

Digital Remote Towers

NACC/WG/11 Working Group Meeting of North American, Central American and Caribbean

Concept & Advantages

Reimagining Control Towers| Transforming infrastructure, operations and cost through digitalization



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Smarter Control, Anywhere

Run full ATC without a physical tower

AI-enhanced Vision

High-fidelity, stitched panoramic views

Operational Flexibility

Scalable to any airport size and cost structure

Augmented Reality System



Augmented Reality System



Visualization



The Budapest Case

Multi-Mast (Single Airport) | Digital Tower Type & Key Benefits



Key areas

Cost efficiency

- Much cheaper than building a new tower (80% cost reduction aprox)
- Increased capacity in low visibility conditions
- Increased capacity in contingency

Safety (Situational Awareness)

- Increased situational awareness and operations safety levels by means of augmented reality (labels overlays), zoom, thermal cameras, Tracking & AI functions
- Augmented reality at night or in low visibility conditions

People and Others

- No need to locate the system in the airside
- Much more scalable in terms of CWP, reorganizations, etc..
- Faster to deploy for airports expansion

Multi-Mast (Single Airport) | Digital Tower Key Design Criteria



Key areas

Airfield Equipment

- Number of masts and coverages becomes even more critical [prioritize Operational requirements vs. technical limitations like network, electricity, etc].
- Thresholds: Weather and Low visibility conditions
- Overlapping: Masts redundancy becomes mandatory
- Blind areas / hot spots: Addition of Gap filler cameras and Apron cameras

RTC and System

- Number of CWP's positions / sectors
- Videowall layout redesign [based on Operational requirements with 360° + Runways]
- Combination of Videowall + Individual Videowall

Others

- Operational and Contingency become replicas
- Contingency/3D Simulator becomes mandatory for training

Background & System Issues



History of LHB rTWR

- 2016 Remote tower implementation (SESAR VLD)
- 2017 Authority approval for contingency rTWR

Technical content of LHB rTWR

- Duplication or extension of existing conventional TWR systems + Video system
- 3 camera locations, 28 cameras (6 PTZs)
- Individual video displays + common video wall



Statistics

- 3 000+ hours live operations
- 15 000+ movements
- 90% IFR movements
- 90% in good visibility
- 60% in dual RWY operations
- Emergencies
- Training flights
- Airport and airspace restrictions
- In 2021 250+ hours without conventional TWR backup



Human factor difficulties

- Information overflow for ATCOs
- Too many independent systems
- Too many peripherals

Technical difficulties

- 2 “main” ATM systems developed parallelly
- Partial integration
- A-SMGCS capabilities not utilized
- Heritage systems in operation

Financial difficulties

- Main tower need to be refurbished

Past



“The Decision” & Project Main Work Areas

mirTWR program goal: implementing the most advanced and integrated visual + A-SMGCS tower system in order to solve all the issues detected in the previous digital tower system while avoiding the need of a conventional tower for providing control services to Budapest airport



How to do it?

- Upgrading to a best in class A-SMGCS
- Better visual coverage of the airfield
- Implementing a state of the art visual system
- Full integration between heads-up and down systems
- Redesign of the CWP integrating most auxiliary systems into the TWR system HMI

mirTWR program Schedule

- Program launched 2017
- A-SMGCS interface upgrade 2019
- Video system upgrade 2020-2023
- A-SMGCS major upgrade 2020-2023
- MLAT upgrade 2021-2022
- ATSEP trainings 2025-2026
- ATCO trainings 2025-2026
- Live operations 2026

Future: Today



Better Visual Coverage Of The Airfield



Multi-mast digital tower visual system (1 mast with 360° view + 6 additional masts) for a perfect visual coverage of the airport

Location	Type	N	FOV
Mast 1	Fix Cameras (4K)	4	180°
Mast 2b	Fix Cameras (4K)	3	150° ^a
Mast 12c	Fix Cameras (4K)	5	235°
	PTZ (FullHD)	3	
Mast 5	Fix Cameras (4K)	6	270°
	PTZ (FullHD)	1	
Mast 4	Fix Cameras (4K)	5	235°
	PTZ (FullHD)	2	
Mast (CARGO)	Fix Cameras (4K)	4	180°
	PTZ (FullHD)	1	
	Fix Cameras (4K) Vertical	16	360°
TWR	SLG PTZ (FullHD)	2	
	PTZ Thermal (FullHD+VGA)	1	
TOTAL		53	

Foggy weather

Mast view

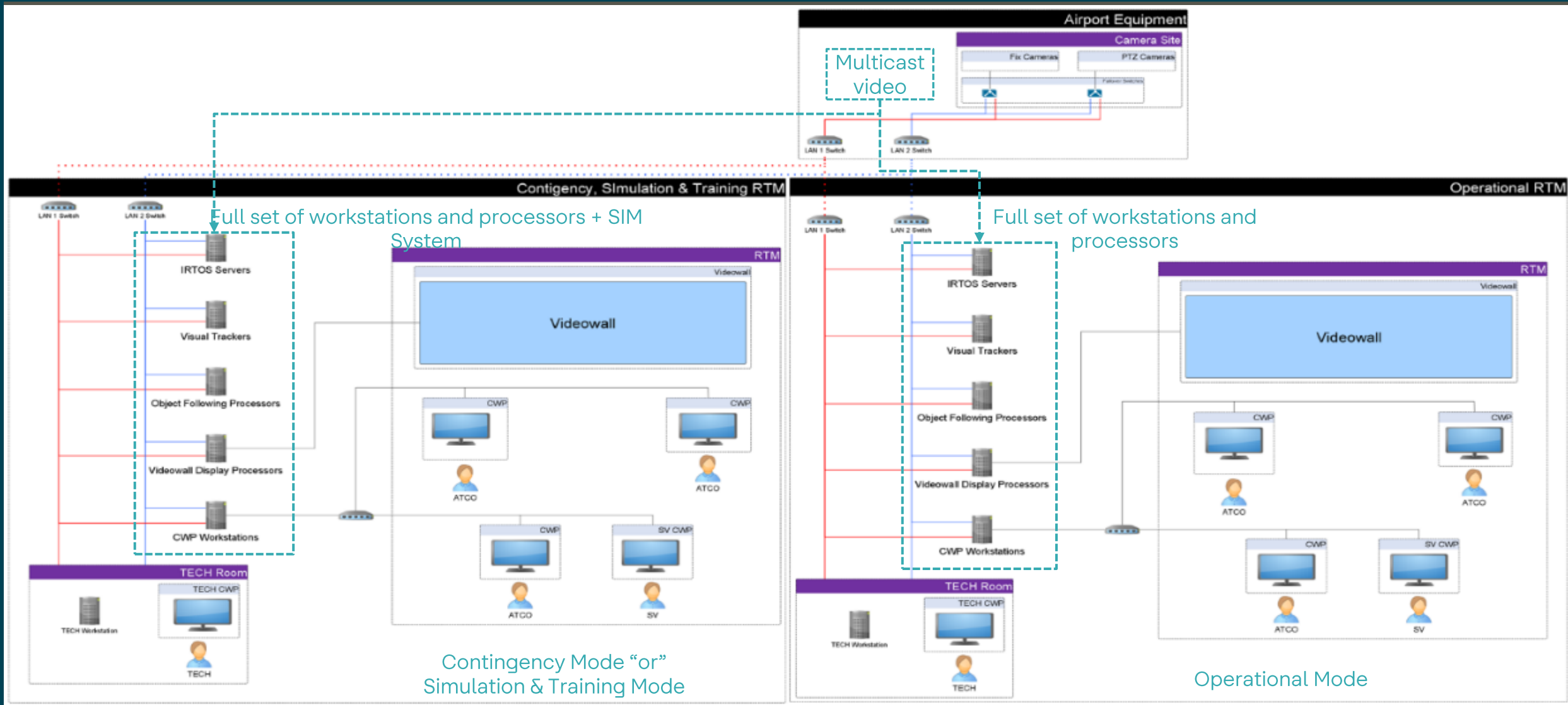
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13L III II

Tower view

31R III II

Architecture & Working Modes



Main & Contingency Remote Tower Centre



Common video wall

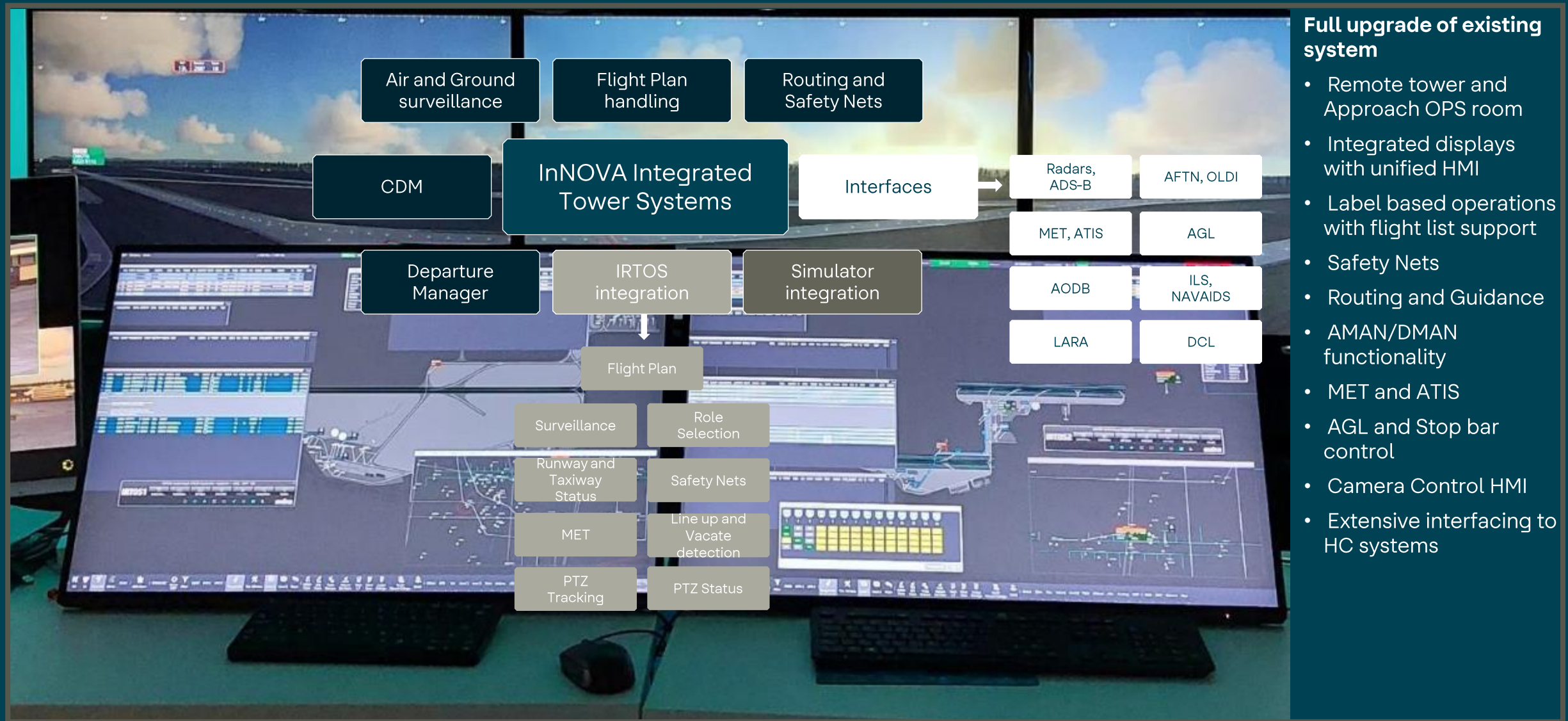
- Views from multiple camera towers
- Controlled by Supervisor

Five fully integrated working positions

- Personal Video displays
- Jurisdictions and camera control according to role

Contingency centre with Training facilities

Indra InNova ATM System



Full upgrade of existing system

- Remote tower and Approach OPS room
- Integrated displays with unified HMI
- Label based operations with flight list support
- Safety Nets
- Routing and Guidance
- AMAN/DMAN functionality
- MET and ATIS
- AGL and Stop bar control
- Camera Control HMI
- Extensive interfacing to HC systems

Integration Of TWR & Visual Module



Avoids the need of adding extra screens in CWP and simplifies the operation of the system

Advanced Integration (ICD+InNOVA)

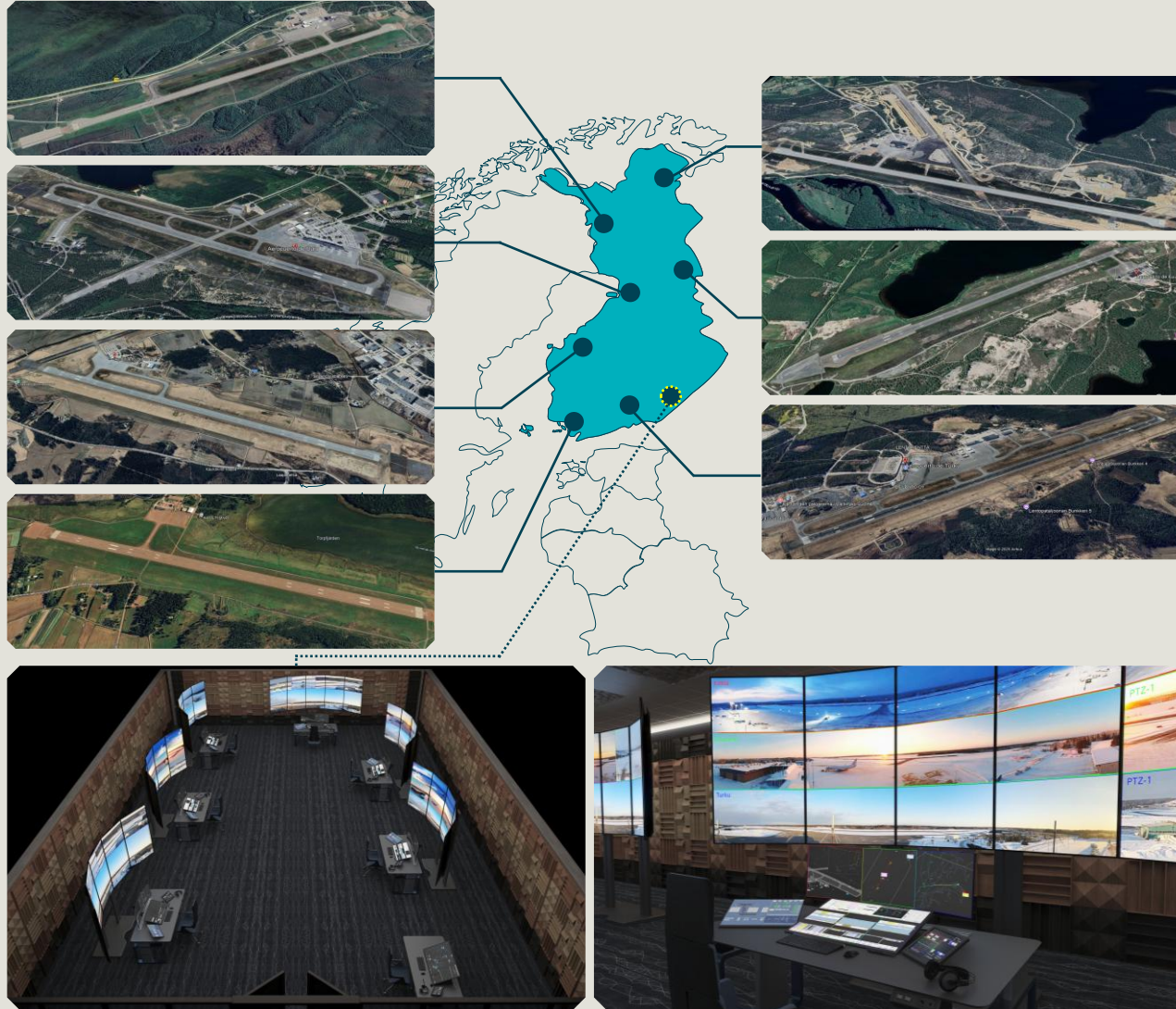
- Surveillance Information, etc
- Flight Plan Information, etc
- IRTOS HMI controlled from InNova

Fully operational Bidirectional actions

- Sectorisation
- Click&Point PTZ
- Click&Track
- TWY & RWY A-SMGCS maps
- Low Visibility maps
- Threshold monitoring function
- PTZ status on CWP

The Finland Case

Multiple Airports | Digital Tower Type & Key Benefits



Key areas

Cost efficiency

- Synergies in multi-airport operation (roughly 50%)
- Flexibility in staffing and shift optimization
- Savings in re-location of controllers in remote areas
- Optimization of maintenance and spare costs
- Can enable a “low cost control service” that small airports can afford

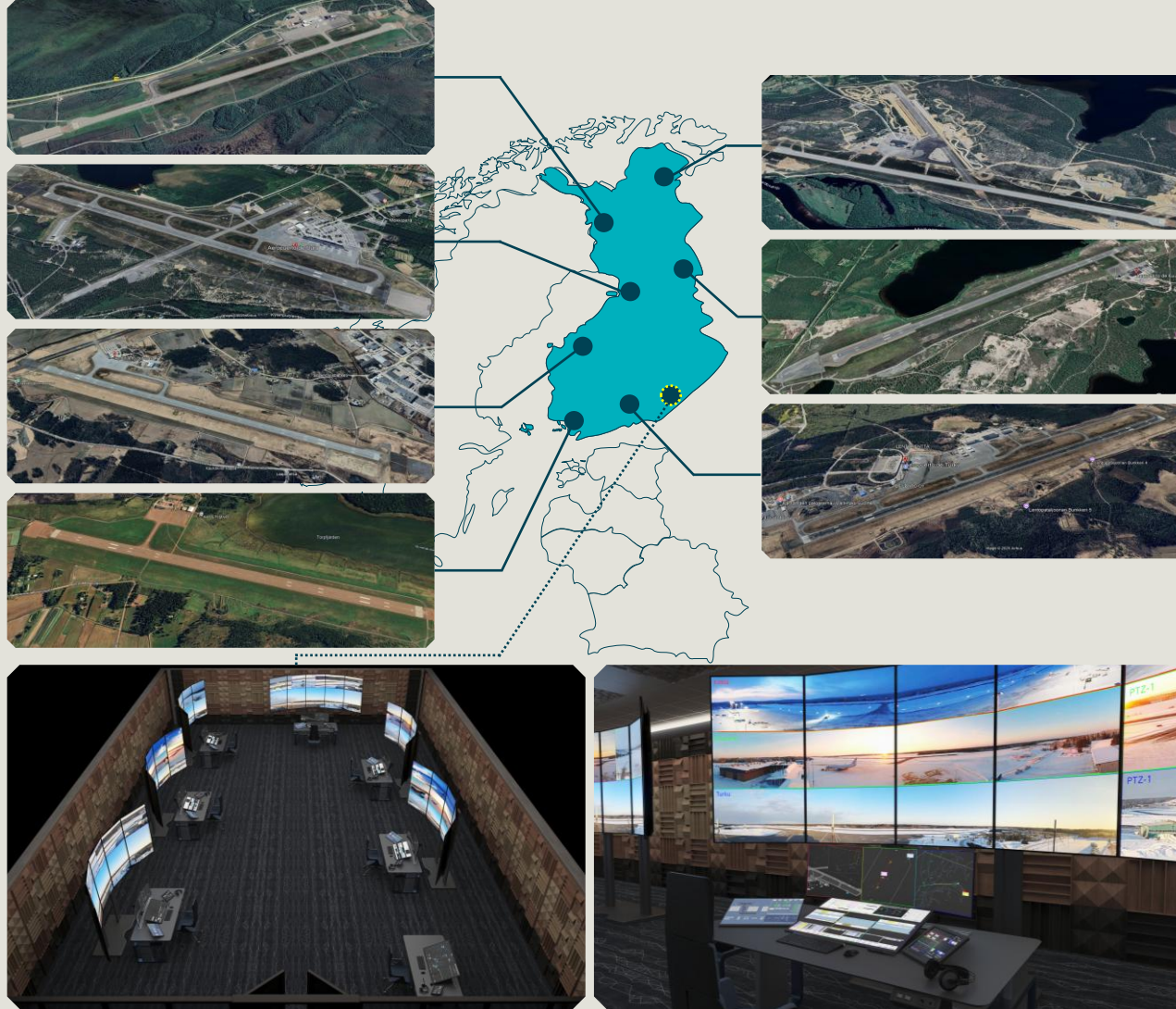
Safety (Situational Awareness)

- Increased situational awareness and operations safety levels by means of augmented reality (labels overlays), zoom, thermal cameras, Tracking & AI functions
- Augmented reality at night or in low visibility conditions
- Can enable a “low cost control service” for small airports

People and Others

- No need of re-locating of controllers in remote areas
- Better work environment – colleagues and professional community
- Better support in complex situations – e.g. emergencies
- Better location for recruiting and talent retention

Multiple Airports | Digital Tower Key Design Criteria



Key areas

Airfield Equipment

- Network design
- Equipment in extreme weather conditions
- Local maintenance

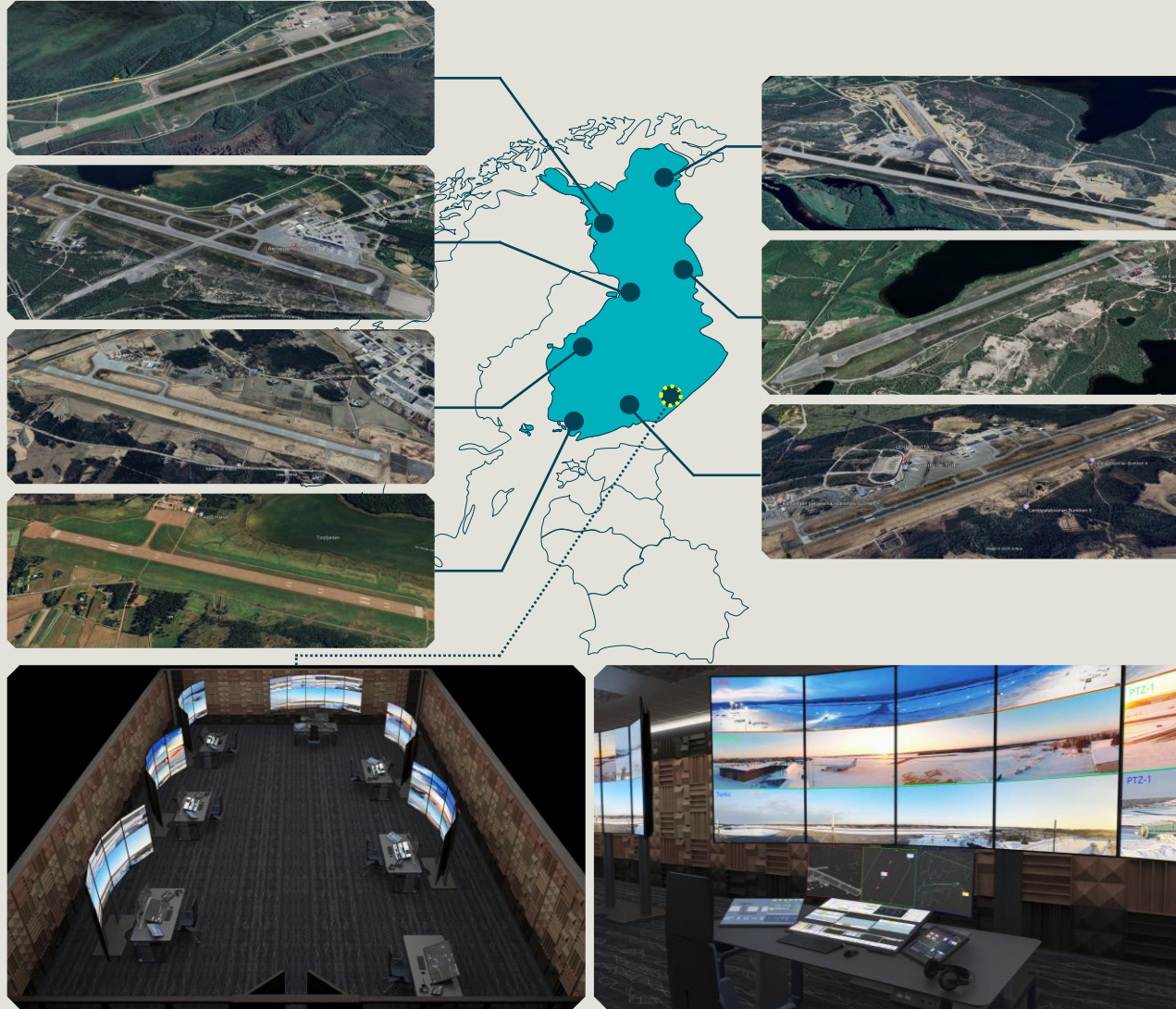
RTC and System

- Multi-operation configuration
- Workload-capacity optimization system
- System design to accommodate the operation
- CWP design to accommodate the operation

Others

- Training and certification of Controllers
- Regulatory process
- Other stakeholders such as airlines or unions

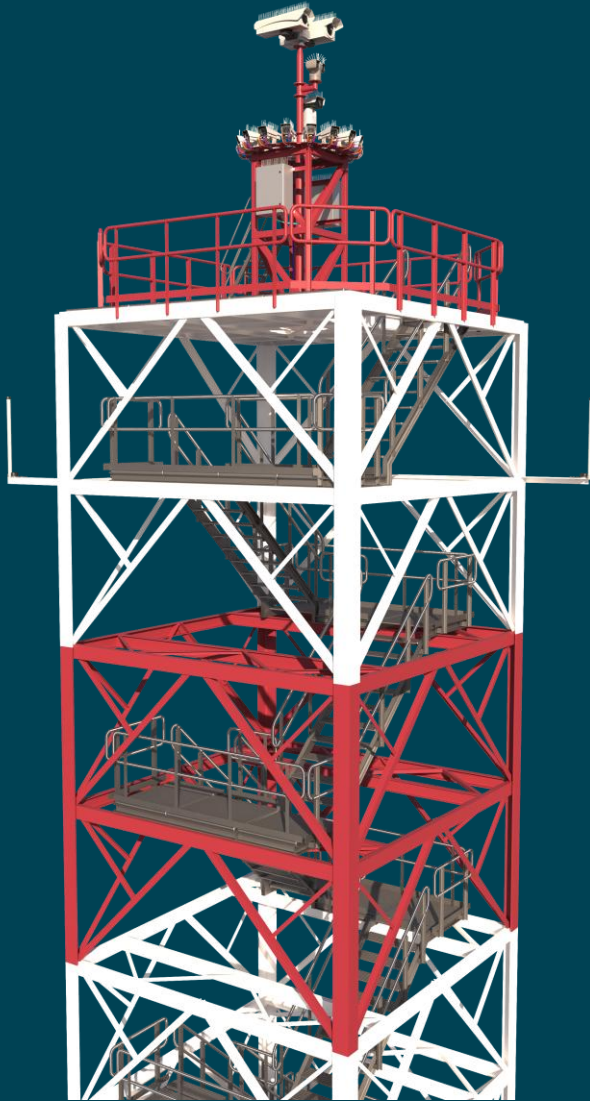
Multiple Airports | The Fintraffic Program



The Fintraffic Program

- 7 Airports in Finland
 - RTCs in Helsinki
 - 1200 Kms to the furthest airport
 - Very extreme weather conditions
 - Operational, Contingency and Test/Training Environments
 - All Head up and Head down equipment from Indra
 - Multi-airport operation from day 1
 - Workload-capacity optimization system including all cases:
 - 1 Controller for 3 airports
 - 1 Controller for 2 airports
 - 1 Controller for 1 airport
 - 1 Controller for 0,5 airport
- First program in the world to target Multi-Airport Control Operations

Mast & Cameras

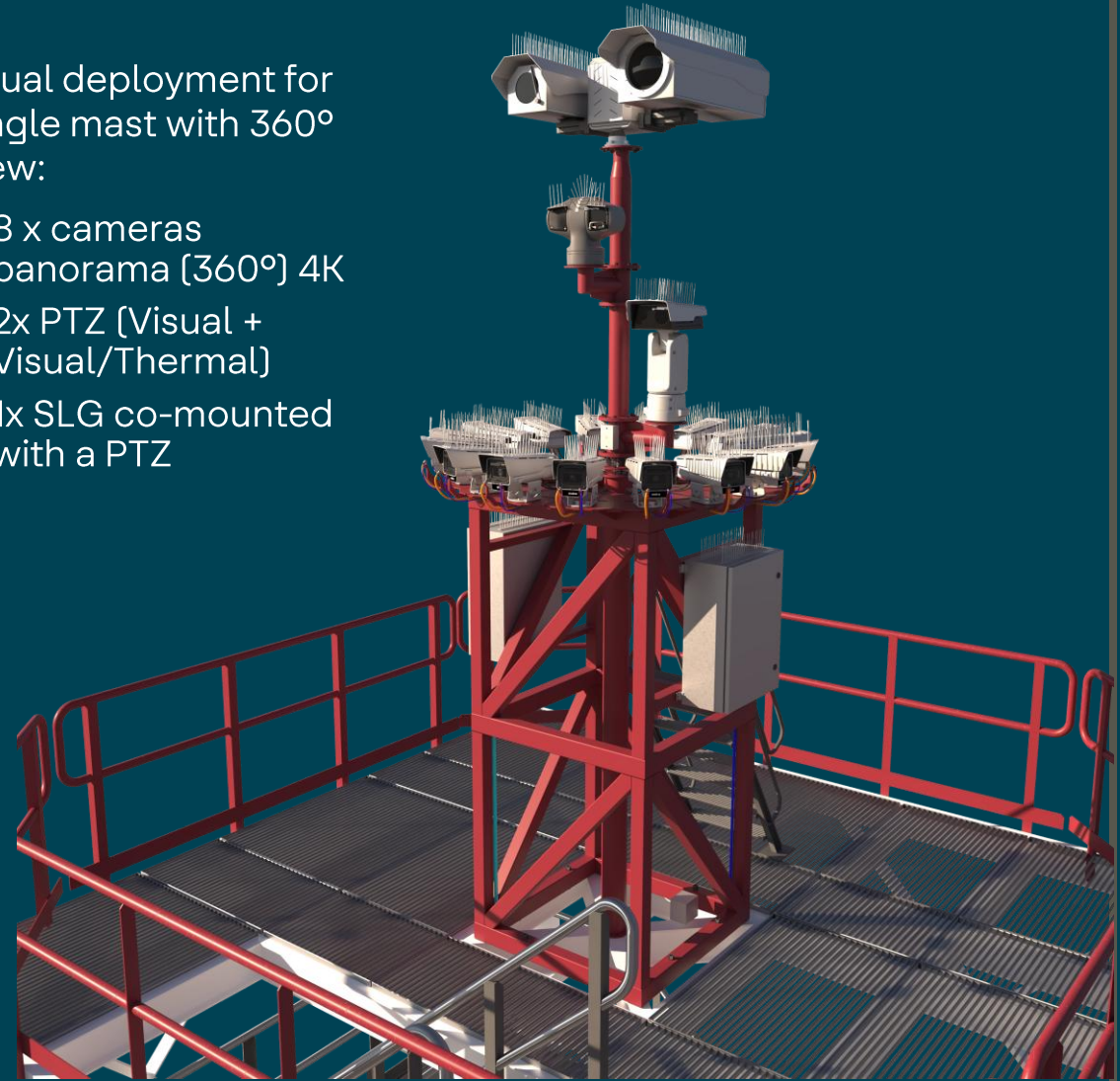


Mast to be deployed by
the customer based on
Indra's design

Stairs model selected

Usual deployment for
single mast with 360°
view:

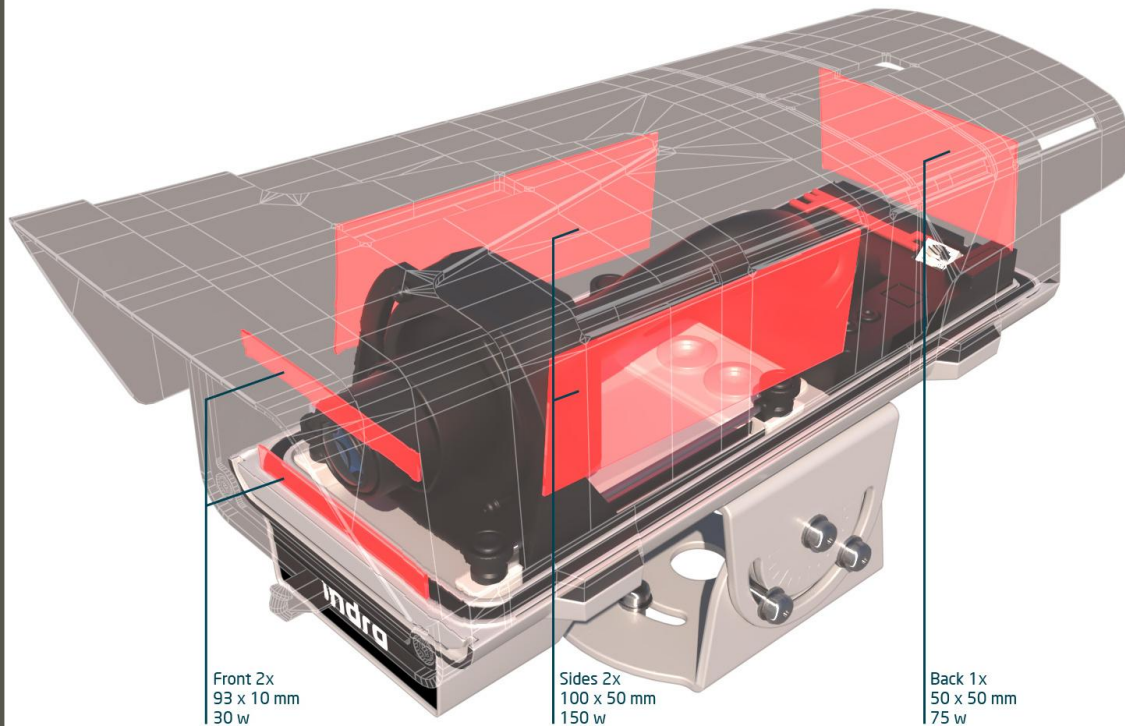
- 8 x cameras
panorama [360°] 4K
- 2x PTZ (Visual +
Visual/Thermal)
- 1x SLG co-mounted
with a PTZ



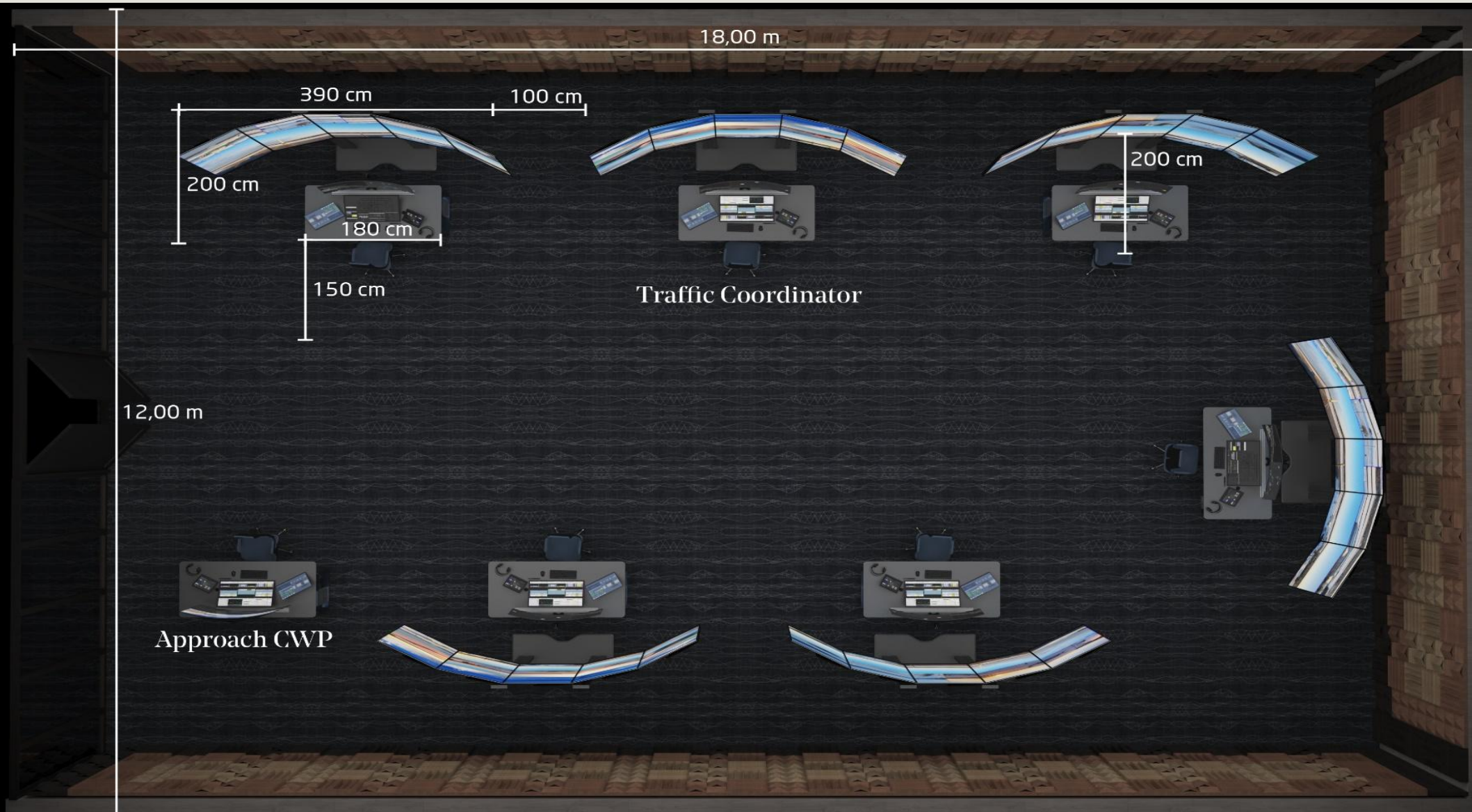
Mast & Cameras

Dual Cleaning and Heating system:

- Cleaning: water&wipers + compressed air
- Heating: electric + compressed air



The Fintraffic Program | Operational RTC



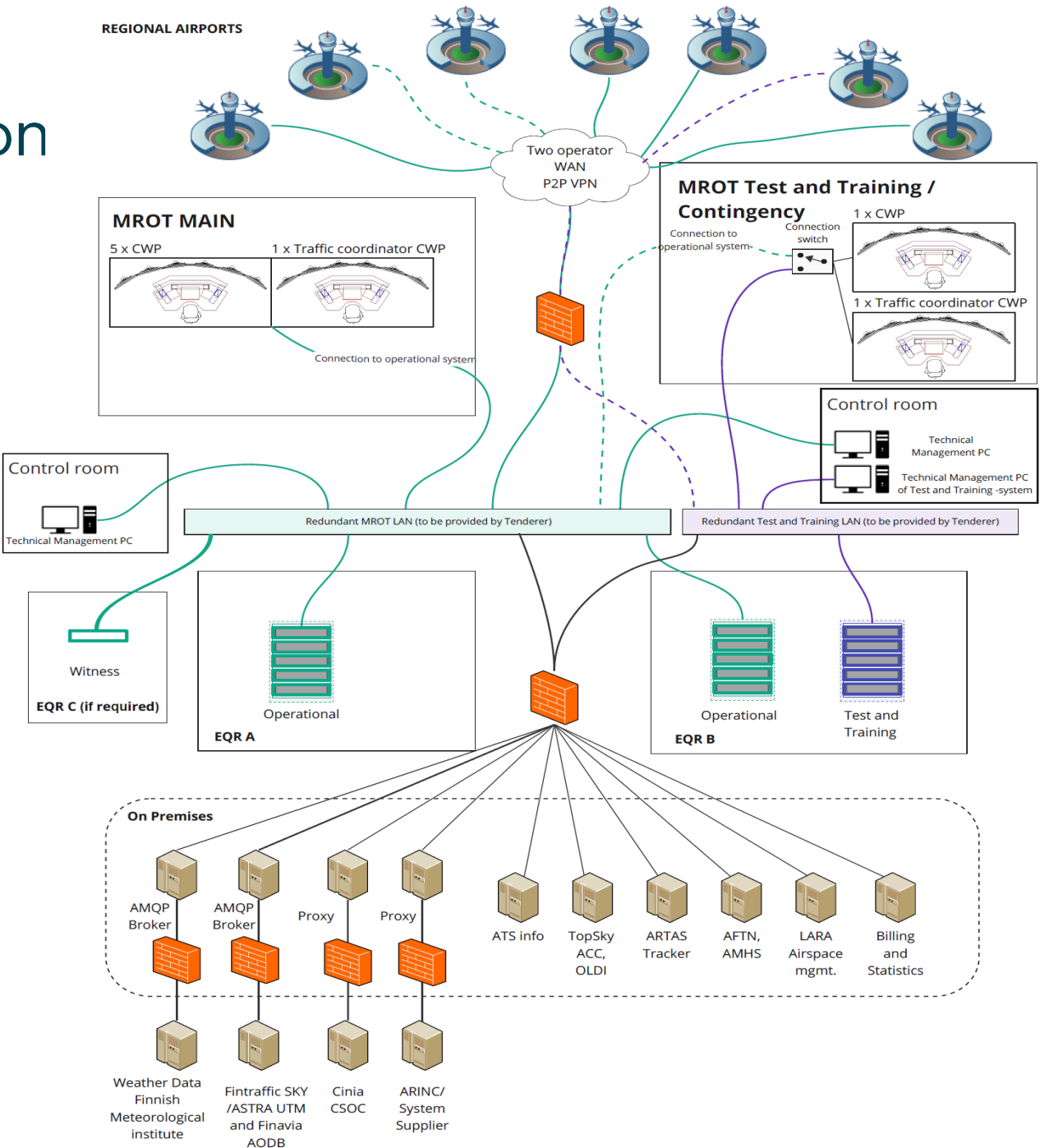
The Fintraffic Program | Module/CWP



The Fintraffic Program | Module/CWP



The Fintraffic Program | Integration



The Fintraffic Program | Module Configurations: Standard Tripe



The Fintraffic Program | Module Configurations: Secondary Triple



A 3D rendering of a modern, curved control room. The room features two operator desks with ergonomic chairs. The walls are covered with large, curved monitor arrays. The left monitor array shows various camera feeds, including a 'Zoomed Area' and 'Turku'. The right monitor array shows a grid of camera feeds, including 'Kittila', 'Rovaniemi', and 'PTZ-1'. The floor is covered with a dark, patterned carpet. The room is dimly lit, with light coming from the monitors and ceiling lights.

