SESAR – Delivering Digital Remote Tower Solutions

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International Remote Tower Seminar, 9 October 2018

ENAC, Toulouse

SESAR JOINT UNDERTAKING

Founding Members

EUROPEAN UNION EUROCONTROL

Agenda

- Introduction to SESAR
- Delivered SESAR Remote Tower Solutions and Past Demonstration Activities
- Ongoing SESAR Remote Tower Industrial Research and Exploratory Research Activities
- Conclusion

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SESAR lifecycle

The power of partnership

founding members

EUROPEAN UNION EUROCONTROL

AIRBUS

AT-One

B4 CONSORTIUM

COOPANS REAL COOPERATION, REAL RESULTS

DASSAULT AVIATION

DFS Deutsche Flugsicherung

dgac DSNA

ENAIRE

enav

FREQUENTIS SESAR PARTNERS Frequentis • Atos • HungaroControl

Honeywell

indra

LEONARDO

NATMIG

NATS

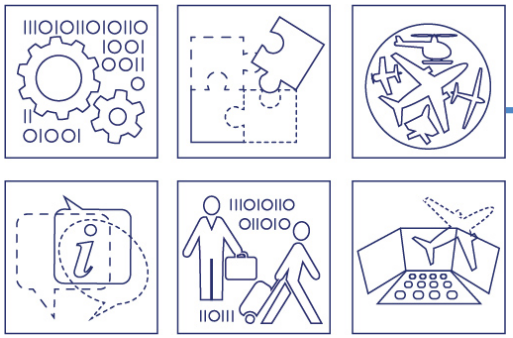
SEAC

skyguide

THALES

SESAR 1 (2008-2016)

The SESAR 2020 pipeline to innovation



4 THEMATIC AREAS

3 research strands

- EXPLORATORY RESEARCH
- INDUSTRIAL RESEARCH
- LARGE-SCALE DEMONSTRATION

Budget: EUR 1,6 billion
Timeline: 2016-2024
Calls: open and closed

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

A changing world

Traffic growth

- World's population to grow to ~9.7B in 2050
- Reduced share of Europeans (~7%)
- Two thirds in urban areas & new middle class
- Emergence of mega-cities
- Increased need for mobility

Technology disruption

- Augmented/virtual reality/Internet of things/drones
- Entry of digital players
- Accelerated technology lifecycle

Customer expectations

- Hyper or 'always-on' connectivity
- Personalised, data-driven customer experience
- Door-to-door service capabilities.

Automation

- Application of machine learning & mobile robotics
- Changing role of human
- Enriching talent pool

Global competition

- Reshaped with new global leaders (China, India)
- Growing influence of non State players (e.g. Google, Amazon, Facebook and alike)

What does this mean for aviation?

- **High performing connected aircraft**
  - ✓ Industry is constantly developing and improving its products in response to competition
  - ✓ New entrants in a global market drive innovation
  - ✓ Technology lifecycles are accelerating

- **Optimised airline operations**
  - ✓ Competition leads to improvement of services while putting pressure on costs
  - ✓ Mobility as a service to passenger vs. air transport

- **An ecosystem that will have to adapt**
  - ✓ Technology, regulation and policy are key drivers
  - ✓ Management of information at the core of the system
  - ✓ Reform while leading change is our major challenge

The SESAR digital transformation

SESAR Innovations

S1&S2020

Coming Next

Virtualisation

Virtual & Augmented Reality

- Approach & landing aids for the cockpit
- Visual aids for tower control

Virtual Centres

- Rationalisation
- Contingency
- Dynamic cross border
- Delegation of airspace

Remote Tower

- Single airport
- Multi-source surveillance data fusion
- Multiple & Large airports

Connectivity

Cockpit evolution

- Multilink Management
- Broadband Satellite comm. (ESA-Iris)
- Broadband Airport comm. (Aeromacs)
- Broadband Ground Comm. (LDACS)
- Cellular link for GA/RC

U-Space

- Command & Control
- Tracking & telemetry
- Vehicle to Vehicle
- Vehicle to Infrastructure

Data sharing

- Collaborative Airport and Network
- Digital Aeronautical Information (AIM-MET)
- Flight object sharing (IOP)
- Cloud based drone information management

System-Wide Information Management (SWIM)

- Yellow profile for Web Services
- Blue profile for Flight Data
- Purple profile for Air/Ground Advisory Information Sharing

Coming Next

- Defragmented European Sky
- Pan European service provision capability
- All weather operations
- CNS as a service
- Fully Dynamic Airspace
- Resilient operations
- Pan European Mobility of staff
- Hyper Connectivity for High Automation
- Next generation links
- Internet of Things for aviation
- Future Data services and applications
- Interconnected Network
- Passenger centric ATM
- Advanced analytics for decision making
- Open Data
- Multimodality

Baseline

New standards for safety and security

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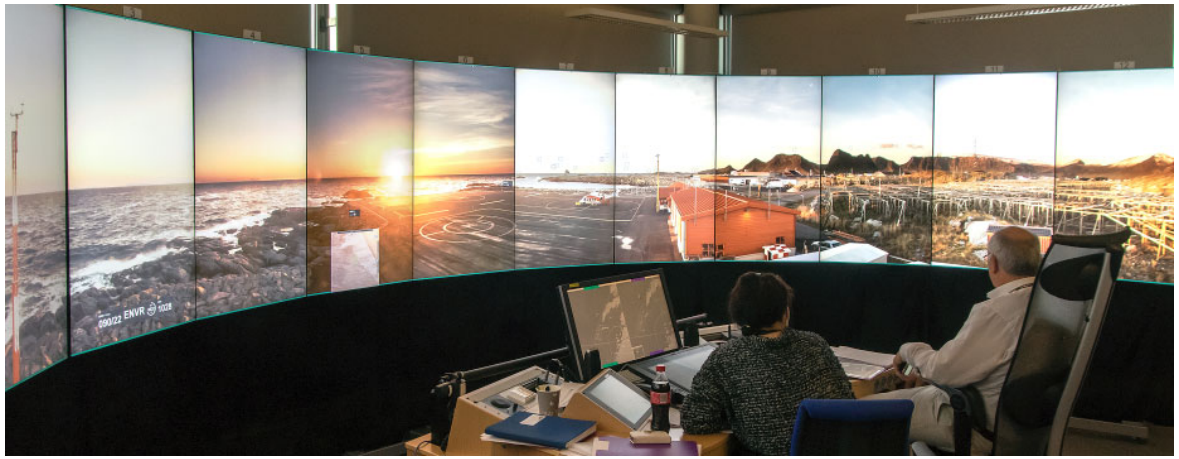
ATC And AFIS Service In A Single Low-Density Aerodrome From A Remote CWP

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

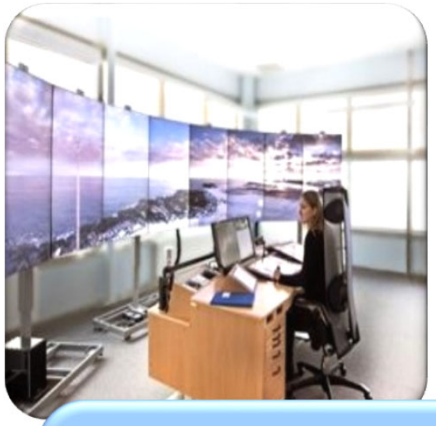
- **Increased cost efficiency**
- **Increased accessibility to and support for regional economies**

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

STAKEHOLDERS

- ANSP
- AO
- AU
- NM

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.

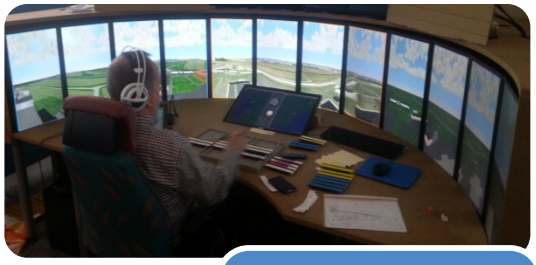
BENEFITS

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

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

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

STAKEHOLDERS

- ANSP
- AO
- AU
- NM

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.

BENEFITS

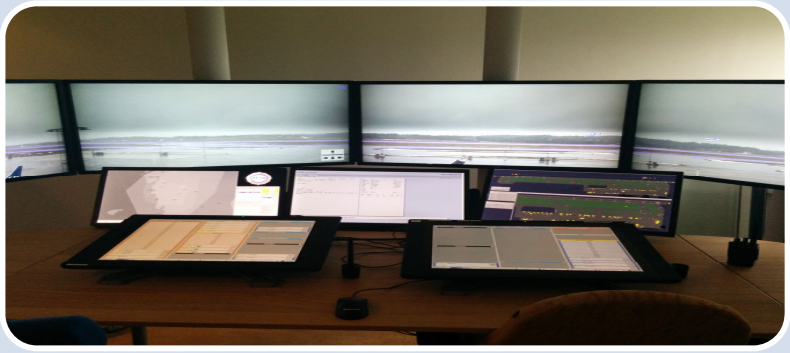
- **Increased cost efficiency**
- **Improved resilience in degraded situations**

Contingency towers deliver increased operational resilience for medium-sized airports

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

SJU references:
#13 / Release 5

Solution #13 Final Validations



V3 shadow mode contingency operations

- Göteborg Landvetter airport, Sweden
- March 2015

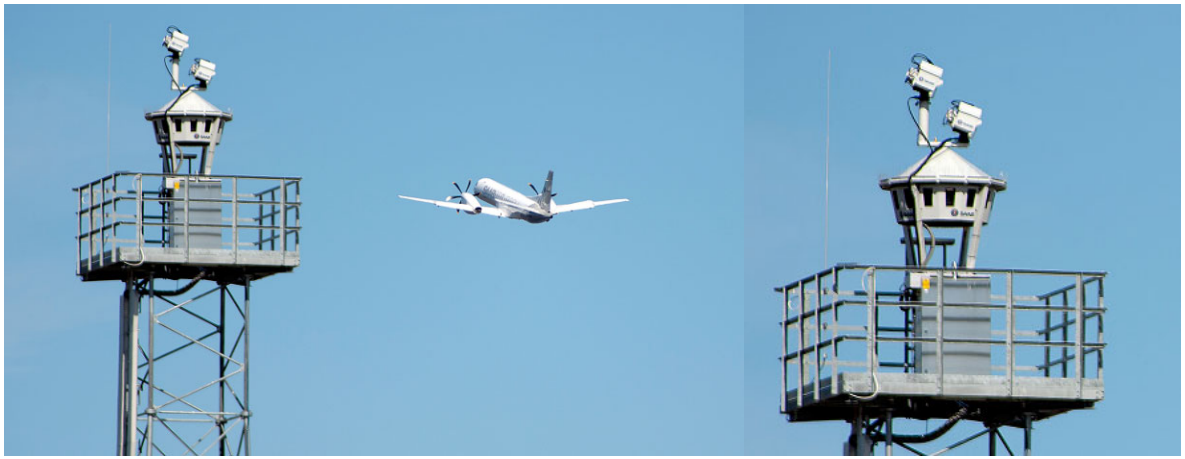
V3 shadow mode contingency operations

- Girona airport, Spain
- November 2015

Single Remote Tower Operations For Medium Traffic Volumes

STAKEHOLDERS

- ANSP
- AO
- AU
- NM



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.

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

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

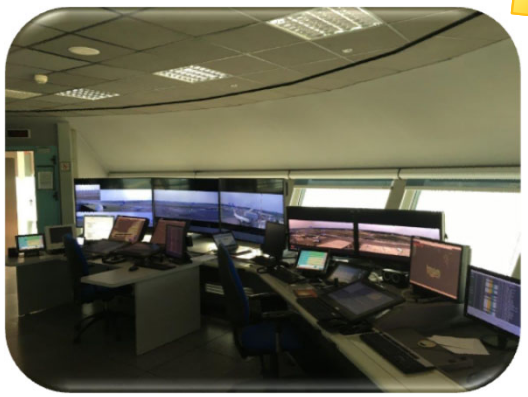
Remote airport: part of Milan Malpensa

Scenario 1

Scenario 2

Scenario 2

Physical airport: Milan Malpensa



RACOON RTC – Milan Malpensa

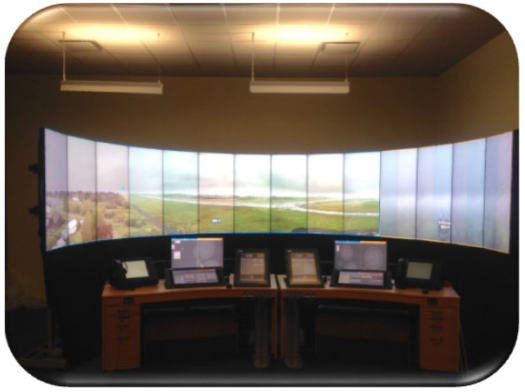
All scenarios in low traffic, nominal conditions, good weather and day & night

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

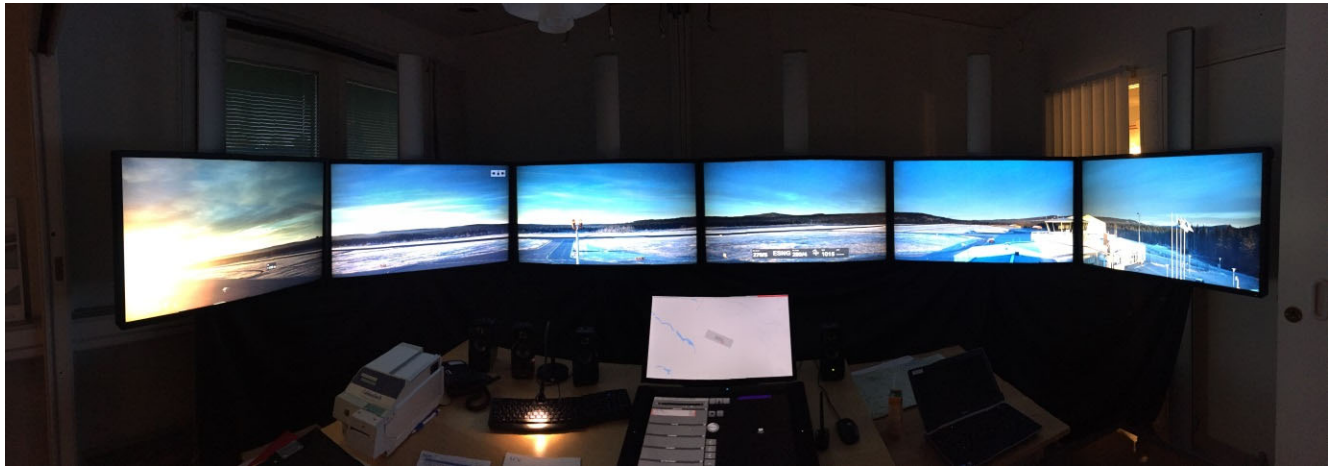
Remote airport: Shannon

Remote airport: Cork

Large Scale Demonstration – RTO

LVNL led 2 years project aiming at demonstrating that:

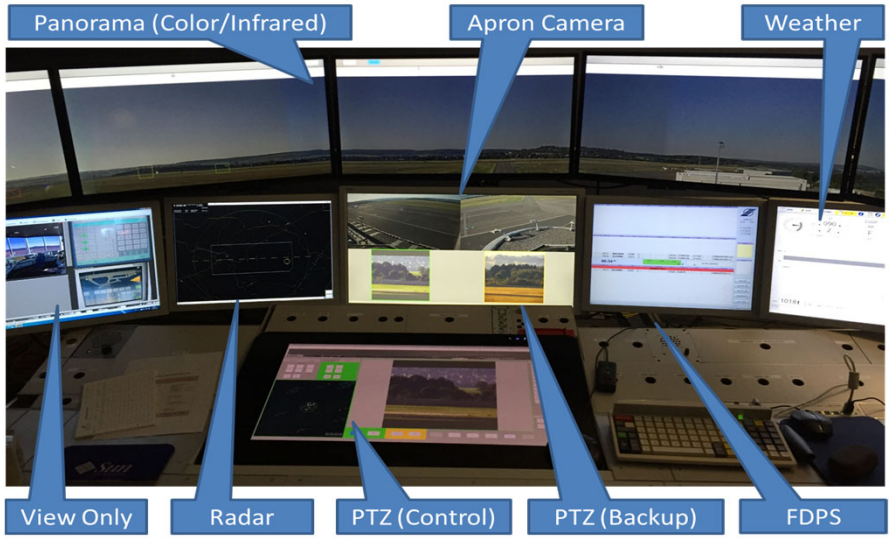
- It is possible to provide a basic solution for RTC with a reduced number of screens displaying a reduced view (full view selectable) and with a less complex CWP
    - Leader: LFV
    - Single remote tower (AFIS for a very small aerodrome)
    - Passive shadow mode
    - RTC: Sundsvall, Sweden
    - Remote airport: Gällivare, Sweden



Large Scale Demonstration – RTO

LVNL led 2 years project aiming at demonstrating that:

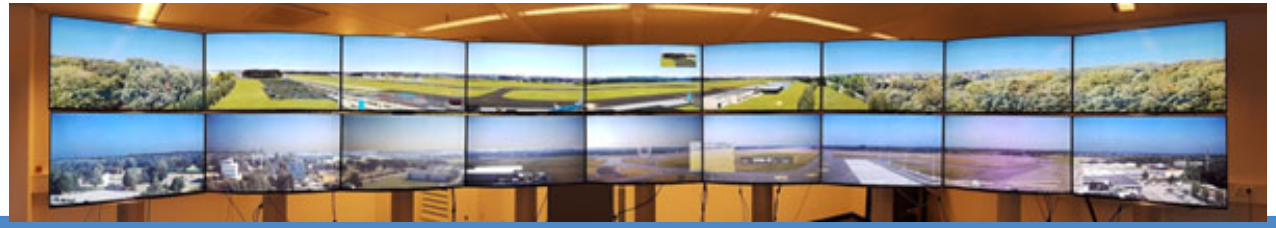
- Remote ATS can be provided to a medium size airport in an operational and technical environment
    - Leader: DFS
    - Single remote tower (ATS for a medium sized airport)
    - Passive shadow mode then live trials
    - RTC: Saarbrücken, Germany
    - Remote airport: Saarbrücken, Germany



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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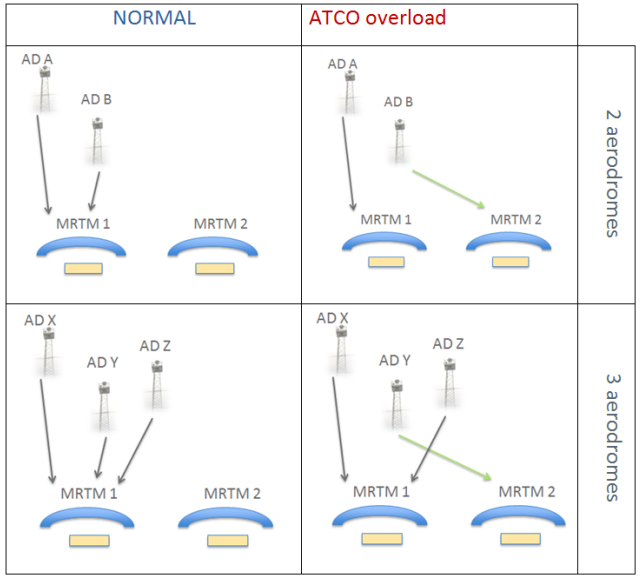
SESAR 2020 PJ05 – Remote Tower Beneficiaries

SESAR Solution PJ05-02

Remotely Provided Air Traffic Service for Multiple Aerodromes

Provision of Aerodrome Control Service or Aerodrome Flight Information Service for more than one aerodrome by a single ATCO/AFISO from a remote location. The ATCO (or AFISO) in this facility performs the remote ATS for the concerned aerodromes. It includes further development of the CWP and MET information from multiple airports. This solution goes beyond the scope of solution #52 (two small aerodromes).

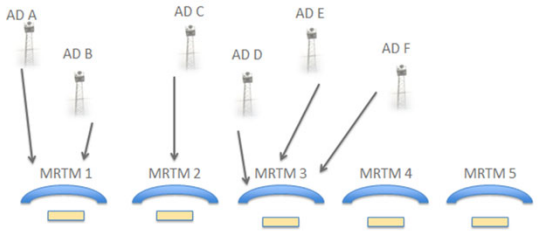


SESAR Solution PJ05-03

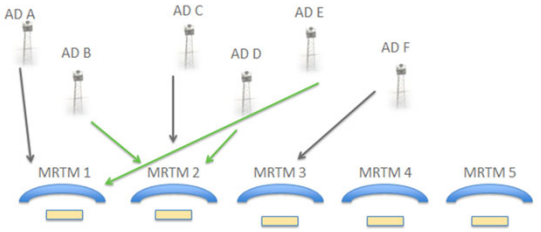
Remotely Provided Air Traffic Services from a Remote Tower Centre with a flexible allocation of aerodromes to Remote Tower Modules

Provision of remote tower services to a large number of airports with a flexible and dynamic allocation of airports connected to different RTM over time.

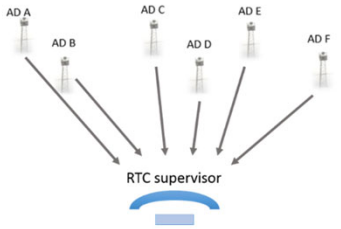
It includes the development of RTC supervisor and support systems and advanced automation functions for a more cost efficient solution, integration of approach for airports connected to the remote centre and connections between RTCs with systems for flow management between remotely connected airports and development of tools and features for a flexible planning of all aerodromes connected to remote tower services



Aerodrome allocation within an RTC with MRTM´s



Flexible allocation of aerodromes to MRTM´s



RTC Supervisor role with data from all connected airports

MOTO – the embodied remote tower

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

September and October 2017


March 2018

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

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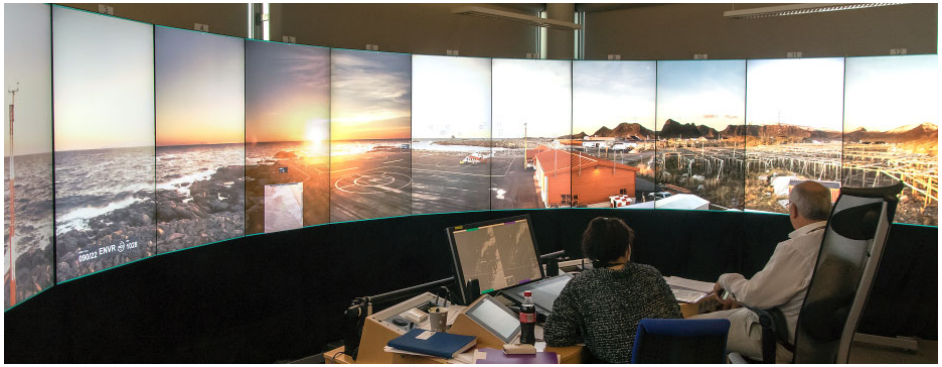
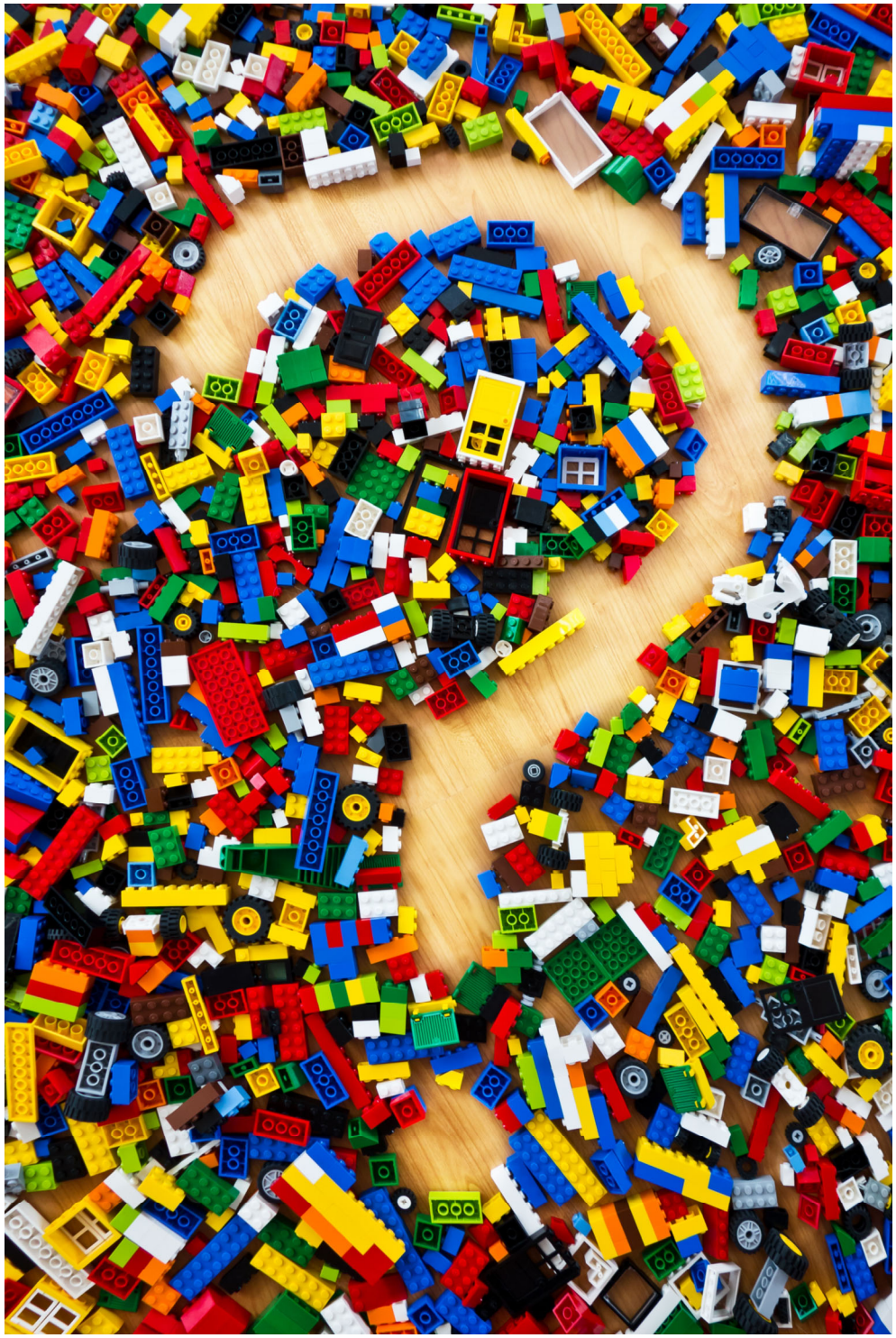
Conclusion



- Remote tower is part of the digital transformation needed to sustain the future of European aviation
- It supports the regional connectivity the European citizens are entitled to
- Several SESAR remote tower solutions are ready for deployment
- R&D continues to explore new safe, cost efficient and resilient solutions



SESAR Remote Tower Activities & Solutions

Thank you very much for your attention!

For more information: https://sesarju.eu/

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