

• items to be addressed instead of subjects etc.

• changes in terminology/wording

• some new items introduced (e.g. factors that can generate fatigue in 'remote tower')

- in addition to the previous

- new content containing issues raised by the RMG e.g.

  - use of communication facilities for simultaneous provision of ATS (frequency confusion)

  - procedures for traffic management - traffic prioritisation

  - procedures for prioritising between aerodromes
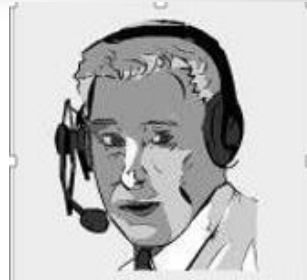
Unit endorsement course multiple mode of operation

➤ transferring/merging/splitting of aerodromes in a RTM

➤ different weather conditions at different aerodromes

➤ human limitations with regard to the simultaneous handling of more than one aerodrome and distribution of attention

Refresher and conversion training

➤ **GM Refresher training** should include familiarisation with the physical aerodrome environment and the different stakeholders via study visit(s)

➤ **GM Conversion training** addressing transition
  • from conventional to remote   ->
  • from remote to conventional   <-
  • from single to multiple mode of operation (new)

Questions?

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Proposed guidelines – chapters 5-12

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- To address the operational as well as procedural needs

- Based on that, to also address the system/equipment aspects

This chapter is new material compared to existing GM.

- Some examples:

  - In line with Reg. 1035/2011, Annex I, Paragraph 8.1, the introduction of remote aerodrome ATS shall be transparent to airspace users.
    - E.g.; establish a consultation process with the users of the service on a regular basis or as needed for specific changes (Reg. 2017/373, ATM/ANS.OR.A.075)

  - All interfaces with all stakeholders which may be influenced should be re-evaluated to include items that are unique to remote aerodrome ATS.
  - The need for coordination and agreements with the aerodrome is specifically highlighted.

  - When providing ATS to several aerodromes from the same RTC/location:
    - the ATS provider should ensure appropriate measures to avoid a situation where the use of 'alternate aerodrome' for a particular flight/aerodrome is not jeopardised,
    - it is recommended to streamline and unify operating methods and procedures between the aerodromes,
    - it is recommended to unify HMI and equipment between the aerodromes/RTMs/CWPs.

Visual presentation

The part on Visual Presentation has been expanded compared to existing GM.

➤ A visual presentation constitutes the core element of remote aerodrome ATS, as it replaces the OTW view of a conventional tower.

➤ May take different forms, e.g.:
  ➤ "panorama"
  ➤ "video wall"

➤ It needs to provide a presentation enabling the ATCO/AFISO to: *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.*

➤ Hence, the overarching operational need for the visual presentation:
  ➤ The ATCO/AFISO needs to be able to see;
    » **aircraft** in the vicinity of the aerodrome,
    » **aircraft, vehicles** and **personnel** on the manoeuvring area.

Visual presentation

➤ Then one would naturally ask:
  ➤ Which aircraft, vehicles (size, distance, etc)??
  ➤ Under which conditions (weather, visibility, light, etc)??

➤ This needs to be defined locally, taking into account the local conditions and specific needs.

➤ A process for how to define such requirements and how to verify them is suggested in EUROCAE ED-240.

TABLE 1: SAMPLE MATRIX FOR CREATING AERODROME SPECIFIC DRRP

ID	Area of Interest	Targets	Profile size (m)	Panorama D (m)	Panorama R (m)	PTZ D (m)	PTZ R (m)
[Example DRRP REQ x]	Final Approach	Medium aircraft	7.0 x 7.0 x 27,2				
[Example DRRP REQ x]	Traffic Circuit	Light aircraft	2.25 x 2.25 x 8.2				
[Example DRRP REQ x]	Manoeuvring Area	Persons / animals	1.8 x 0.5 x 0.5				
[Example DRRP REQ x]	Manoeuvring Area	Vehicle	2.5 x 1.5 x 5.0				
[Example DRRP REQ x]	Manoeuvring Area	Obstructions	0.3 x 0.3 x 0.3				
[Example DRRP REQ x]	Apron	Light aircraft	2.25 x 2.25 x 8.2				
[Example DRRP REQ x]	Apron	Obstructions	0.3 x 0.3 x 0.3				
[Example DRRP REQ x]	Apron	Vehicle	2.5 x 1.5 x 5.0				
[Example DRRP REQ x]	Apron	Persons / animals	1.8 x 0.5 x 0.5				
[Example DRRP REQ x]	Apron	A/c markings	1.0 x 0.5				
[Example DRRP REQ x]	user specified						

Note: The table header "Optical Sensor Presentation" spans the Panorama and PTZ columns.

Visual presentation

Other operational needs (examples):

- Landing gear down (upon pilot request)
- Obstructions on the manoeuvring area
- Significant meteorological conditions & "weather"
- Visual means of communication from the pilot, e.g.:
  - flashing lights, rocking wings etc.

Also such operational needs has to be defined locally, as operational requirements on the visual presentation and the binocular functionality.

Visual presentation

Functional aspects/ system performance requirements

The performance and usability of the visual presentation is a complex combination of many system parameters. Some of the most critical:

➤ Video latency (end-to-end delay)

➤ Video update rate

➤ Difference in daylight/darkness perception

➤ Environmental protection for cameras

➤ Failure detection, e.g. corrupt, delayed or frozen image

New material compared to existing GM.

- Additional sensors at the aerodrome
  - Hot spot / gap-filler cameras,
  - Optical sensors of the non-visible spectrum, e.g. thermal or infra-red

- Digitally overlaid information
  - "Non-static"
    - "visual tracking"
    - "radar tracking"
    - FOD detection support
  - "Static" or service related information:
    - framings/symbols/designators to indicate/highlight parts of the aerodrome
    - cardinal/compass directions, MET-data, distance judgement support,
    - "RWY blocked"

> Considerations:

> > Mitigate the potential risk induced by ATCOs/AFISOs having a different perception of visibility compared to pilots.

> > Care should be taken about the potential unintended loss of such information and the associated risks that may arise as a consequence.

> > Its recommended that all such overlaid information is possible to toggle on/off as well as to adjust in light intensity by the ATCO/AFISO.

Binocular functionality

- No major differences compared to existing GM.

- One important addition:
  - If planned to be utilised as a mitigation mean for (partial or full) loss of visual presentation, this added dependency should be accounted for when developing availability requirements on the binocular functionality.

- The ATS provider should conduct an evaluation of the operational needs and the requested functionalities of the binocular functionality.

- The required visual performance of the binocular functionality should be defined based on the local operational needs.

- The process described in EUROCAE ED-240 may be used to support this process.

Signalling lamp

- No new/added information compared to the existing GM. The information was already there, but spread-out.

- The different parts/aspects have been collected in a single subchapter.

Aerodrome sound

Somewhat expanded info/text compared to existing GM.

➤ Discussing why it could be a valuable stimulus for building up the total ATCO/AFISO situational awareness. .

   ➤ Shown to be valuable particularly for smaller aerodromes where sound could play an important role in the ATCO's/AFISO's job, attracting his/her attention to arising occurrences.

   ➤ Can increase situational awareness during low visibility conditions as well as during emergency situations.

   ➤ Shown to be useful in a 'multiple mode of operation' setup.

Voice and data recording

- Possibilities to record new types of data for the support to accident and incident investigations.

- Recommendations related to remote tower specific systems and data (visual + ad. sound):
  - As a minimum, the data presented to the ATCO/AFISO (including e.g. overlaid info/decision support) should be recorded.
  - In addition, the raw sensor data may also be recorded.

- Acknowledged that integrity issues may result subject to national integrity and surveillance legislation.

- Therefore, exact requirements should be determined and specified by the respective competent authority.

Other ATS system/functions

Other systems/functionalities covered by Ch. 5:

- Communications (voice/data)
- Met-info
- Aeronautical ground lights
- Management of navigation aids
- Alerting service and alarm management
- Management of other aerodrome assets (if applicable)
- ATS surveillance system
- Flight plan and control data

Other aspects covered by Ch. 5

- ▶ Working environment
  - ▶ Aspects of specific interest for remote aerodrome ATS and operations from an RTC.

- ▶ Technical supervision
  - ▶ Specific aspects related to remote aerodrome ATS, being based on a distributed infrastructure.

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➤ This part has been considerably shortened compared to the existing GM.

➤ The focus is on referencing existing safety assessment requirements (Reg. 1034/1035 & 373).

➤ Implementation of remote aerodrome ATS is a change to the functional system and does not require any specific safety assessment methodology.

Change management – "HF assessment"

➤ The aim with the work of the RMG in phase 2 has been to highlight the importance of a human factors assessment.

➤ Therefore, compared to existing GM, this part has been expanded and has been given a more prominent role.

➤ Human factors assessment should be based on a state-of-the-art process that covers the relevant human factors areas affected by the change. It should cover:
  ➤ HMI and system,
  ➤ working environment,
  ➤ procedures and working methods,
  ➤ organisation and human-human interaction,
  ➤ transition factors (competencies, training, acceptance),
  ➤ Those actors (ATCOs/AFISOs, ATSEPs, MET officers, etc) affected by the change.

➤ The chapter list recommendations divided in:
  ➤ Generic human factors elements/aspects for remote aerodrome ATS.
  ➤ Additional elements human factors elements/aspects related to multiple mode of operation.

➤ Similar content as in existing GM.

➤ New sub-part for setting up a new ATS unit.

(Transition from a conventional tower already existed.)

Change management – "Information and cyber security"

- This section partially revised compared to existing GM, but the message is unchanged.

- Information and cyber security is crucial as remote aerodrome ATS relies even more on IT infrastructure and the exchange of data.

- The ATS provider shall (in reference to Regulations 1035/373) conduct a dedicated security risk assessment and take the take the necessary measures to protect its systems and constituents against information and cyber security threats.

➤ Similar text as in current GM.

➤ Added notion to not only consider loss or degradation of a function/information in isolation,

➤ but also to consider combined failures and how they interact.

➤ For multiple mode of operation:

  ➤ contingency procedures to take into account the effect of degraded mode situations for all aerodromes connected to one RTM and how failures may interfere between the aerodromes.

➤ In relation to the demonstration of compliance with the interoperability Regulation (552/2004), this chapter contains some recommendations for how the remote aerodrome ATS system may be split into constituents.

➤ No major changes to this section compared to existing GM.

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NPA 2017-21

An aerodromes' perspective

NPA 2017-21 Consultation workshop

Cologne 19 March 2018

Your safety is our mission.

An agency of the European Union

Background

➤ The aerodromes domain was part of the remote tower concept for *single mode* of operation in 2015

➤ Obvious benefits for aerodrome operators, ANSPs, aerodrome users, etc.
  ➤ operational
  ➤ societal
  ➤ financial
  ➤ …

➤ A change to the aerodrome system may affect anybody
  ➤ important is not the identity of the change initiator, but the change itself
  ➤ focus on the potential impact of the change to the system

Background

➢ Key messages communicated to the Advisory bodies of the Agency back then:

   ➢ *need to think "outside of the box", identify "gaps" in existing regulatory material and address new operational needs and concepts;*

   ➢ *application of a "holistic approach", one that covers the aerodrome (as a system) and beyond;*

   ➢ *coordination between ATS provider/aerodrome operator and competent authorities is a key enabler;*

   ➢ *leave the **door open** for the future possible extension of the scope to cover other, more complex, modes of operations*

➢ The NPA was well received back then

   ➢ ED Decision 2015/014/R

Remote Tower Operations - present

➢ ED Decision 2015/014/R already deals with aerodrome specific aspects

  ➢ *Management of change - coordinated safety assessment*

  ➢ *demonstration of compliance for existing aerodrome systems / equipment*

  ➢ *aerodrome manual and other documentation update*

  ➢ *day to day coordination issues with ATS provider*

  ➢ *allocation of existing (or new) tasks*

  ➢ *review/amendment of procedures and introduction of new ones*

  ➢ *new training areas/material*

  ➢ *safeguarding of new equipment*

  ➢ *equipment sitting*

  ➢ *power supply provision*

  ➢ *maintenance activities*

  ➢ *oversight activities ....*

➢ An effort to support the change ....
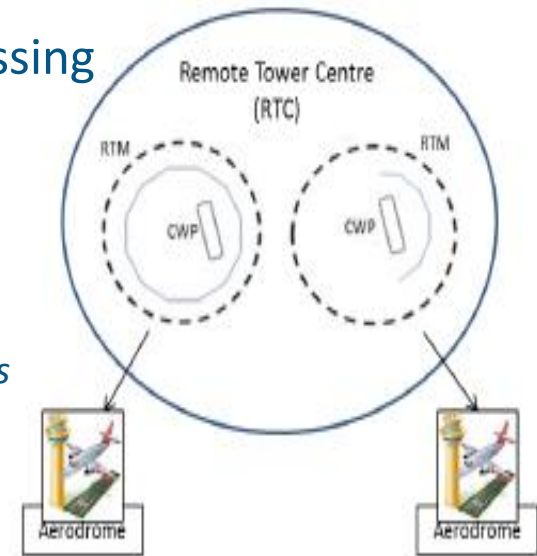
Remote aerodrome ATS – NPA 2017-21

➢ NPA 2017-21 deals with aerodrome related issues addressing

- ➢ Aerodrome certification

  - ➢ *documentation to be submitted*

  - ➢ *aerodrome manual*

  - ➢ *local agreements of aerodrome operators and ATM/ANS providers*

- ➢ Operational aspects

  - ➢ *coordination between aerodrome operator and ATM/ANS providers in the event of system failure*

  - ➢ *aerodrome safeguarding* *("extended" scope to cover the new facilities)*

  - ➢ *maintenance of the remote tower system facilities*

  - ➢ *management of the change to remote aerodrome ATS — aerodrome operator*

  - ➢ *power supply at aerodromes*

  - ➢ *electrical power supply systems for the remote aerodrome ATS*

  - ➢ *cameras at aerodromes*

Remote aerodrome ATS – NPA 2017-21

- Are there differences between the existing material and the NPA?
  - mention of "Annex 14" next to Regulation 139/2014
    - limited scope of Regulation 139/2014, as opposed to Regulations on ATM/ANS
    - however, the principles contained in the text are neutral in terms of regulatory framework
  - text modification in certain parts – but no new issues
    - text remained unchanged in its greatest part
    - some items were rearranged or clarified

- In short, no news for the aerodromes' domain
  - the extension of the scope of the remote ATS concept does not affect individual aerodrome operators
  - the guidance already provided remains valid and relevant to the extended scope

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Aeronautical information products and services

This section has been considerably expanded compared to existing GM.

- Information to be included in the AIP:

  - Indication of **remote** aerodrome ATS (in AIP AD 2.23 'Additional Information)

  - Location of signalling lamp (in AIP AD 2.23 'Additional Information')

  - Any specific communication methods as a result of multiple mode of operation, such as e.g. the inclusion of aerodrome names/ATS unit call sign for all transmissions (i.e. not only for the first contact) between pilots and ATCOs/AFISOs (in AIP AD 2.23 'Additional Information').

  - Any relevant actions required by the airspace users following an emergency/abnormal situation and possible contingency measures by the ATS provider in case of disruptions, if applicable (in AIP AD 2.22 'Flight Procedures').

  - Interdependencies of service availability or indication of aerodromes not suitable for diversion from the aerodrome (for airspace users not to plan an aerodrome as alternate when serviced by the same RTC), if deemed applicable (in AIP AD 2.23 'Additional Information').

- Information on implementation plans and milestones may be published in AIC (Aeronautical Information Circular). E.g. dates and scope of validation exercises, planned date of operation.

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Qualification and training considerations

➤ This text/chapter has been expanded so it now includes separate subsections for ATCOs, AFISOs and ATSEPs respectively.

➤ A discussion/clarification of the current regulatory situation for AFISOs is now included.

➤ This also includes a notion that the ATCO AMC & GM may be considered when deriving local training plans and requirements appropriate to the local environment .

End slide.

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SESAR Remote Tower Activities & Solutions

Olivier Mongénie
Airport Programme Manager, SESAR Joint Undertaking

Cologne, 19 March 2018

Agenda

- Introduction to SESAR

- Delivered SESAR Remote Tower Solutions and Past Demonstration Activities

- Ongoing SESAR Remote Tower Industrial Research and Exploratory Research Activities

Agenda

- Introduction to SESAR

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SESAR lifecycle

Definition

European ATM
Master Plan

Development

SESAR Solutions
SESAR 2020

Exploratory research
Industrial developments
Very large-scale demonstrations

Deployment

Deployment Programme

The power of partnership

SESAR vision

Increased **virtualisation**, regarding provision of services irrespective of the location of physical infrastructure

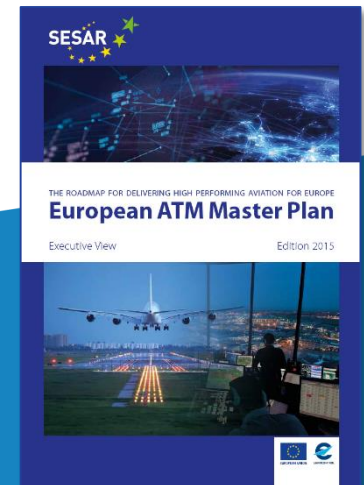**Integration of all vehicles** into Europe's airspace, including drones

OUR VISION

With SESAR, the future of air traffic management is characterised by:

Flight-centric operations, so airlines can fly their preferred routes

Improved information sharing, creating an intranet of services and applications accessible by all aviation stakeholders

Interoperable systems, allowing connectivity of systems across borders

SESAR

THE ROADMAP FOR DELIVERING HIGH PERFORMING AVIATION FOR EUROPE
European ATM Master Plan

Executive View   Edition 2015

Best of SESAR 1

1 unique public-private partnership

2 founding members

15 industry members

+20 million hours of work

+60 research organisations
Universities/SMEs/ research centres

+60 technical & operational solutions

SESAR
FROM VISION TO REALITY

+350 validations

+30,000 flight trials

+90 prototypes

+3,000 ATM experts

+100 companies

SESAR Solutions Catalogue

SESAR Solutions refer to new or improved operational procedures or technologies that aim to contribute to the modernisation of the European and global ATM system.

- **63 SESAR Solutions**
- In 4 areas (Key Features)

- **24 are already being deployed across Europe**

Visit the SESAR Solution portal: sesarju.eu/activities-solutions

SESAR 2020 in a Nutshell

SESAR 2020 Animation: https://youtu.be/ArdXq-hV3TY
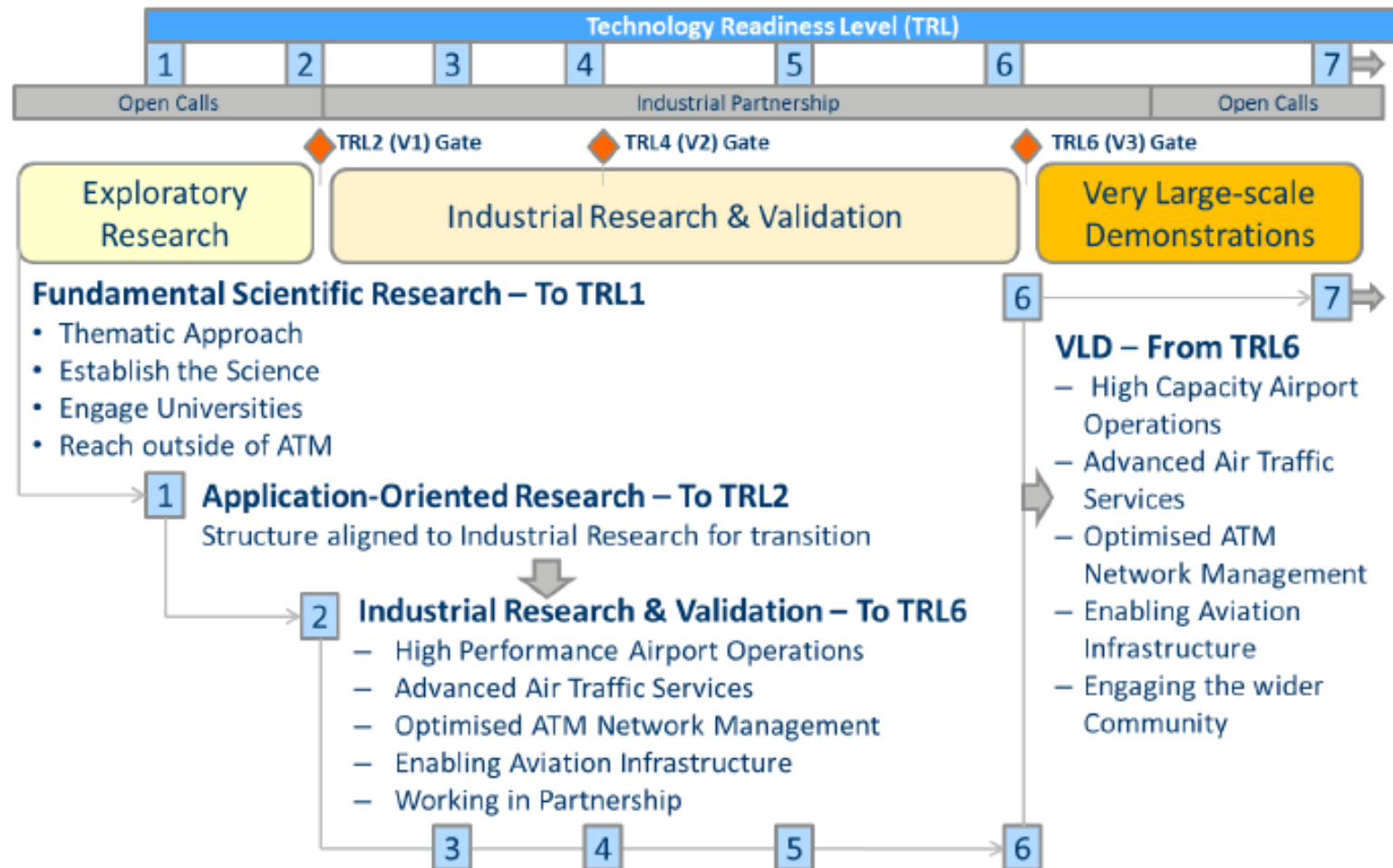
SESAR Solutions Overall Lifecycle

Exploratory Research	Industrial Research	Very Large Demonstration	Industrialisation & Deployment

Optimised ATM network services — R&D Topic — Delivered SESAR Solution

High-performing airport operation — R&D Topic — Delivered SESAR Solution

Advanced air traffic services — R&D Topic — Delivered SESAR Solution

Enabling aviation infrastructure — R&D Topic — Delivered SESAR Solution

U-space — R&D Topic — Delivered SESAR Solution

SESAR SOLUTIONS CATALOGUE — First Edition

SESAR Solutions Overall Lifecycle

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ATC And AFIS Service In A Single Low-Density Aerodrome From A Remote CWP

STAKEHOLDERS

ANSP

AO

AU

NM

Small or local airports are a life-line for a local economy, however they cannot always afford to operate a control tower around the clock. SESAR's remote tower services offer the means to provide air traffic services in a cost-efficient way to such airports, as well as non-towered ones.

BENEFITS

- **Increased cost efficiency**
- **Increased accessibility to and support for regional economies**

In 2014, the world's first remotely-operated tower was opened at Örnsköldsvik, controlled remotely from Sundsvall centre over 150 km away

Operational standards for remote tower services currently match those for real operations and approval is based on the same service delivery requirements as existing ICAO rules

SJU references:
#71 / Release 3

Solution #71 Final Validations
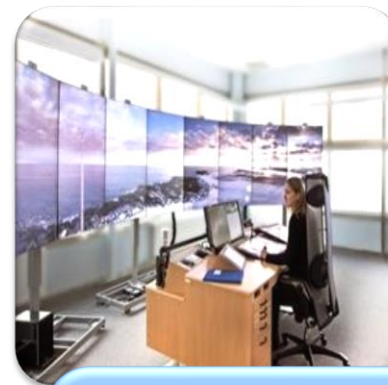
1st V3 shadow mode trial of a 'Single Remote Tower'

- Ängelholm airport TWR ATS from Malmö airport, Sweden
- Q4 2011

2nd V3 shadow mode trial of a 'Single Remote Tower'

- Ängelholm airport TWR ATS from Malmö airport, Sweden
- Q2-Q3 2012

V3 shadow mode trial of a 'Single Remote AFIS'

- Værøy airport AFIS from Bodø airport, Norway
- Q4 2012 / Q1 2013

Remote Tower For Two Low-Density Aerodromes

SESAR JOINT UNDERTAKING

STAKEHOLDERS

| ANSP |
| AO |
| AU |
| NM |

BENEFITS

- **Operational and technology-related cost efficiency**

Multiple remotely controlled airports contribute to SESAR cost-efficiency performance targets

Having proved controllers can provide air traffic control services to an airport remotely, SESAR validated the feasibility of providing simultaneous services to two airports from a single location.

SJU references:
#52 / Release 4

Solution #52 Final Validations

V2 real time simulation of 3 small remote ATS

- Ängelholm, Halmstad and Kristianstad airports, Sweden
- February 2014

V2 shadow mode of 2 small remote ATS

- Örnsköldsvik and Sundsvall airport TWR ATS from Sundsvall airport, Sweden
- September 2014

V3 shadow mode of 2 small AFIS

- Værøy heliport and Røst aerodrome from Bodø, Norway
- December 2014

Remotely-Provided Air Traffic Services For Contingency Situations At Aerodromes

BENEFITS
- **Increased cost efficiency**
- **Improved resilience in degraded situations**

STAKEHOLDERS

ANSP

AO

AU

NM

Contingency towers deliver increased operational resilience for medium-sized airports

Building infrastructure off-site is more cost-efficient, and easier to maintain

Security alerts can shut down control towers. How does the airport ensure minimum disruption in an emergency? This question has been addressed by SESAR looking at contingency situations for airports.

SJU references:
#13 / Release 5

Solution #13 Final Validations

V3 shadow mode contingency operations

- Göteborg Landvetter airport, Sweden
- March 2015

V3 shadow mode contingency operations

- Girona airport, Spain
- November 2015

Single Remote Tower Operations For Medium Traffic Volumes

STAKEHOLDERS

- **ANSP**
- AO
- AU
- NM

BENEFITS

- **Increased cost efficiency**

Single remote towers offer an efficient way to deploy operational staff resources by means of a remote tower centre providing single tower services to a number of airports

Conventional control towers are expensive to operate and maintain, and even at a medium-sized airport can become too costly if the number of flights is insufficient to cover the running costs. SESAR's remote tower services offer the possibility to enhance safety and efficiency at airports where it is too expensive to build, maintain and staff conventional tower facilities and services. The solution is already deployed at small airports, and is under test at medium-sized airports.

SJU references:
#12 / Release 5

Solution #12 Final Validations

V3 shadow mode

- Saarbrücken airport from Saarbrücken, Germany
- January 2016

Demo, shadow mode

- Saarbrücken airport from Saarbrücken, Germany
- August 2016

Demo, live trials

- Groningen airport Eelde from Schiphol, The Netherlands
- September 2016

Demo, live trials

- Cork and Shannon airports from Dublin, Ireland
- Q2/Q3 2016

Large Scale Demonstration – RACOON

ENAV led 2-years project aiming at demonstrating:

- The provision of ATC services to a single runway aerodrome from a remote location, under given operational conditions and technical assumptions (low traffic conditions, good weather condition)

- The sharing of ATS services for Multiple airport, under given operational conditions and technical assumptions (low traffic conditions, good weather condition)

- *Acceptability/flyability of RNP-APCH (APV-BARO and PInS) procedures and GNSS monitoring*
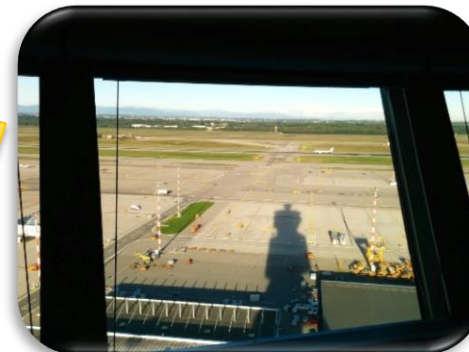
Large Scale Demonstration – RACOON

Remote airport: Milan Linate

Remote airport: part of Milan Malpensa

Scenario 1

Scenario 2

Scenario 2

RACOON RTC – Milan Malpensa

Physical airport: Milan Malpensa

All scenarios in low traffic, nominal conditions, good weather and day & night

Large Scale Demonstration – Remote Towers

IAA led 2-years project aiming at demonstrating the provision of air movements control and surface movement control for Cork and Shannon airports remotely from the Dublin Air Traffic Control Centre in multiple aerodrome configuration using remote tower technology

Incremental approach:

- Surface movements then air movements
- Vehicles then aircraft
- Single then multiple

Remote Towers RTC – Dublin ACC

Remote airport: Shannon

Remote airport: Cork

Large Scale Demonstration – RTO

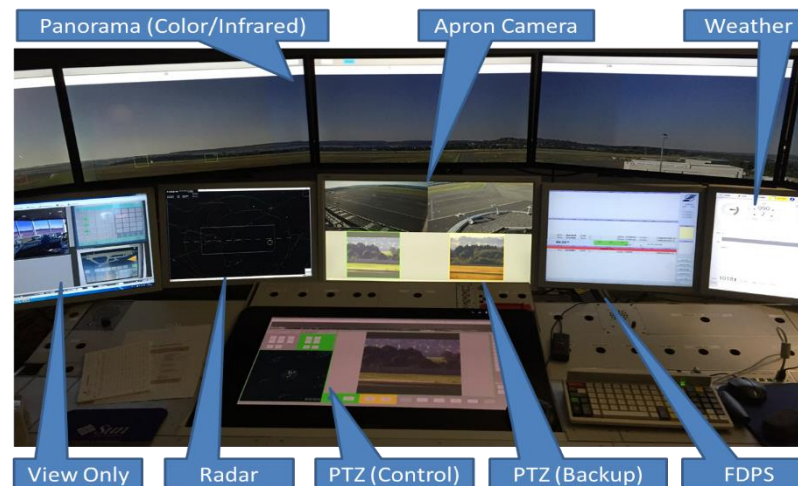LVNL led 2 years project aiming at demonstrating that:

- It is possible to provide a basic solution for RTC with a reduced number of screens displaying a reduced view (full view selectable) and with a less complex CWP

    - Leader: LFV

    - Single remote tower (AFIS for a very small aerodrome)

    - Passive shadow mode

    - RTC: Sundsvall, Sweden

    - Remote airport: Gällivare, Sweden

Large Scale Demonstration – RTO

LVNL led 2 years project aiming at demonstrating that:

- Remote ATS can be provided to a medium size airport in an operational and technical environment

  - Leader: DFS

  - Single remote tower (ATS for a medium sized airport)

  - Passive shadow mode then live trials

  - RTC: Saarbrücken, Germany

  - Remote airport: Saarbrücken, Germany

Large Scale Demonstration – RTO

LVNL led 2 years project aiming at demonstrating that:

- Remote ATS can be provided to a medium size airport in an operational and technical environment

- Remote ATS can be provided to a medium size airport in an operational and technical environment and a small size airport simultaneously in a simulated environment

  - Leader: LVNL

  - Single remote tower (ATS for a medium sized airport) & multiple remote tower (ATS for a small and a medium airport)

  - Live trials & real time simulation

  - RTC: Schiphol airport, The Netherlands

  - Remote airports: Groningen Airport Eelde (live trials) and Maastricht Aachen Airport Beek (simulated)

Large Scale Demonstration – Budapest 2.0

PildoLabs led 2 years project aiming at demonstrating how the implementation of new solutions and concepts developed within SESAR can contribute to improve operations, and provide most cost-effective business models for small/medium airport stakeholders and airspace users. These solutions include:

- Single Remote Tower Operations For Medium Traffic Volumes

    - Shadow mode then live trials for one then two runways of Budapest airport

    - 586 aircraft controlled during live trials

- *CDO enhancement tool*

- *RNP-based operations*

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Solution PJ.05-02 – Remotely Provided Air Traffic Service for Multiple Aerodromes for up to three airports

LFV/COOPANS, ON (B4), ACG, CCL, LFV, DFS, ENAV, INDRA, FREQUENTIS, HC, SAAB, EUROCONTROL, DLR, FINNMECCANICA, NLR

REMOTE TOWER · SESAR JOINT UNDERTAKING

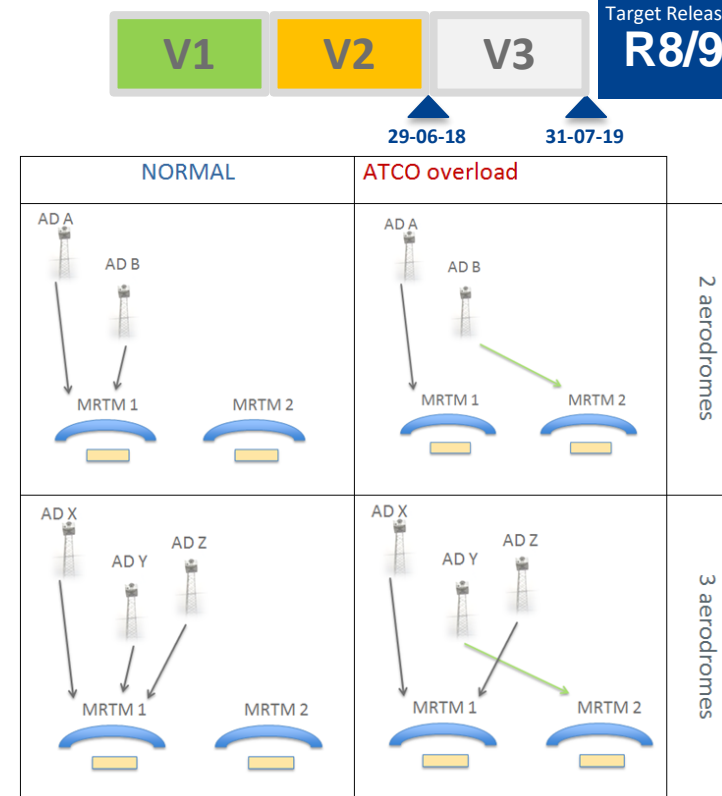| V1 | V2 | V3 | Target Release R8/9 |

29-06-18   31-07-19

Solution Scope:

The solution will enable an ATCO to maintain situational awareness and provide Aerodrome Control Service or Aerodrome Flight Information Service for 1, 2 or up to 3 different remote airports at a time, with the following indicative traffic characteristics:

- 2 airports with 6 simultaneous movements or 3 airports with 4 simultaneous movements;
- 10 to 20 movements (ground and air) per hour in total for all airports.

In order to allow it, the solution considers advanced features of the visual reproduction as well as additional voice services being integrated into the Multiple Remote Tower Module (MRTM).

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

	NORMAL	ATCO overload	
2 aerodromes	AD A, AD B → MRTM 1, MRTM 2	AD A, AD B → MRTM 1, MRTM 2	
3 aerodromes	AD X, AD Y, AD Z → MRTM 1, MRTM 2	AD X, AD Y, AD Z → MRTM 1, MRTM 2	

Intended Benefits:

Compared to the predecessor remote tower solutions of SESAR 1, more significant impacts in cost-efficiency, flexibility and service tailored ATS are expected with "multiple" remote control, for small and medium sized airports.

Rural, less frequented airports are supported to retain in operations or even to increase the service levels for more hours of operations or even to upgrade non-controlled to controlled airports, what in the end, the passengers will benefit from.

Cost effectiveness, Flexibility, Safety, Human performance

Solution PJ.05-03 –
Highly Flexible Allocation of Aerodromes to Multiple Remote Tower Modules

DFS, LFV/COOPANS, ON (B4), ACG, CCL, LFV, ENAV, INDRA, FREQUENTIS, HC, SAAB, EUROCONTROL, DLR, LEONARDO, NLR

REMOTE TOWER **SESAR** JOINT UNDERTAKING

V1	V2	V3

31-07-19

Target Release **R9**
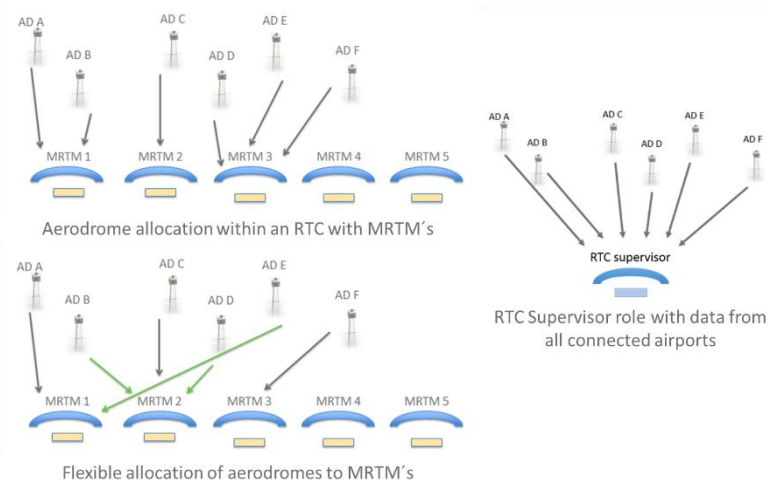
Solution Scope:

The solution will enable the provision of remote tower services to a large number of airports from one Remote Tower Centre (RTC), housing one or several Multiple Remote Tower Modules (MRTM), thanks to complementary approaches:

- Advanced automation functionalities are added in each MRTM (e.g. conformance monitoring, task prioritisation) to allow the ATCO to maintain situational awareness and provide Air Traffic Service for up to 3 or 4 different remote airports at a time, with the following indicative traffic characteristics:

  • 3 airports with 8 simultaneous movements or 4 airports with 6 simultaneous movements;

  • 20 to 30 movements (ground and air) per hour in total for all airports.

- A RTC supervisor managing flexible and dynamic allocation of airports connected to the different MRTMs over time, in order to balance ATCO workload and traffic volumes, with the support of a planning tool.

- An harmonisation of systems and procedures in the MRTMs/RTC making it easier for the ATCOs to hold endorsements for more than 3 airports.

Aerodrome allocation within an RTC with MRTM´s

RTC Supervisor role with data from all connected airports

Flexible allocation of aerodromes to MRTM´s

Intended Benefits:

Compared to the solution PJ.05-02, still more significant impacts in cost-efficiency, flexibility and service tailored ATS are expected; Less MRTMs might be provided due to a synergy in the required backup MRTMs.

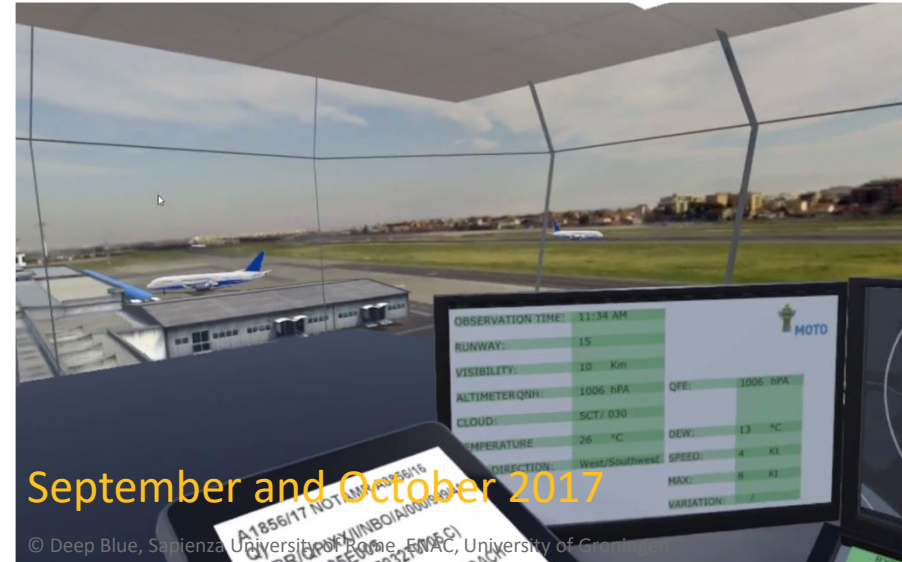**Cost effectiveness, Flexibility, Safety, Human performance**

MOTO – the embodied remote Tower

The overall objective of the project is to **identify the key multimodal stimuli required on RTO to enhance the sense of Presence experienced by ATCOs**.

MOTO project detailed objectives are the following:

1. Assess the role of multimodal (i.e. multisensory, beyond visual, and proprioception) acquisition of information in current control tower operations.

2. Define user requirements for a multimodal Remote Tower, to reconstruct multimodal perception in a remote tower simulation platform including the development of augmented multimodal interfaces.

3. Define brain-physiological indexes, customized for Remote Tower operations, to monitor aspects of Human Performance like: workload, situation awareness, fatigue, drop of attention.

4. Validate the above results in realistic ATM operational conditions through simulation facilities in two scenarios:

   - Compare the performance benefits between a baseline Remote Tower and the Augmented Remote Tower;
   - Assess the performance benefits of the Augmented Remote Tower in radically changed scenarios.

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RETINA – Resilient Synthetic Vision for Advanced Control Tower Air Navigation Service Provision

In the RETINA concept, controllers are no longer limited by what the human eye can physically see out of the tower windows.

As trust in digital data will continue to grow, RETINA's concept allows the controller to have a head-up view of the airport traffic even in low visibility conditions similar to the synthetic vision currently used in the cockpit.

RETINA builds upon the technologies developed in SESAR, such as remote tower, safety nets, SWIM, to provide augmented reality tools for the tower controller.

SAFETY

ENVIRONMENT

EFFICIENCY

COSTS

EXPECTED IMPACTS
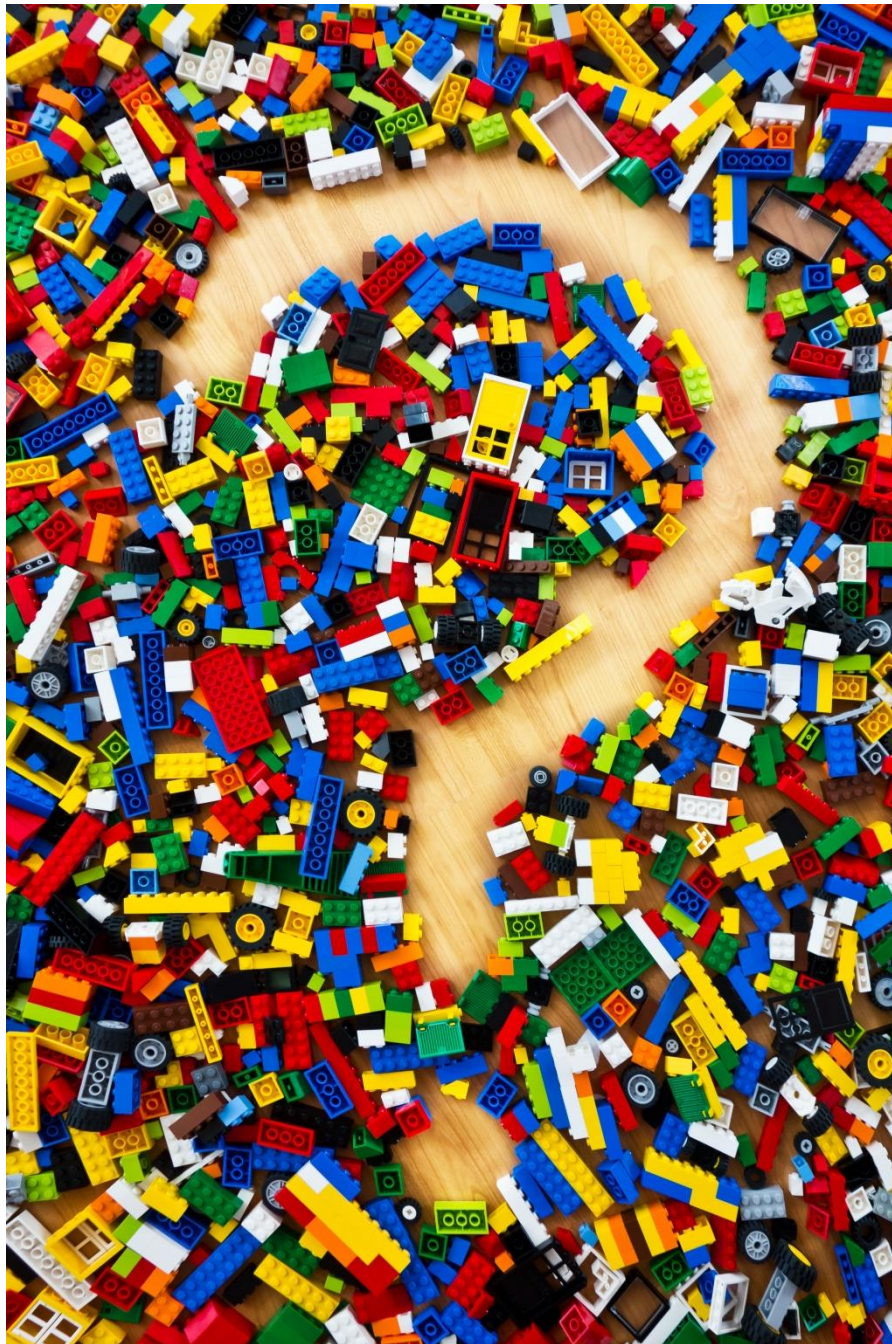
SESAR Remote Tower Activities & Solutions

Thank you very much for your attention!