

r-TWR Research/Industry update

Remote/Digital Towers

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Research “phases”

- Pre-SESAR 2006-2010
- SESAR1 2010-2016
- SESAR 2020 Wave 1 2017-2019
- SESAR 2020 Wave 2 2020-2023



(SESAR = Single European Sky ATM Research)

Pre-SESAR (2006-2010)



2006-2009

“Proofed the remote TWR concept” in the initial **ROT-project**, partnership with LFV

2008-2010

Additional advanced remote TWR-tools to ATCOs, in the **ART-project**, partnership with LFV, NLR, LYNN and EEL

Validation trials in SESAR 1

Single aerodromes

- TWR Validation 1 (*Ängelholm*) 2011
- TWR Validation 2 (") 2012
- AFIS Validation (*Röst/Norway*) 2013

Multiple aerodromes

- TWR/AFIS Simulation 2013/14
- Multiple TWR Validation (*Sweden*) 2014
- Multiple AFIS Validation (*Norway*) 2014/15

Contingency

- Validation 1 (*Gothenburg*) 2013
- Validation 2 (" - ") 2014

Single remote tower TWR trial 1 (VP-056)

- Remote tower platform in Sturup/Ängelholm, Sweden, as base (background from ROT/ART)
- Changed from projected images to LCD screens
- Incorporated infrared imaging
- Enhanced the image through camera pre- and post processing



Single remote tower TWR trial 2 (VP-057)

- Trial 1 platform as base
- Electronic strip system
- Upgraded 2/3 of the airport view to Full HD cameras for increased resolution
- Increased frame rate of video image
- Added 5 additional camera viewpoints at the airfield (gap filler and hotspot monitoring)
- Target tracking
- Image enhancements



Single remote tower AFIS trial 1 (VP-058)

- New platform in Bodö (RTC) and Värøy (heliport), Norway
- 360 degree Full HD view (260+100 presentation)
- Increased vertical camera coverage
- Upgrade of image enhancements
- Infrared image
- Target Tracking



Multiple remote tower TWR simulation (VP-060)

- New simulation platform in Växjö, Sweden
- Ability to dynamically open and close airports (with support of up to three simultaneous airports)
- Exercise leader and pseudo pilot positions connected to the remote tower system
- Multiple airport visual reproduction
- From paper strips to EFS



Multiple remote tower TWR simulation (VP-060)

- Multiple x2 – side-by-side and stacked



Visual Presentation for multiple airports

- Multiple x3 – side-by-side presentations



Örnsköldsvik Sundsvall

Landvetter



Örnsköldsvik

Sundsvall

Landvetter



Örnsköldsvik Sundsvall

Landvetter

Multiple remote tower TWR trial (VP-061)

- New platform in Sundsvall/Örnsköldsvik (connected to already existing remote airports)
- Controller working position for 2 simultaneous airports
- Visual reproduction of live video image from 2 airports
- Geographical overlays in the image
- Heads-up information
- Target tracking
- Enhanced image

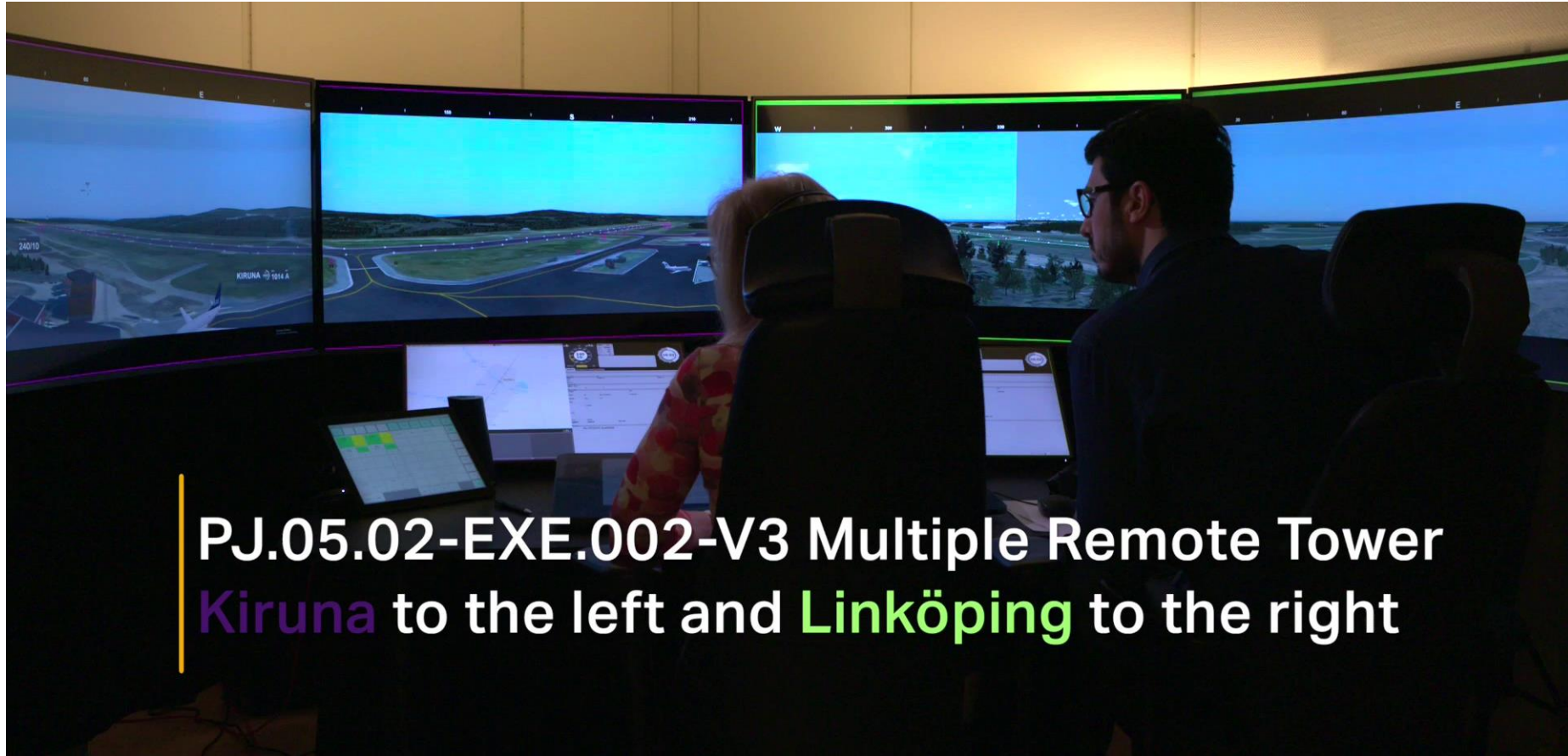


Multiple remote tower AFIS trial (VP-063)

- Based on single remote tower AFIS platform in Bodö/Värøy, Norway
- Added Röst airport
- Multiple simultaneous airports
- Infrared imaging
- Target tracking
- Image enhancements

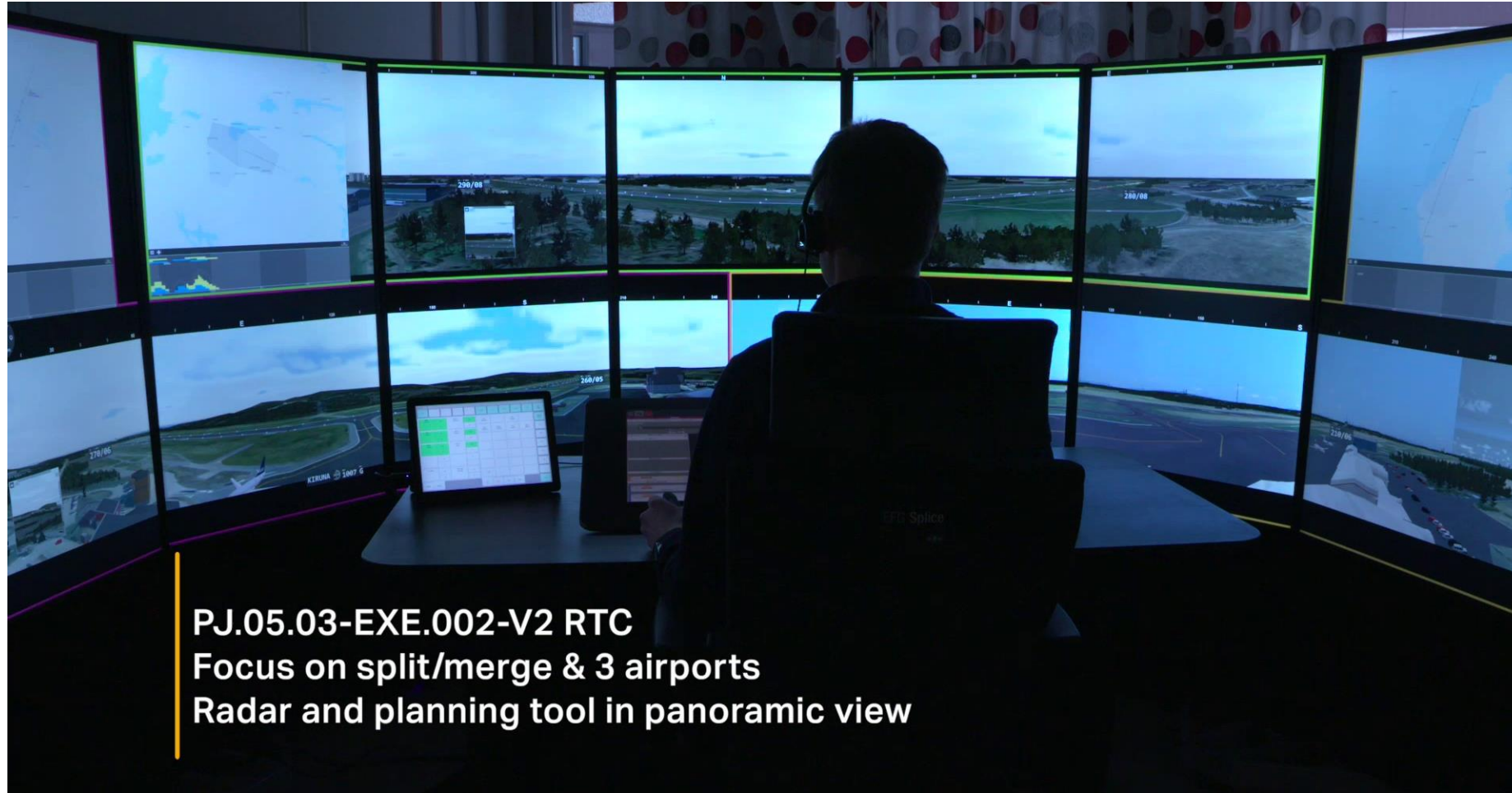


SESAR 2020 PJ05 Wave 1 2017-2019



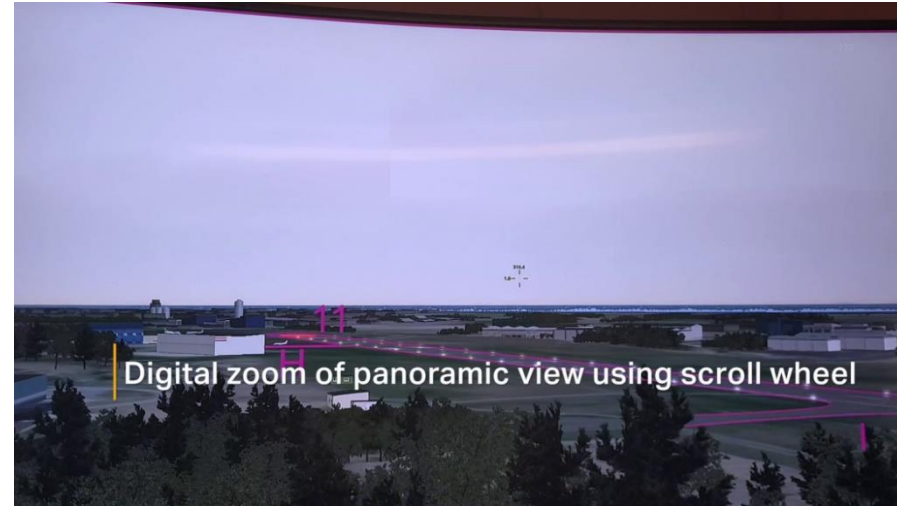
PJ.05.02-EXE.002-V3 Multiple Remote Tower
Kiruna to the left and **Linköping** to the right

SESAR 2020 PJ05 Wave 1 2017-2019



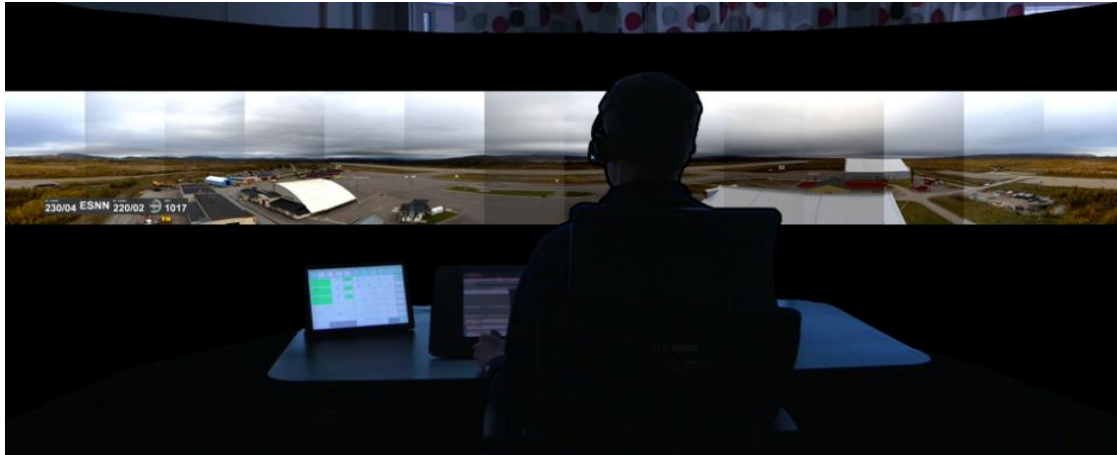
PJ.05.03-EXE.002-V2 RTC
Focus on split/merge & 3 airports
Radar and planning tool in panoramic view

SESAR 2020 PJ05 Wave 1 2017-2019

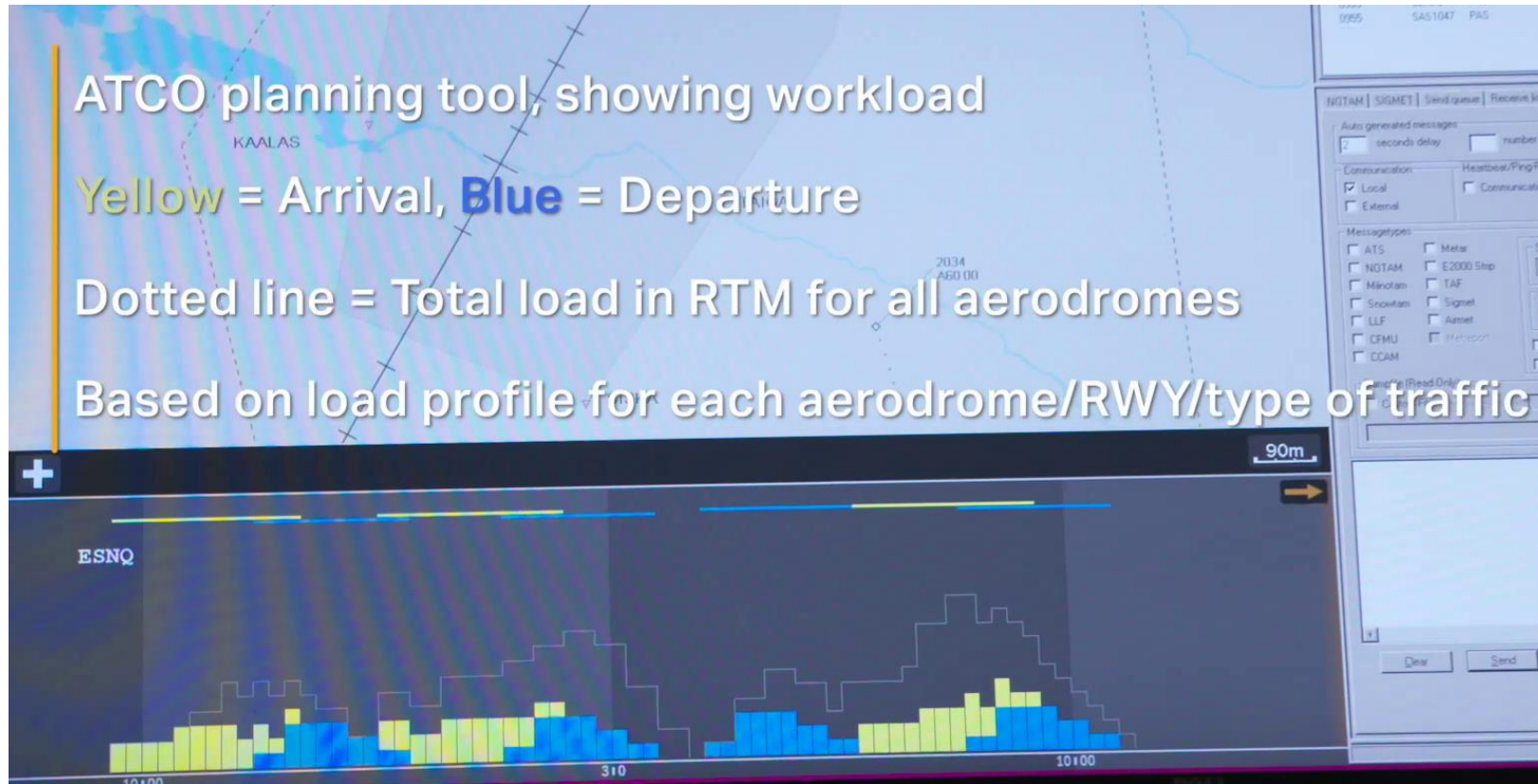


Digital zoom in the VP – Operator view

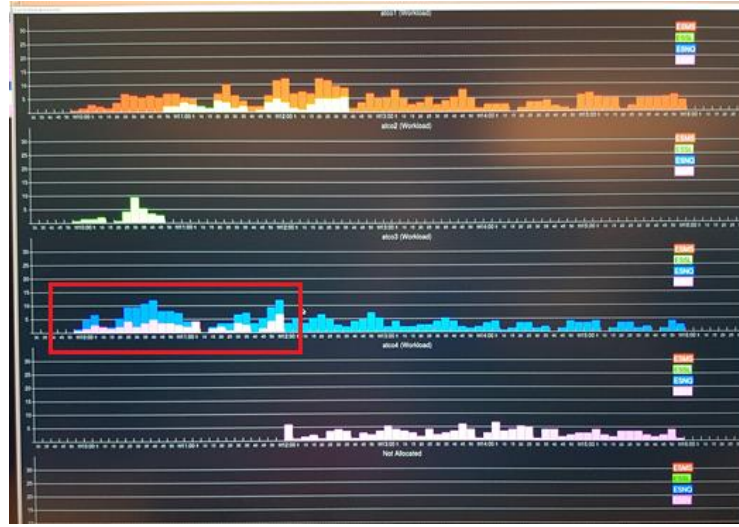
- Utilizing the whole VP as a PTZ camera – Visual Presentation Interaction (VPI)



Workload monitoring



Workload simulations (NLR) – 4 aerodromes



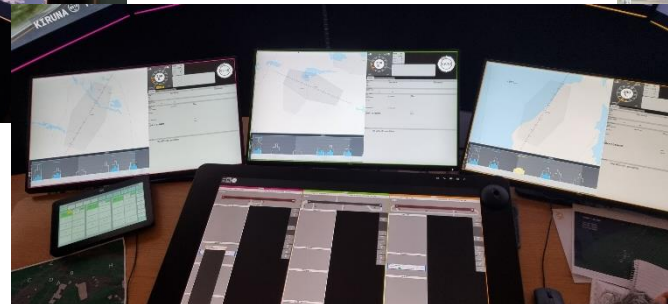
- Merge of workload for two aerodromes (pink and blue)
- Fast time (x15) simulation for the two aerodromes - Can I as an ATCO deal with the situation?

SESAR 2020 PJ05 Wave 2 V3, 2020-2022

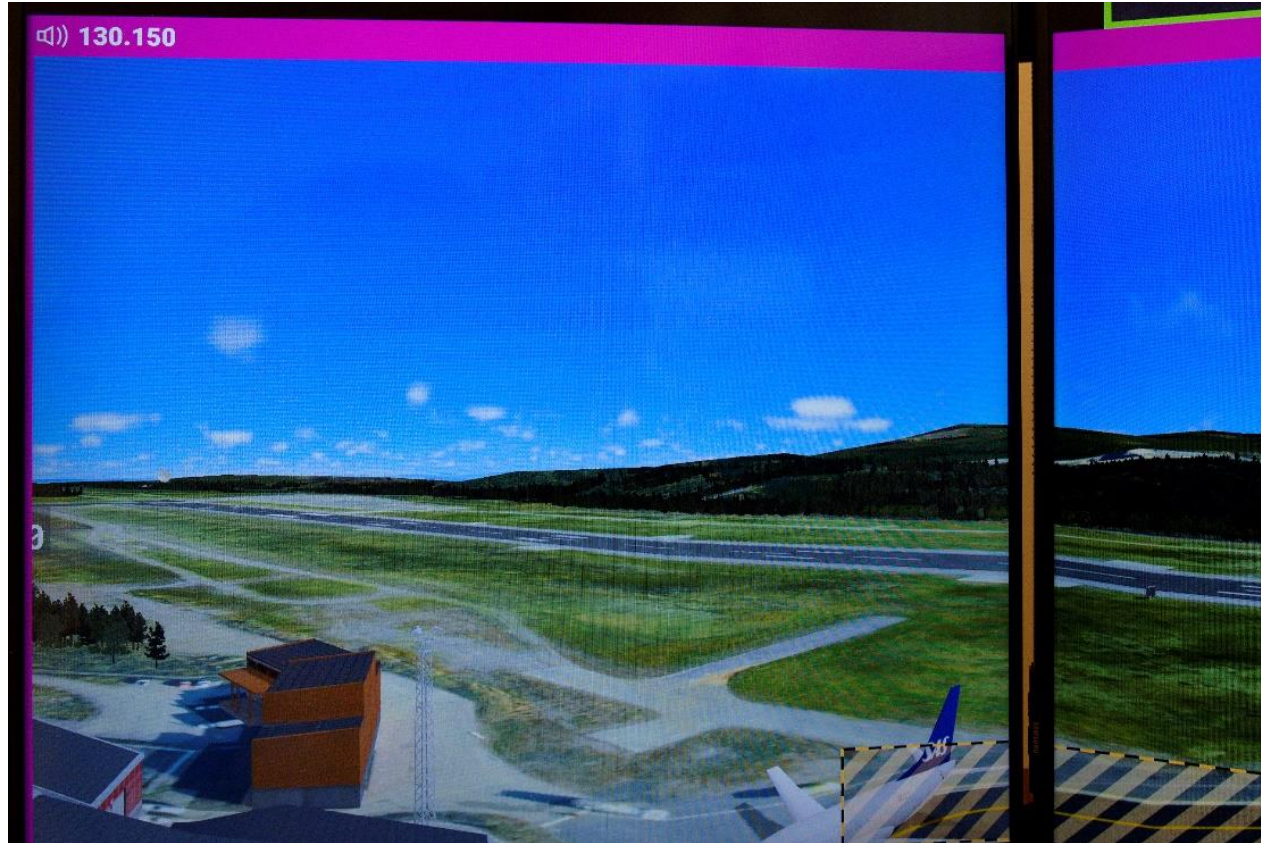
- Three Simultaneous airports
- Flexible allocation of airports
- **Operational handover process (VCS)**



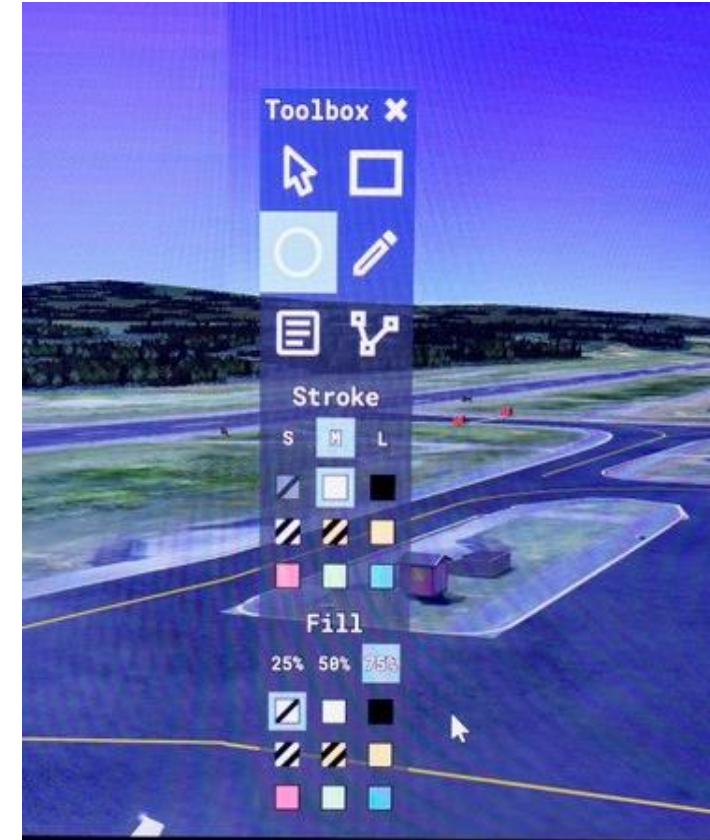
ATCOs from Sweden, Germany, Austria and Croatia



Indication of radio on panorama, drawing tool



Airport border color highlight - top=air, bottom=ground vehicles



Drawing tool

Compact RTM



Visual Presentation – A presentation surface – Any number of displays



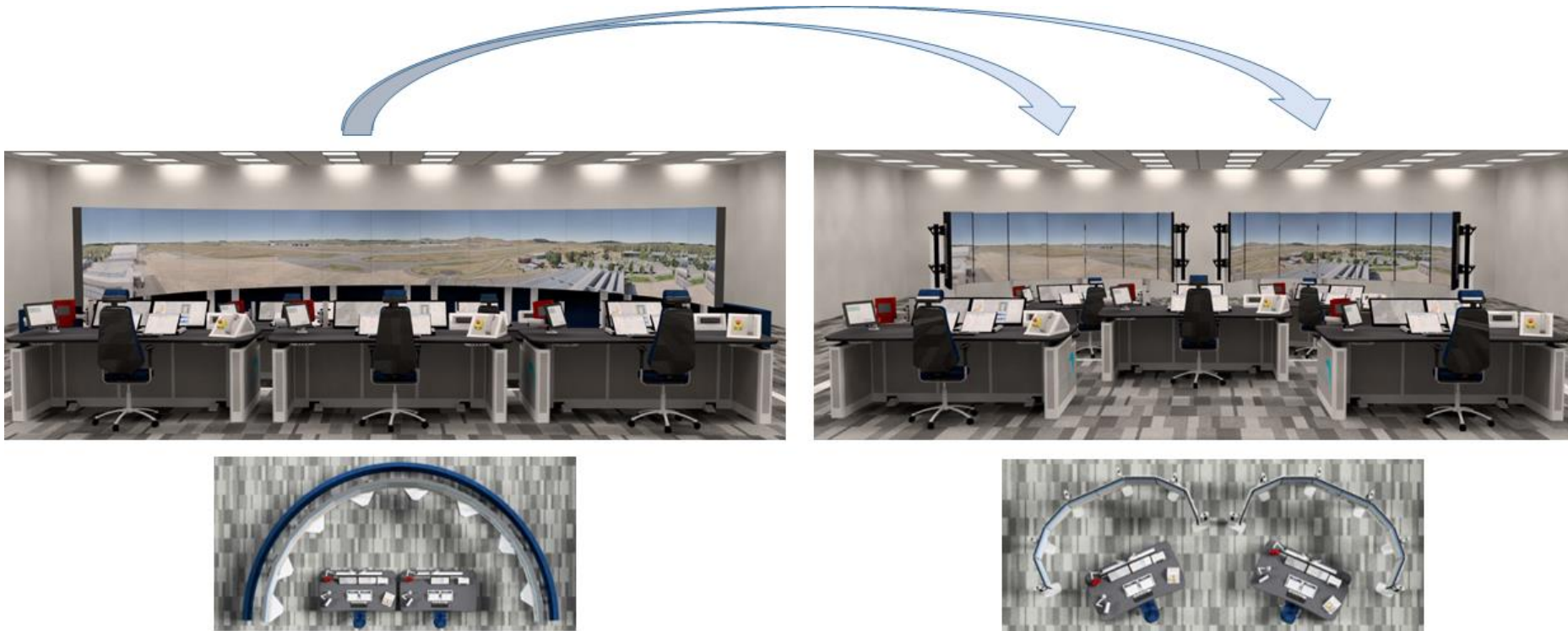
Movie working in a MRTM (4 min):
<https://youtu.be/MemvfN2hos8>



Movie MRTM hand over (10 min):
<https://youtu.be/gbSIOiXONts>

Role based presentation

- One large common VP or dedicated role based VPs
- Utilizing the VPI features (zoom/slide/pan/tilt) allows the operator to focus on their AoR (Area of Responsibility) using the same video feed.

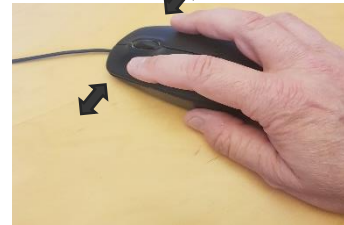


Simple/Basic tools may be what you really need!

- From multiple mouses (which mouse) to one common mouse (for VP and CWP)
- Where is the mouse pointer?



Where are you?



I'm here!

**Open Day
29 September
2022
~ 100 visitors**



EXE-2.2-V3-COOPANS
PJ05.35
Multiple Remote Tower
& Remote Tower Centre

JOINT UNDERTAKING KLAV COOPERATION. REAL RESULTS

PJ05.35
Multiple Remote Tower
& Remote Tower Centre
LFV



Saab r-TWR operational installations



 **SWEDEN**
RTC Sundsvall Örnsköldsvik,
Sundsvall, Linköping, SMA




 **SWEDEN**
RTC Stockholm Kiruna and
Östersund (Malmö and Umeå 2023)



 **UK**
London City Airport




 **GERMANY**
NATO Base, Geilenkirchen



 **USA**
Leesburg Airport



 **USA United Airlines**
Houston and Kansas City



 **UK**
Cranfield Airport



 **Romania**
Brasov new airport, ROMATSA



 **THE NETHERLANDS**
Schiphol, Centralised base



 **UK**
Royal Navy, Culdrose



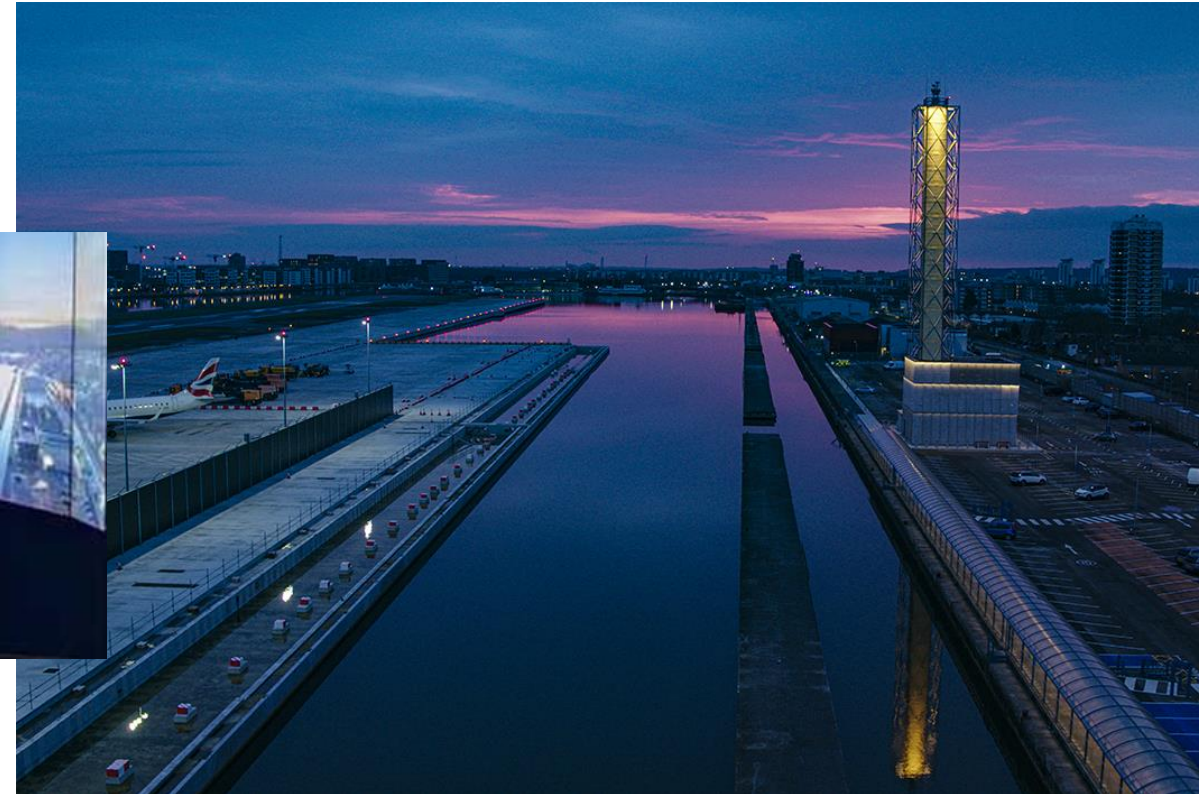
 **Belgium**
Charleroi/ Liege RTC



 **IRELAND**
Cork and Shannon

London City Airport

- Operational from the RTC in Swanwick in April 2021



Rumania – Brasov airport

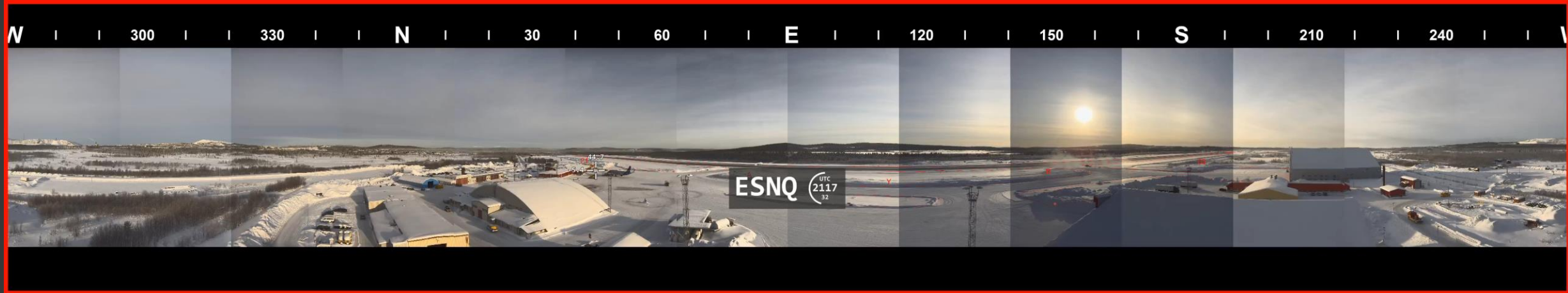
- Second new airport in the world without building a traditional tower



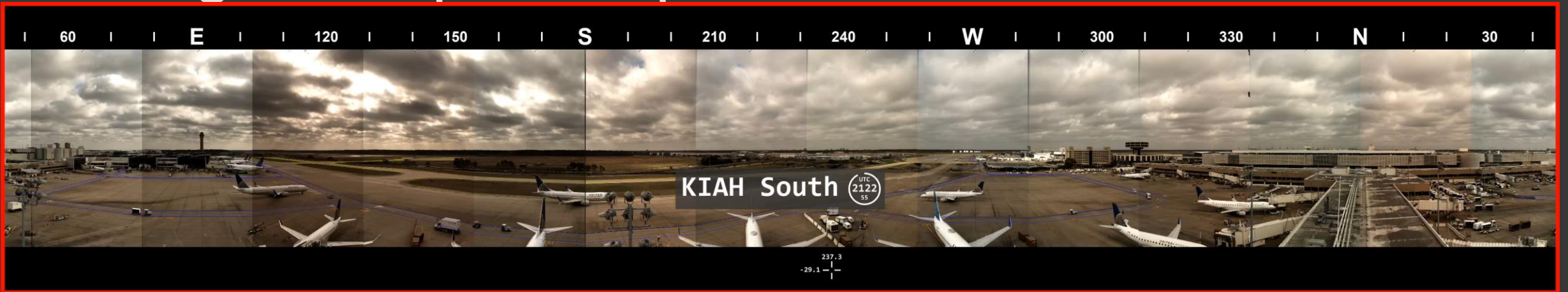
R-TWR camera house assembly



Regional airports



Large Complex Airports



r-TWR Integrated Training & Simulation – RTC Stockholm



Transportable

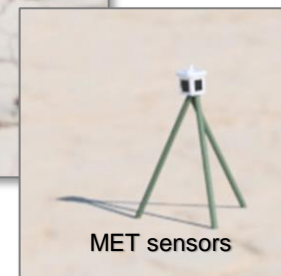
The total system can either be transported with :

- Standard container trailers or
- C-130 Hercules
- Helicopter



Deployable solution

- We estimate the system to be deployed within 1 hour by 3 technicians
- Mast container and an expandable operator container



Aircraft Last Look Check (ALLC)

- ALLC is a spin off product from r-TWR
- The ALLC allows the controller to remotely perform tasks:
 - Check landing gear position of an aircraft on final approach
 - Allow controllers to confirm that an aircraft has cleared the landing area
 - Allow a controller to inspect an aircraft at the holding point to confirm the state of panels, streamers and pins
 - Allow other safety inspections as required
 - Send signals to aircrafts with the SLG
- Installed in Q3 22 at a Royal Air Force UK Air Base (Culdrose)



Thank you listening!

Questions?

