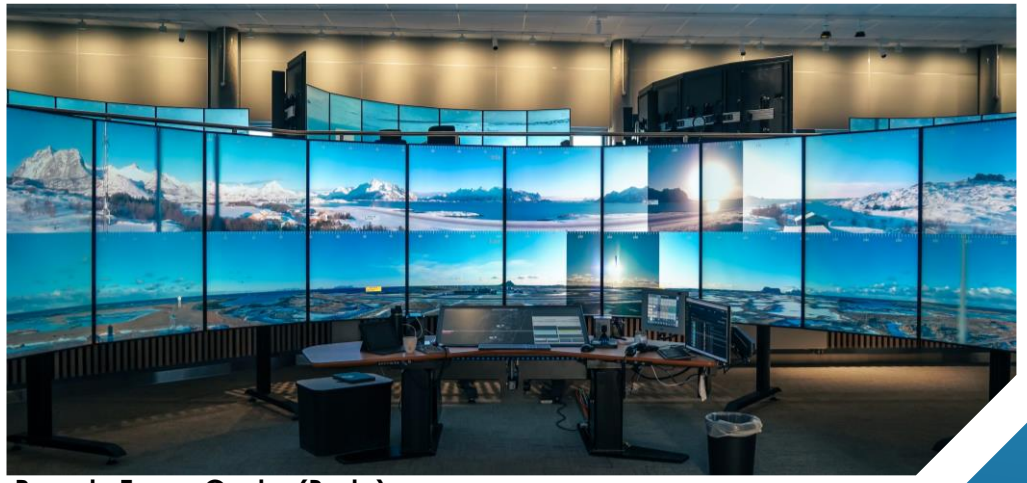
Conventional Tower (Førde) © Avinor / Photo: Bernt Olsen-Hagen



Remote Tower Center (Bodø) © Avinor / Photo: Øystein Løwer

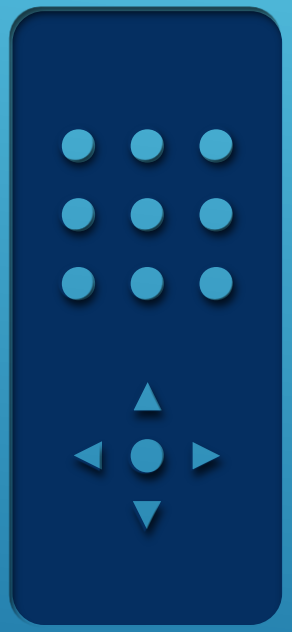
REMOTE AFIS / DIGITAL TOWERS

AND MULTIPLE OPERATIONS

AFISO perspective on the transition from conventional to digital/remote tower, and insights into multiple operations

AGENDA

- Remote tower backgrounds and timeline
- New tools
- The conversion experience – AFISO point of view
- Developing multiple operations



BACKGROUND AND TIMELINE

ENBV – Berlevåg airport. Photo: Avinor

- 44 Avinor airports, including 26 with AFIS
- Old infrastructure and ATM systems
- **Main objectives: Maintaining operations at all airports and upgrade ATM systems as necessary, while saving operating costs for Avinor and costumers**

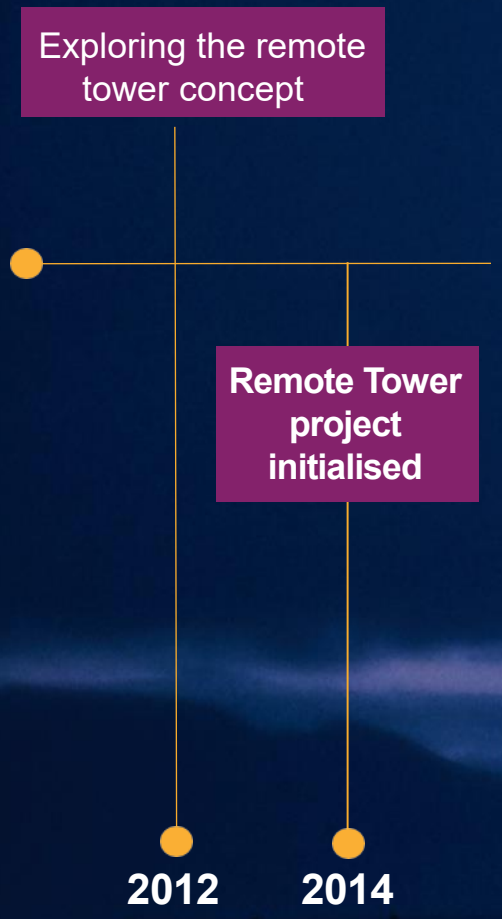
WHY REMOTE TOWERS IN NORWAY?

MAIN MOTIVATORS

REMOTE VS. CONVENTIONAL

- Aging towers – costly upgrades
- Old equipment
  - Many small independent systems
  - Future ATM development
  - Meet the requirements of tomorrow
- Recruitment issues to some rural areas
- Professionalize the work environment
  - Optimize and professionalize AFIS
  - Utilize the AFISO more efficient (multiple operations)
- A more cost-efficient service

TIMELINE



- 2012: Avinor decided on developing a Remote Tower system as the means of meeting new ATM standards
- 2014: Avinor initialized the project, with the objective of running up to 36 TWRs from a Remote Tower center
- Expected timeline:
  - 2015 – Contracting the Remote Tower System developer
  - 2016 – System ready for testing period
  - 2017 – System ready for operations

TIMELINE

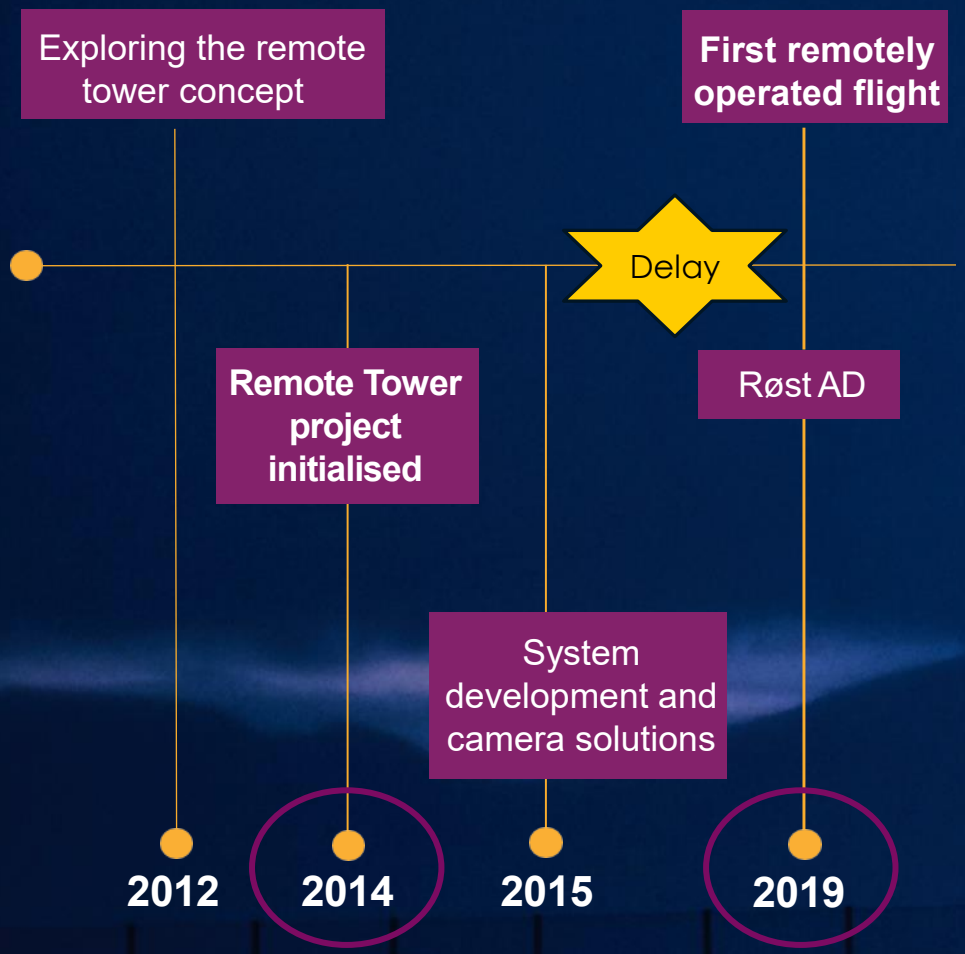
Exploring the remote tower concept

Remote Tower project initialised

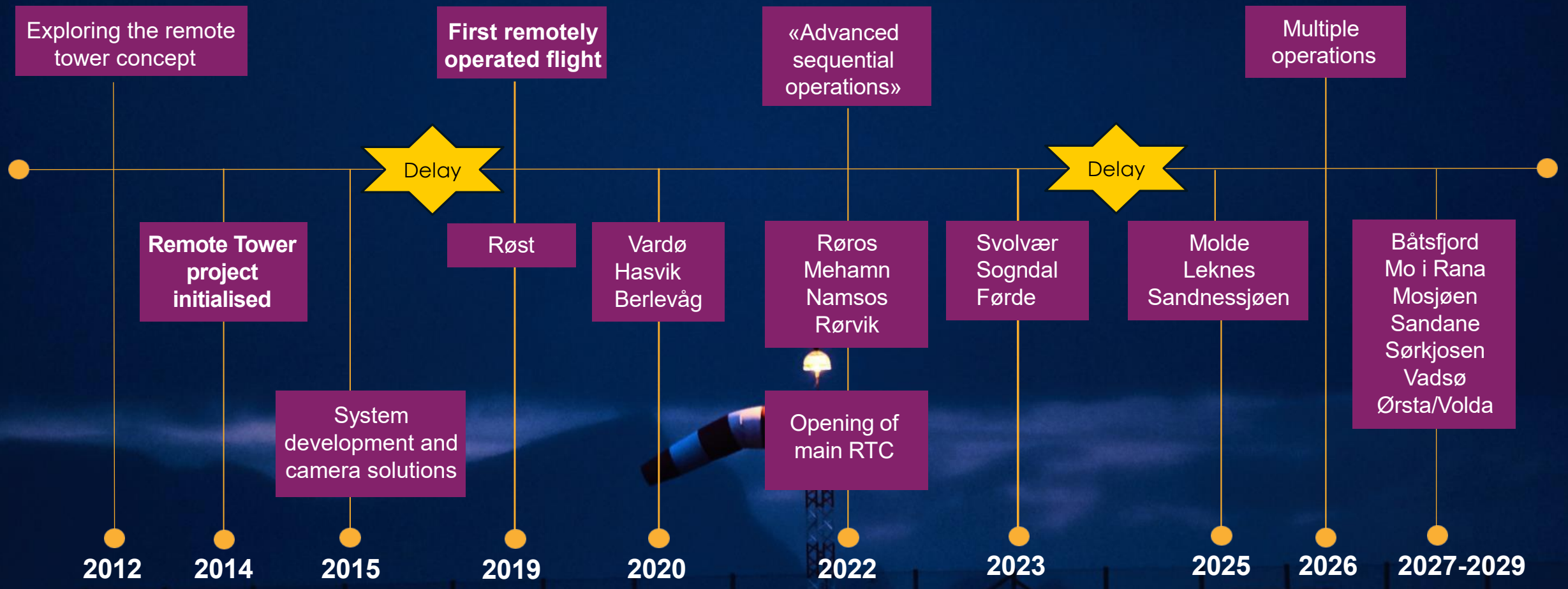
2012 **2014**

- Delta Luftfart and the Avinor unions were informed and involved from the beginning of the project
- Insights into the project objectives, the development plan, the business case, and predicted impact on personnel
- Avinor involved the employee representatives in the RT system development, the professional AFIS development, HMI cases and the HR processes

TIMELINE


Exploring the remote tower concept
First remotely operated flight
Delay
Remote Tower project initialised
Røst AD
System development and camera solutions
2012
2014
2015
2019

TIMELINE - TODAY



AVINOR

STATUS TODAY

- 14 Remotely operated TWRs
- Adding another 7 TWRs the next 2-4 years
  - Dependent on the success of integrating multiple operations
- By 2030, only five conventional AFIS TWRs will remain (out of a total 26 TWRs with AFIS)

COSTS

- 2015: Apx. €90m
- 2023: Apx. €125 m
- 2024: Additional €45m for adding the 7 new TWRs

https://youtu.be/w9yY_tW0KBo?si=GVNgpU5W3GbjAT_d

NEW TOOLS

Cameras and sensors

Photo: Jim Tørlen

© Avinor / Photo: Øystein Løwer

EQUIPMENT

- 360°-camera
  - With IR
- PTZ (Pan-Tilt-Zoom)
  - With IR
- Signal Light Gun (SLG)
  - Following PTZ
- Laser Range Finder (LRF)
- MET-sensors (AWOS)
- 10 monitor HUD
  - Giving 360° view of AD
- 1 monitor HDD

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WORKING POSITIONS

CONVENTIONAL VS. DIGITAL

- Goal: All in one HDD and a "clean" work environment

ALL IN ONE HDD – A SUCCESS?

THE CONVERSION EXPERIENCE

1. HR process

2. Transition training

New systems
New Methodology
Surveillance

3. Safety

Remote
vs
Conventional

THE HR PROCESS

- Informed years in advance: you have two main options
  - a) Stay on and join the move
    - Optional: commute for a year before deciding on a permanent move
  - b) Severance package
  - c) Apply to other positions at AD within same company
    - i.e., Firefighter
- All options had some additional supportive benefits (i.e., support for additional education, realtor fees, etc.)
- Result: Many AFISO quit, and we lost a fair amount of experience. We had to start large recruitments over several years.

TRANSITION TRAINING

approx. 3-4 weeks

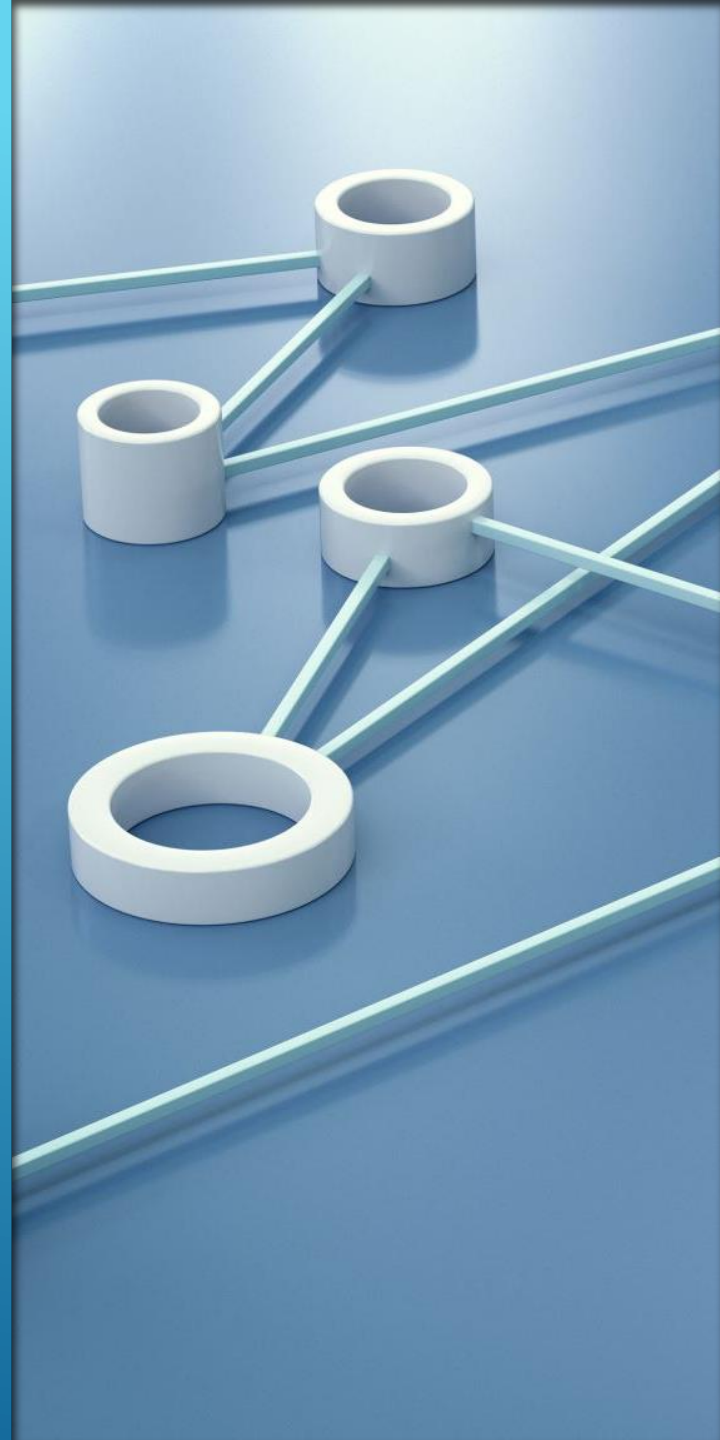
1. Generic surveillance theory → training in simulator
2. System theory → eqpt. familiarization → training in simulator
   - Completely new operating environment
     - Binocular → PTZ-camera
     - Analog buttons, displays and panels → HDD and HUD
     - Paper flight progress strips → EFS in HDD
- Both theoretical and practical examinations followed

Abbreviations:

EFS	Electronic Flight Strips	PTZ	Pan Tilt Zoom
HDD	Heads Down Display	HUD	Heads up Display

SAFETY

- Workforce initial reactions and safety concerns
  - Potential vulnerabilities in both tech and concept?
  - Decreased accuracy and quality in weather observations?
  - Will operators lose local area knowledge over time?
- In several areas the technology has enhanced safety
  - Increased wild-life detection with IR eqpt.
  - Surveillance
  - Standardization and professionalization the service (AFIS)
- Known weaknesses:
  - Camera replacement may take days
  - Issues with data transfers, and network outage



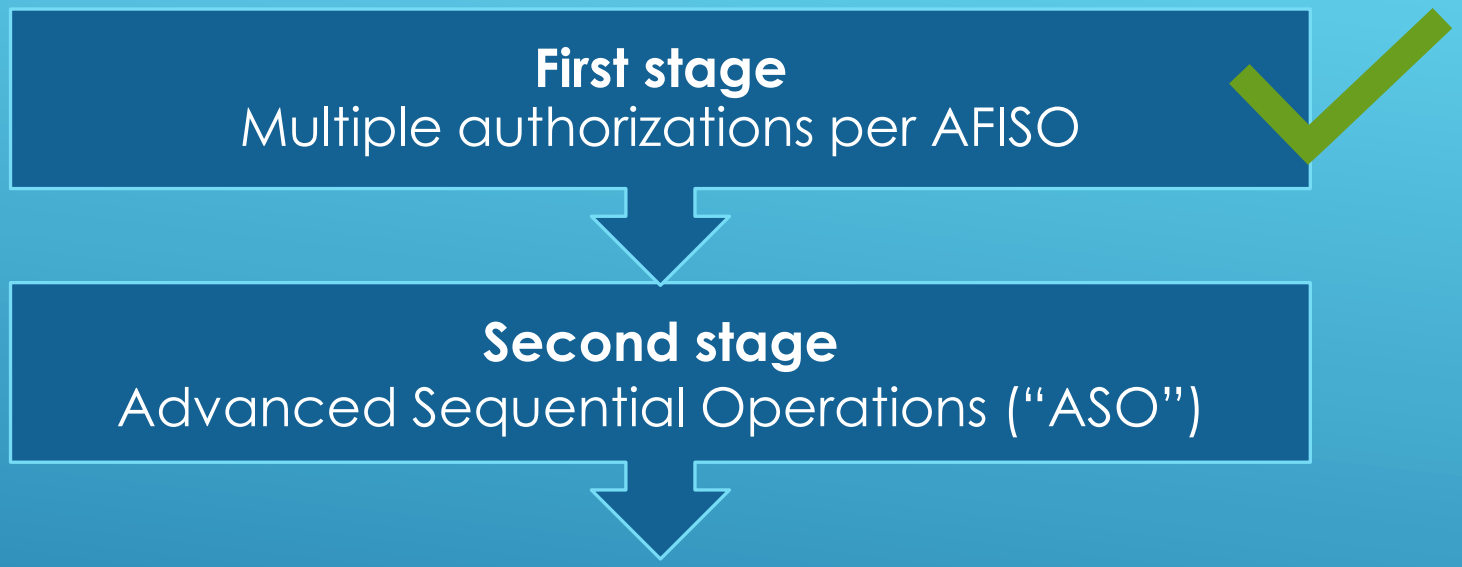
MULTIPLE OPERATIONS

One person operating two(or more) AD simultaneous

First stage
Multiple authorizations per AFISO

MULTIPLE OPERATIONS

CONCEPTUAL DEVELOPMENT STAGES



MULTIPLE OPERATIONS

CONCEPTUAL DEVELOPMENT STAGES

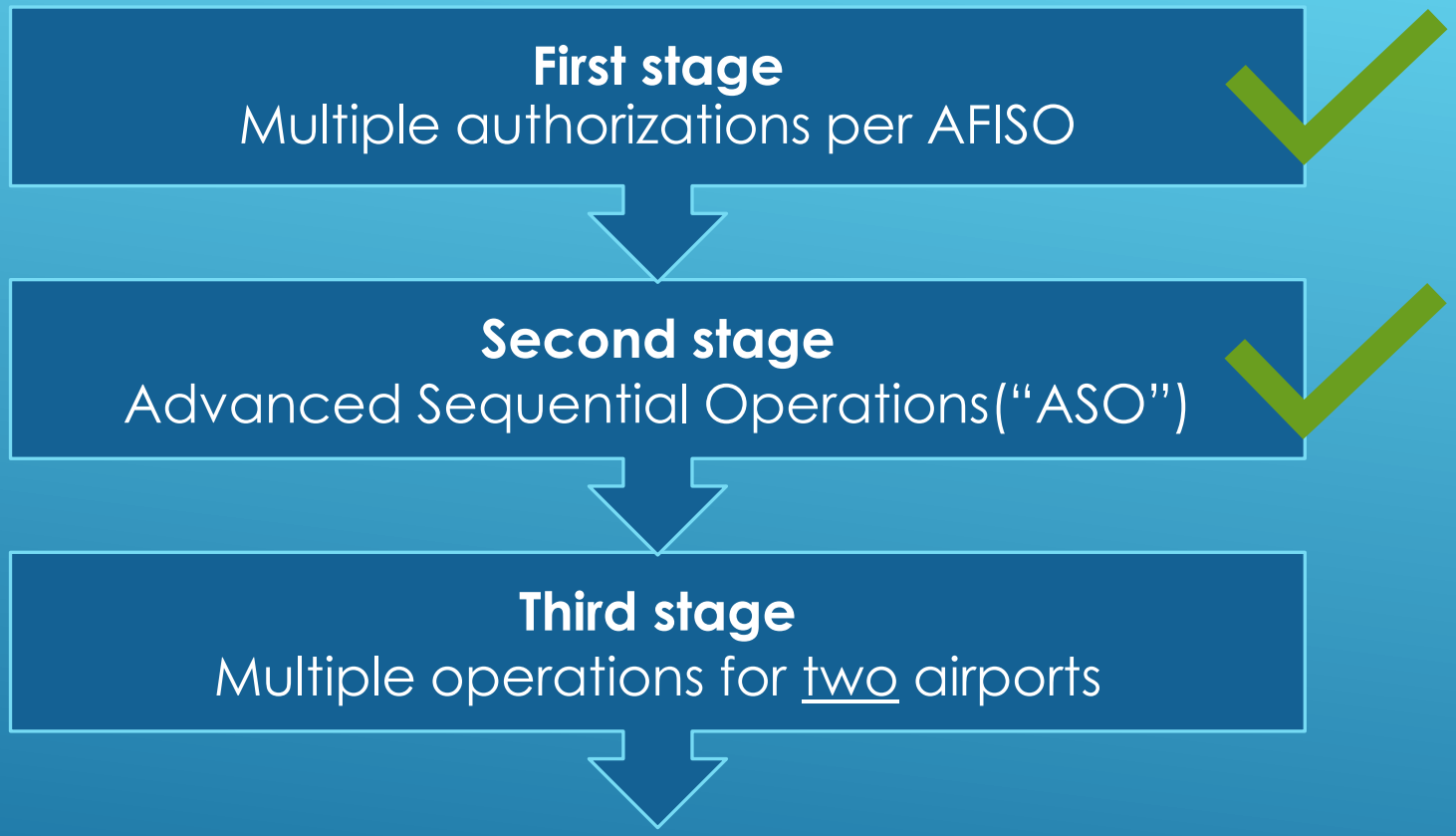
© Avinor / Photo: Øystein Løwer

STAGE 2 "ADVANCED SEQUENTIAL OPERATIONS"

- One person operating two AD, utilizing two work positions
- 2nd operator on stand-by nearby
- Limited to air-traffic only at one AD at a time

Why we did "ASO"?

- Test new standard phraseology
- Test new methodical practice
- Collect experience, data and input on possibilities for development of multiple operations
- Other hypotheses for multiple operations



MULTIPLE OPERATIONS

CONCEPTUAL DEVELOPMENT STAGES

CONCEPT OF MULTI OPERATION

- Complex Con-OPS
  - AFISO was utilized during testing of methodology
  - Experiences from a year of ASO was utilized
- CAA has been involved closely in the process from the start
- Concept is currently only approved temporarily for testing
  - Expecting approvement of concept and permanent change by the end of 2026

Involvement of AFISO and union rep. in:

1. Assessment criteria for pairing TWRs
2. Hazard identification
3. Several different risk assessments
4. PSM (Passive Shadow Mode) + evaluation
5. Multiple ops. methodology validation
6. Human factor analysis
7. Conversion training plan
   a) Incl. competency goals
8. Best practices for Multiple ops.

2025 SETBACK:
DEVELOPMENT VS. BUGFIX AND PATCHING

Multi-update:

Large software update delivering multiple-operation capability for the system

- Focus on inventive aspects and features, over time
- "Multi-update" was delivered with a large backlog of bugs
  - Resulting in many workarounds → increased workload for the operators
  - Did not harmonize with transition to multiple operations
- Further system development put on hold
- Implementing some smaller features and fixing bugs got prioritized
  - Was estimated to take four months

PREPARING AFISO FOR MULTIPLE OPERATIONS

- Using the "Multi-update" in single ops. → Familiarization
- Training and evaluation in simulator environment (~20 hrs.)
  - The Simulator is mirrored close to the system (important)
  - Slowly increasing complexity, by increasing TFC and number of simultaneous task
  - Large changes to phraseology, scanning patterns and working methodology
  - A final examination (in simulator) with moderate to high complexity
- Ten shifts for each AFISO with a supporting AFISO in position
  - 4-eyes principle, and a backup, etc.

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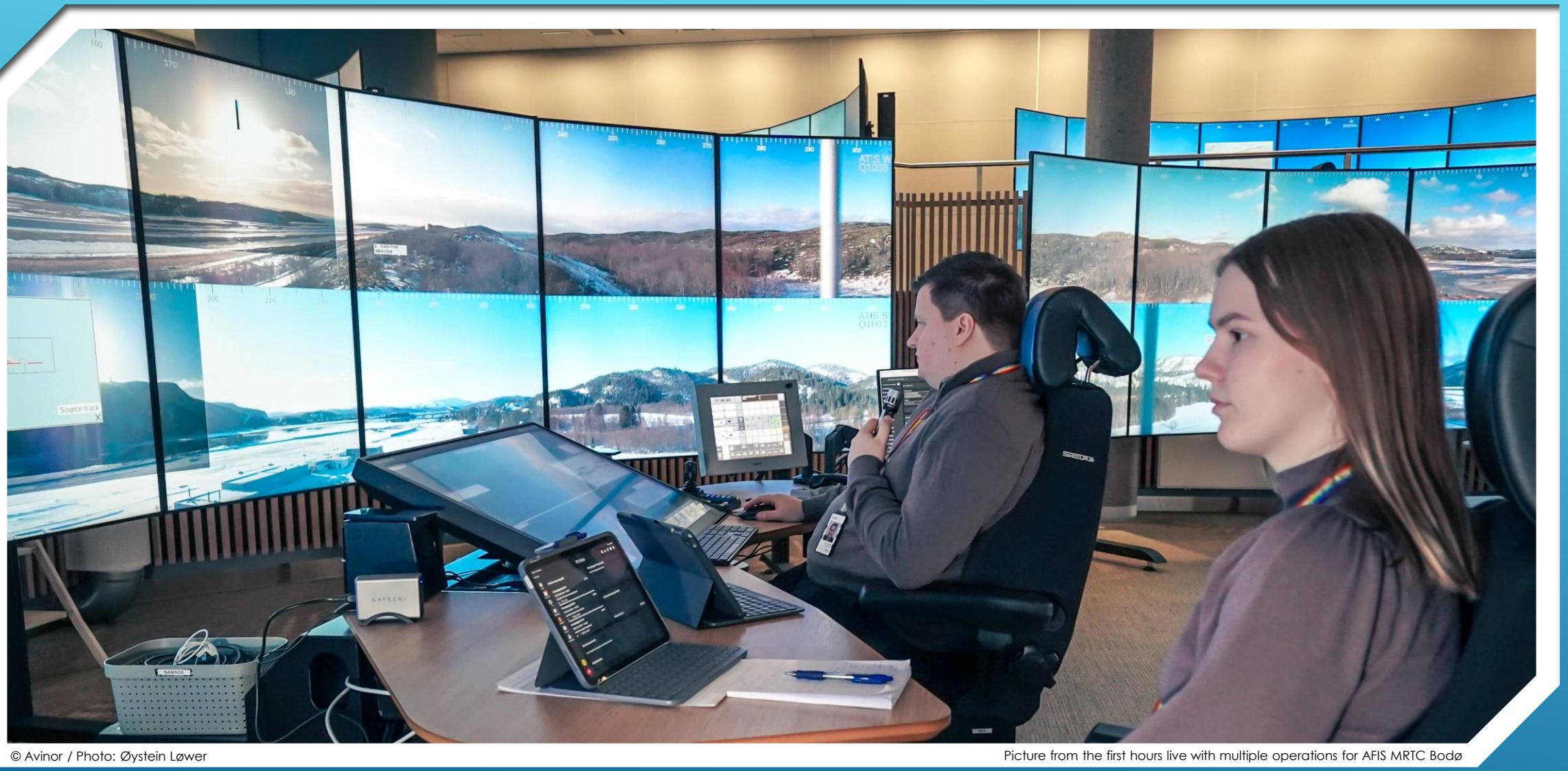

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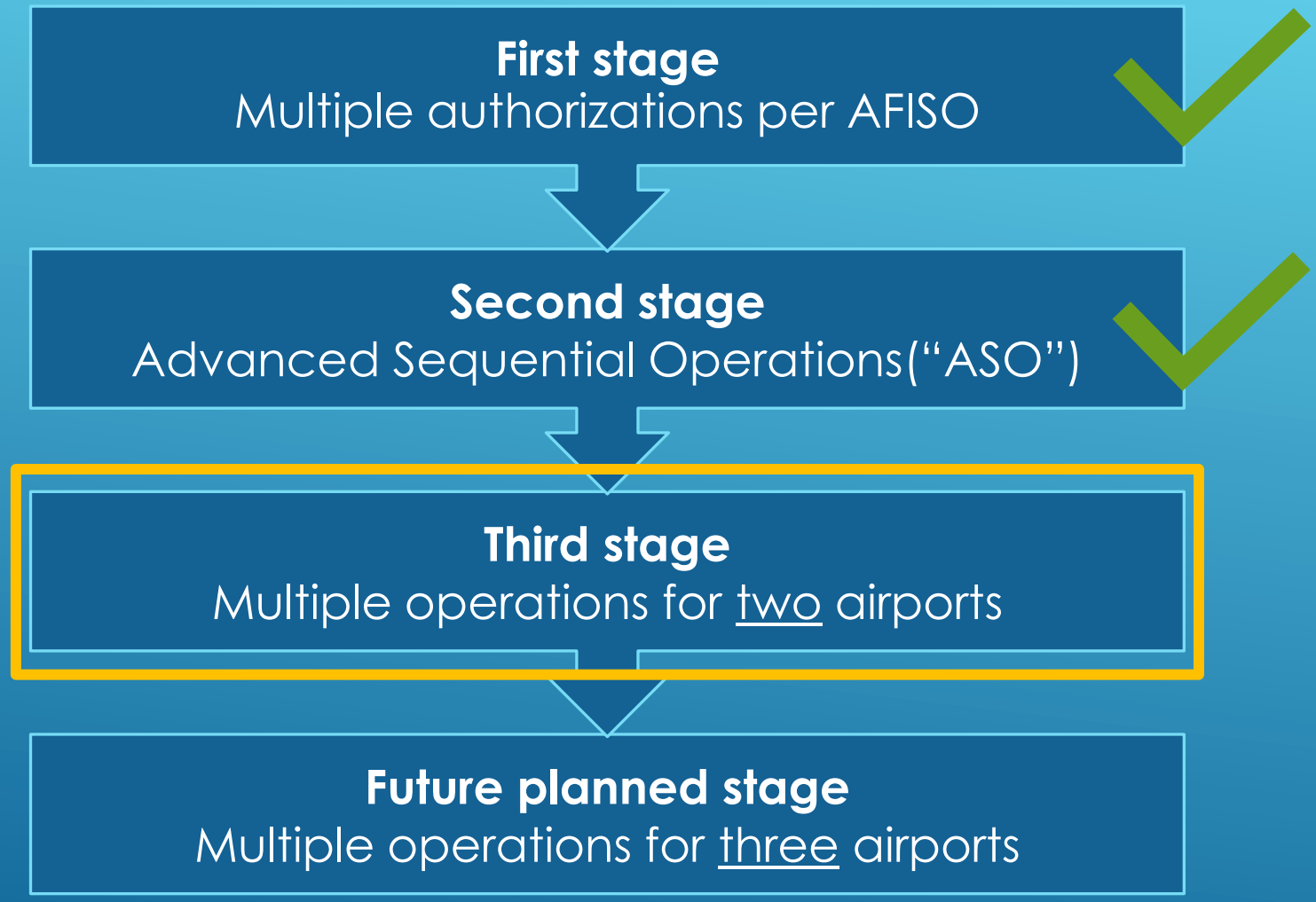
Picture from the first hours live with multiple operations for AFIS MRTC Bodø



MULTIPLE OPERATIONS

CONCEPTUAL DEVELOPMENT STAGES

TODAY

- 8 TWRs in multi (4 pairs)
- 6 still in single operations

QUESTIONS? ☺

JIM.TORLEN@AVINOR.NO
MARI.HALVORSEN.SUNDGOT@AVINOR.NO