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Remote Tower Operations - the Human Factor

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Member of



The Human in Remote Tower Operations



In this presentation

Characteristics Remote Tower

Human Factors issues for Remote Tower

Human Factors research

Studies in the Netherlands and in Hungary

- Multiple medium sized airports
- One main port



Characteristics of Remote Tower Operations

- No tower needed, just camera's
- Out of the window view replaced by monitors
- More flexibility to arrange CWP's
- Single and / or multiple remote
- Impact on operation
 - Arrival and departure management more important
- Options for additional features (software or special cameras) in the CWP

Human Factors aspects Remote Tower Operations 1/2



Camera perspective and resolution



IR and tools for poor visibility conditions



PTZ will replace binoculars



Data integration



Augmented data



Divide attention within CWP

Human Factors aspects Remote Tower Operations 2/2



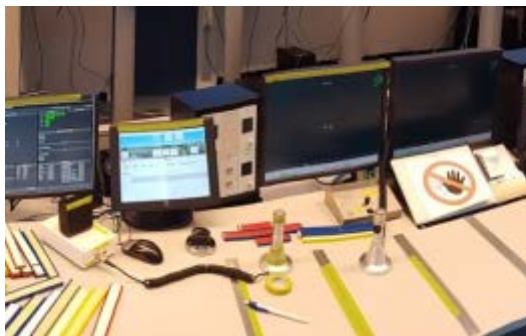
Different workload situations



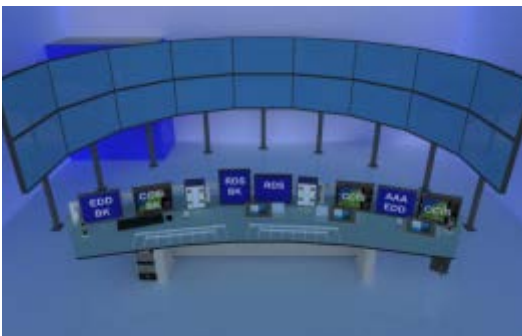
Impact on ATCo fatigue?



Impact on teamwork



Design CWP



Positioning monitors out of window view



ATCo operational strategies



Why simulation studies first

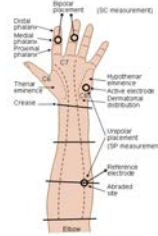
From low to high fidelity

Evaluate complicated or new situations

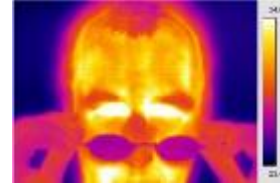
Human Factors analysis techniques



ElectroCardioGraphy
(ECG)



Galvanic Skin Response
(GSR)



Body Temperature



ElectroEncephaloGraphy
(EEG)



Facial expressions



Eye Tracking



Questionnaires



Performance

Whole is more than the sum of the individual components

Data recording

- Data recording during operation
- Minimal impact on controllers and operation
- Compare conditions
 - Conventional TWR with rTWR





Study at ATC The Netherlands (LVNL)

Demonstration Set-up

Groningen
(medium-sized)



Maastricht-Aachen (NARSIM)
simulated (small-sized)



Remote Tower Demonstration for Groningen Eelde (live) and Maastricht-Aachen Beek (simulated with NARSIM) from one CWP with one ATCo



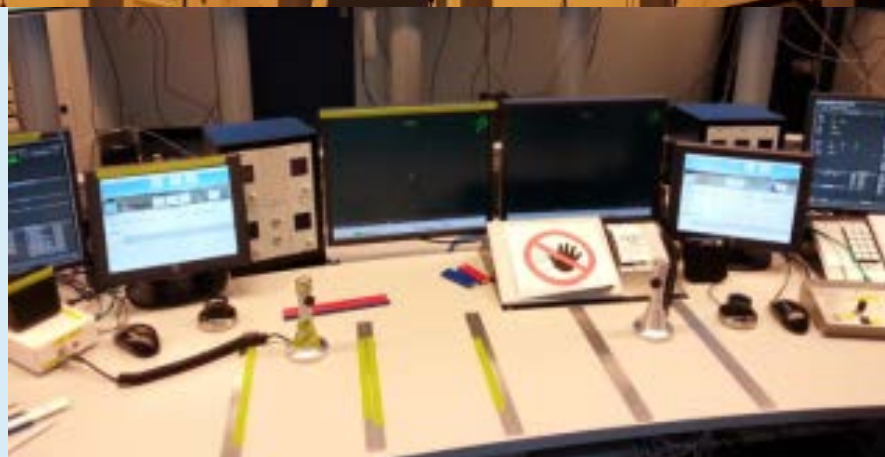
LVNL Remote Tower Centre (Schiphol-Oost)

Remote Tower System

From Simulation to Live Trial



Multiple Remote Tower Operations





Study at HungaroControl

Introduction by
Dezső Dudás



Situation

Initial study

Compare TWR with new rTWR

- Division of attention over information elements
- Scanning strategies for information acquisition
- Levels of workload and stress
- Fatigue building up



Field study at HungaroControl in two phases:

1. Identification of the situation, applicability of Human Factors measurement tools in TWR and rTWR
2. Data acquisition
 - 3 ATCos in ground- and aerodrome position on TWR and rTWR

First trends identified

- ATCos looked more at video wall than window
- ATCos used radar display more often in TWR than rTWR
- ATCos showed different scanning strategies in TWR and rTWR
 - Also differences between ATCos exist
- Symptoms of fatigue increased during shift in TWR and rTWR in a comparable way



Next steps

- Larger scale study for statistical evidence of the findings
 - More measurements / situations
 - More subjects
 - Longer measurement periods for fatigue
(also sleep quality the night prior to a shift)
- Consider the use of other measures (than eye blink frequency) for workload. Possibly cortisol levels, or galvanic skin response
- Methodological triangulation
 - Integrate bio behavioural measures with performance and subjective measures

Added value HF research for Remote Tower Operations

- HF research can answer a part of ATCos-questions in an objective manner
- It informs both ATCos and ANSP in advance about pro's and con's of remote tower operations for their particular situation
- It provides mitigations for possible HF issues prior to operation
- Every human is different, there is no other way to identify how the ATCo influences the remote tower operations and vice versa
- The ANSP will be able to:
 - Make a well informed decision
 - Will be able to operate more optimal by taking human factors into account

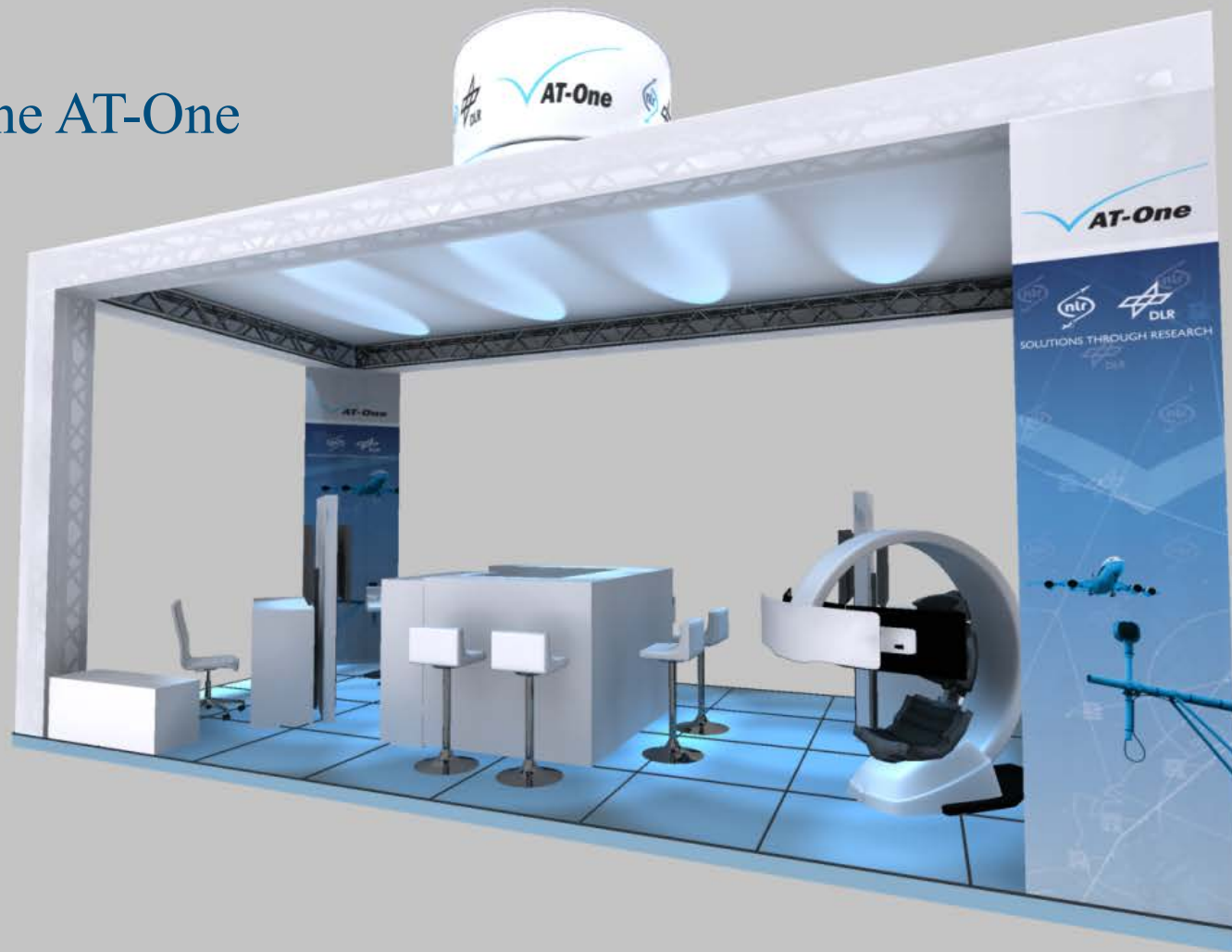


Concluding

- Remote tower operations are introduced for various reasons
- They have impact on the ATCos
 - Workload (multiple RTO)
 - Information presentation / Situational Awareness
 - Usability of system
 - Etcetera
- Human Factors experiments qualify and quantify that impact
- Knowledge about this impact may lead to mitigations and a better controlled introduction of remote tower operations
- Eventually it will protect you from making expensive mistakes



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Fully engaged

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