

How to improve aviation efficiency through remote and digital tower

Part 1-Guidance Materials

Tuesday 19 January 2021

13:00 – 14:00 CET

Introduction



Coleen Hawrysko
Operations Programme Manager

CANSO

Moderator



Conor Mullan

Managing Director

Think Research Limited

Co-Chairs



Niclas Gustavsson
Vice President Head of Product
& Solutions
SAAB



Rory Hedman
ATM and Airports Consultant

Think Research Limited



Rolf Zon
Senior R&D manager
NLR



Zoltan Molnar
ATM Safety and Risk
Management Specialist
Hungarocontrol



Mattias Abel
ATM/ANS & Remote Tower
Expert
LFV



Sarah McLarty
ATM Consultant
Think Research Limited



Elizabet Pavlova
ATM Consultant
Think Research Limited

Speaker



Niclas Gustavsson
Vice President Head of Product &
Solutions
SAAB

Time to jump – guidance needed!



Innovators

Early adopters

“the chasm”



Early majority



Late majority



Laggards



Speaker

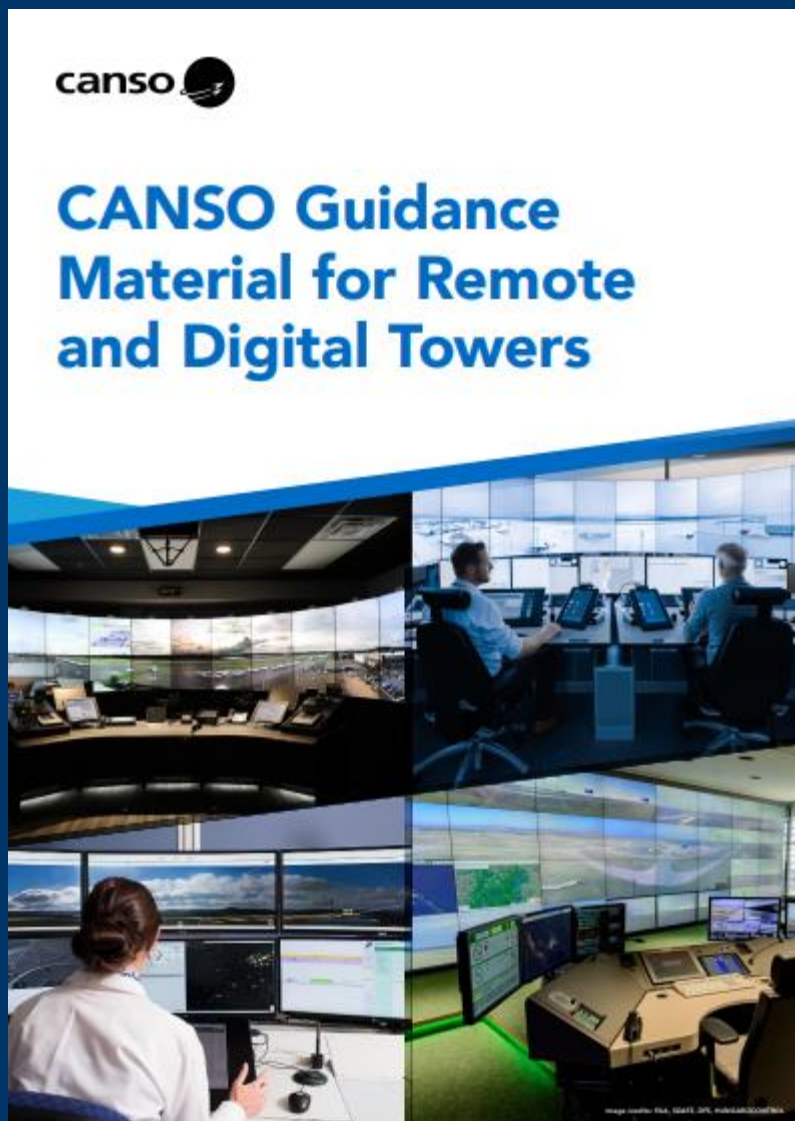


Rory Hedman
ATM and Airports Consultant

Think Research Limited

An Overview of the CANSO Guidance Material for Remote and Digital Towers





CANSO Guidance Material

The guidance material has been structured to answer some key questions.

What is Digital Tower?

Why Implement a Digital Tower?

When to Implement Digital Towers?

How do I get started with Digital Tower?

What is next for Digital Towers?

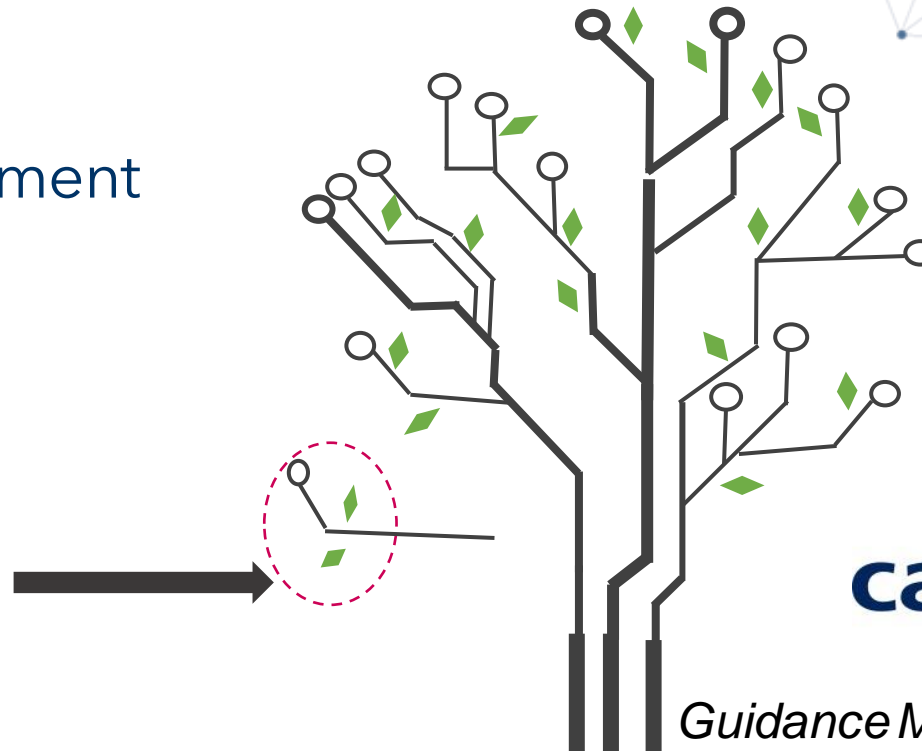
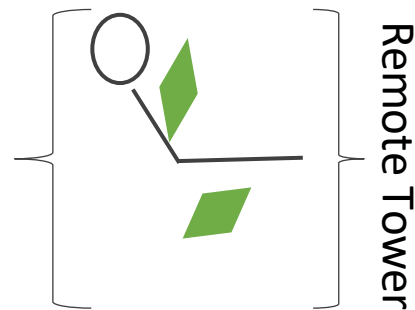
Plus, a view through case studies



What is a Digital Tower?

The Guidance Materials provides an overview of Digital Tower.

- Definition
- Concept evolution, including historic & current understanding
- Different operating modes
- The influence of operating environment
- Technologies



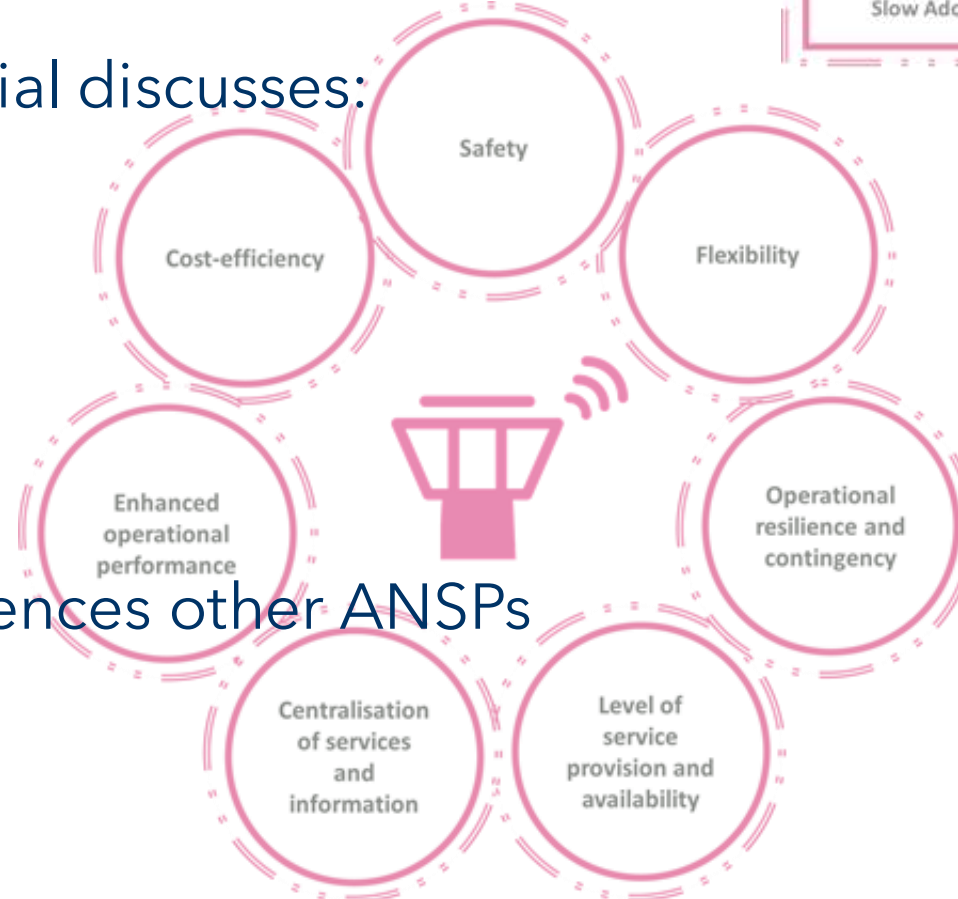
Why Implement a Digital Tower?

The decision to implement a Digital Tower will be based on a balance of business decisions.

The Guidance Material discusses:

- Benefits
- Challenges
- Considerations

Based on the experiences other ANSPs



A View Through Case Studies

Case studies include a mix of operational environments, business drivers and technologies.

- FAA Digital Towers
- LFV & SDATS Remote Tower Services
- Hungarocontrol Remote Tower Operations
- DFS Remote Tower Control



When to Implement Digital Towers?

Growth of an airport justifies need for ATS business continuity

Airport expansion introduces new runways (or other blind spots) away from existing conventional tower

Conventional tower replacement at end of life

New airport build

Financial and resourcing pressures impacting upon the viability of an airports operation


Providing ATS to airports that do not have a conventional tower

Tower systems require upgrade or refurbishment requiring temporary closure

To couple with other tower system integration and upgrade projects



How do I get started with Digital Tower?

- Regulatory and Standardisation Outlook
- Approval Aspects
 - Validation 
 - Safety Assurance
 - Human Factors
- Other Aspects (Data capture and recording, Licencing and training of operators, Facilities, Locating a Remote Tower Facilities, Ownership, Cyber and Physical Security, People Change Management)

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Speaker



Rolf Zon
Senior R&D manager
NLR

Human Factors

Aviation efficiency through remote
and digital towers



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Why Human Factors of Remote and Digital Towers

- Remote and Digital Towers have direct impact on ATCOs
 - Human Factors may be influenced
- Pay attention, prior to installation of the new system
- Measuring identifies which factors are influenced
 - For ANSPs as well as for ATCOs, discussion can be focused on facts, which will make the change smoother



Human-in-the-Loop simulations to

- Specify requirements operation and functions
- Determine impact of changes on
 - Operation
 - working environment
 - human performance
- Validate new situation
- Identify potentially hazardous operations
- Train controllers for new operations and functionality



Relation human factors construct - measurement device

Human Factors Construct

Attention / distraction
Situational Awareness
Workload
Fatigue
Stress

Measurement device

Eye Tracking

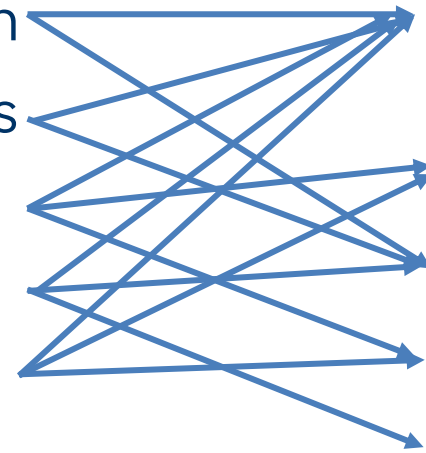
- (Point of Gaze, Pupil Diameter, Eye Blink, Entropy)

Heart Rate (variability)

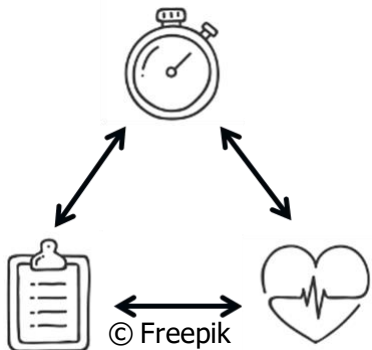
ElectroEncephaloGram (EEG)

Galvanic Skin Response

Day / Night Rhythm



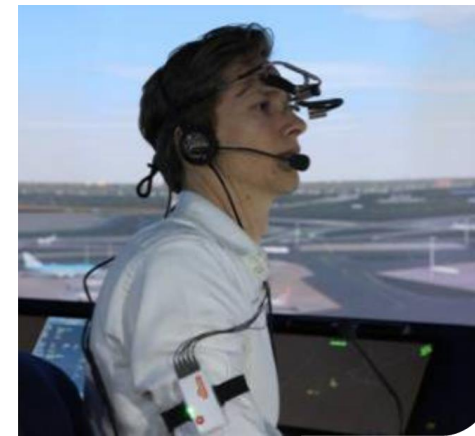
Performance



Subjective

Bio-behaviour

Methodological -Triangulation





Rolf Zon

Human Effectiveness

**Royal Netherlands Aerospace Centre
(NLR)**

rolf.zon@nlr.nl

+31 88 511 3190

+31 6 2012 9465



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Zoltan Molnar

ATM Safety and Risk Management
Specialist

Hungarocontrol

Safety aspects of remote towers



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Safety assessment

- Remote tower implementation can be handled as a change of the functional system - specific safety assessment methodology is not necessary
- EC Implementing Regulation (EU) 2017/373 defines the requirements and methodology to be followed in the EU
- EASA guidance material (ED 2019/004/R) supports the assessment



Safety benefits of remote towers

- Flexibility – view from a conventional tower is given, a well-designed visual surveillance system (VSS) can provide a more accurate view and enhance situational awareness
- Integration of the VSS with ATM systems – tailored information can be presented on the panorama/videowall and CWP screens
- Filtering functions – to enhance image quality, and provide better visualization even in low visibility periods
- Image recognition algorithms – to support additional functions (e.g. alerts, safety nets)



Safety issues of remote towers

- Visual surveillance – coverage needs, camera locations (fix and PTZ), camera types, orientation, redundancy
- Visual presentation – type, size, arrangement, overlays
- CWP – arrangement, layout, visual surveillance system HMI, personal screens (hotspot, PTZ)
- Network – connection between the aerodrome and the RTC
- Human factor issues – the role of validation
- Degraded modes – loss of one/more elements of the VSS, freezing of one/more screens, quality problems (delay, blurred picture, ...)



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Mattias Abel
ATM/ANS & Remote Tower Expert
LFV

Regulatory outlook



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EUROCAE – Technical standards

- WG-100 “remote and virtual towers” active since 2014.
- Includes representatives of manufacturing industries, ANSPs, research institutes and unions from around the globe.
- ED-240A (Oct 2018), includes “visual tracking” / “box-and-follow”.
- ED-240A change 1 anticipated Q4/2021 – readability and content improvements to better support tender and implementation purposes
- ED-240B edition, including “radar tracking” anticipated mid 2022.



The European Organisation for Civil Aviation Equipment
L'Organisation Européenne pour l'Équipement de l'Aviation Civile

MINIMUM AVIATION SYSTEM PERFORMANCE STANDARD FOR REMOTE TOWER OPTICAL SYSTEMS

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ED-240A

October 2018

Supersedes ED-240

9-23 rue Paul Lafargue
93200 Saint-Denis, France
Web Site: www.eurocae.net

Tel: +33 1 49 46 19 65

Email: eurocae@eurocae.net

EASA – regulatory support

- Rulemaking group active since 2014.
- Includes representatives of (mainly) ANSPs, CAAs, and unions from around Europe.
- GM Issue 2 published Feb 2019 – complementing applicable international/ICAO standards and EU requirements on ATS.
- + AMC & GM complementing the ‘ATCO Licensing’ Regulation (EU) 2015/340.
- Continued work to keep EASA material up to date ongoing – updated versions expected Q4 2023 (NPA Q2 2022)

European Union Aviation Safety Agency

Guidance Material
on
remote aerodrome air traffic services

Issue 2
15 February 2019¹

¹ For the date of entry into force of Issue 2, please refer to Decision 2019/004/R at the [Official Publication](#) of EASA.

ICAO

- ICAO Doc 4444 (PANS-ATM) Amendment 8 (Nov 2018) introduced support for remote ATS.
- ICAO ATM Operations Panel (ATMOPSP) has – following the request from several states/stakeholders – reinitiated the Remote ATS Sub-Group, for the development of potential ICAO specific guidance material and further ICAO provisions, if required – *gap analysis in progress*.
- In parallel, the ‘ATS Planning Manual Sub-Group’ is working on an update of Doc 9426 (ATS Planning Manual), likely to include a new section on remote ATS – *draft section ready, awaiting approval by the ATMOPSP*.



In conclusion..

- Technical standards and regulatory support already available and being further improved/developed
- EUROCAE standards applicable globally
- EASA regulatory material applicable in Europe (EASA member states) and may be used as guidance globally (currently referenced from ICAO Doc 4444)
- ICAO already introduced remote ATS support in Doc 4444 and may be developing ICAO specific guidance as well as further ICAO provisions as applicable in the upcoming years



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Think Research Limited

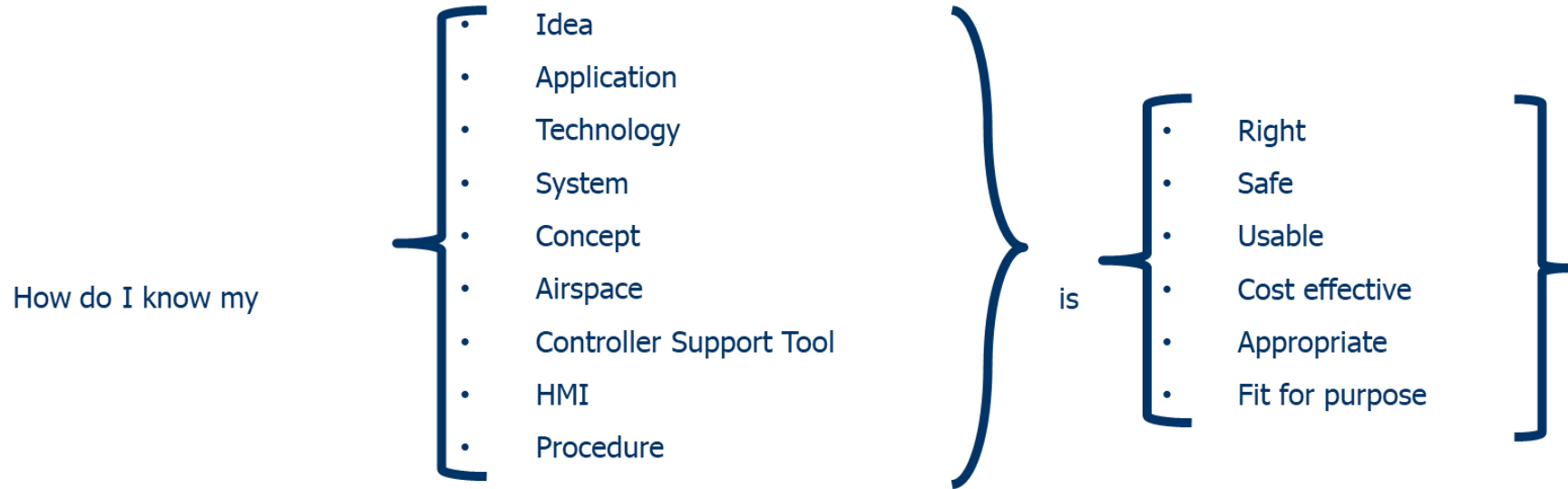
Validation in Remote Towers



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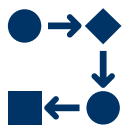
What is validation?



“The iterative process by which the **fitness-for-purpose** of a new system or **operational concept** being developed is established”
(European Operational Concept Validation Methodology definition)



Provides critical evidence and stakeholder buy in



Without a proper validation process, chances of getting a complex system into operations are greatly decreased

Why do we need validation?

- Most Digital Tower procurement projects start with a set of requirements
- Success is often measured around if these requirements have been met. This is verification, not validation

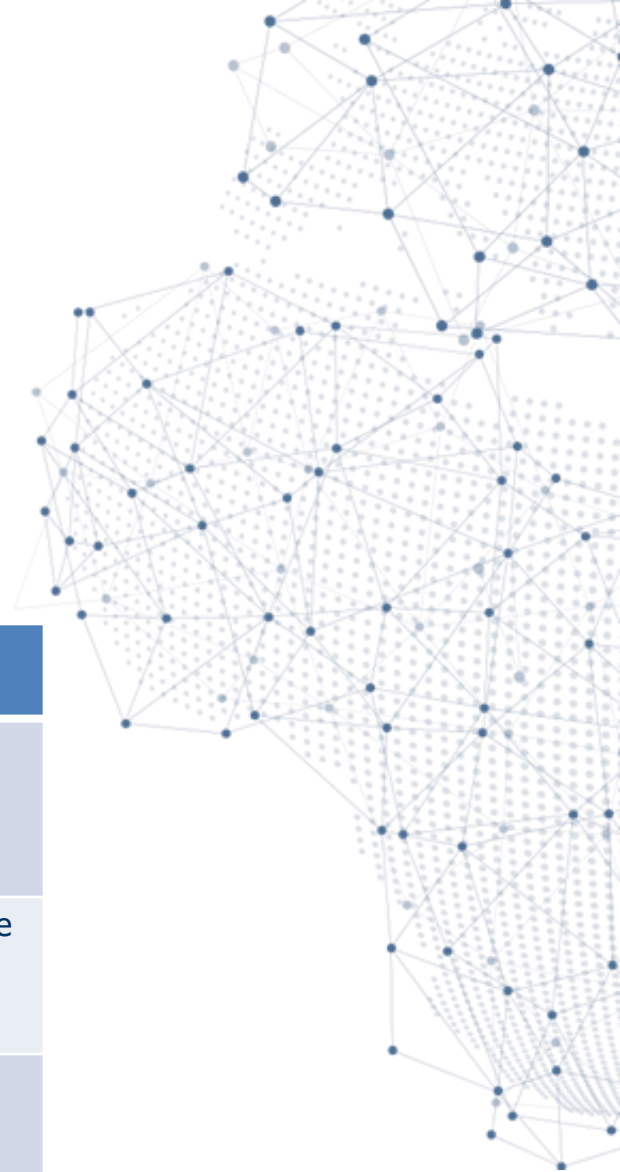
Verification	Vs.	Validation
Are we building the system right?		Are we building the right system?

- All successful implementation projects have shown that getting to SAT is a positive move, but several validation cycles are required to get to operations
- Projects which have stalled, often stall due to incomplete consideration of validation in the implementation planning

Validation Techniques used in Remote Tower

- The majority of Digital Tower implementation projects have used:
 - Desktop research and workshops
 - Real Time, Human-in-the-loop simulation
 - Shadow Mode Trials or Live Trials

Validation Technique	Benefits	Drawbacks
Workshops	<ul style="list-style-type: none">• Engages stakeholders early on• Low cost• Tailored CBA – good indication of feasibility	<ul style="list-style-type: none">• Subjective based
RTS	<ul style="list-style-type: none">• Can test wide range of operational scenarios• Good for prototyping especially for new tools, HMI and workstations	<ul style="list-style-type: none">• Uses synthetic visual presentations and not live feeds from airport – usually critical factor
Shadow Mode Trials	<ul style="list-style-type: none">• Use real system (or close to it)	<ul style="list-style-type: none">• Difficult to see a wide range of operational scenarios
Live trials	<ul style="list-style-type: none">• Realistic• Exposed to reality	<ul style="list-style-type: none">• Expensive



Validation Lessons in the CANSO Guidance Material

- Take the lessons learned from the Case Studies:



Emphasis on early stakeholder involvement



Time required for approval



Need for human performance assessment and user acceptance

- Validation Strategy:



Plan a validation phase and a Validation Strategy into your Digital Tower project



It will greatly enhance your chances of success and avoid time/cost overruns



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Elizabeth Pavlova
ATM Consultant
Think Research Limited

What is next for Digital Towers?



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Future Technology Concepts

Digital Tower solutions should be scalable for future technology and technological concepts concerned with:

- Data integration
- Operational enhancements
- Advanced conflict detection
- Forecasting and data visualisation
- Advanced Digital Tower integration with ATS systems



Increased
functions



Increased
integration



“Smarter” and more digitally
connected







Opportunities

Digital Tower centre





Operational concept in Norway – Avinor's Bodø Remote Tower centre

Provision of aerodrome ATS together with other ATS could result in:

Performance and efficiency benefits:

-  Flexibility
-  Increased ATS availability
-  New operational concepts
-  Improved business cases

Challenges and differences:





-  New roles
-  Integrated training
-  Increased coordination
-  New dependencies



Opportunities (2)

ATM and UTM integration

Digital Tower technologies could be used to accommodate a growing unmanned aircraft systems (UAS) presence and could result in:

-  Improved safety
-  Operational continuity
-  Continuous UAS information sharing
-  Improved situational awareness



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Questions and Answers

Register now for the other webinars in the series

Part two – Technology and Enhancements

2 February @ 13:00 CET

This second webinar in the series is a discussion with vendors and systems providers and to address the technological aspects of remote and digital towers.

Part three -Case Studies and Key Learnings

16 February @ 13:00 CET

The final webinar is a discussion with ANSPs who will talk about the operational aspects of remote and digital towers.

<https://canso.org/events/>

Thank you

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