



Multiple Remote Tower – Challenges and Solutions

Validation Exercise with ON
SESAR PJ.05.03

Anneke Hamann
Institute of Flight Guidance
Human Factors
Anneke.Hamann@dlr.de

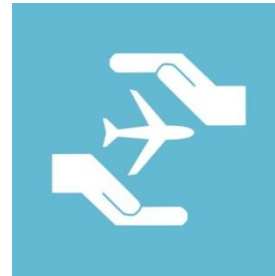


Knowledge for Tomorrow



Validation Context PJ.05.03

- Which impact does Multiple Remote Tower have on...
 - Human Performance
 - Safety
 - Capacity
 - Cost Efficiency?



Set-Up EXE-05.03.V2-3.1 – ON

Multiple Remote Tower module:

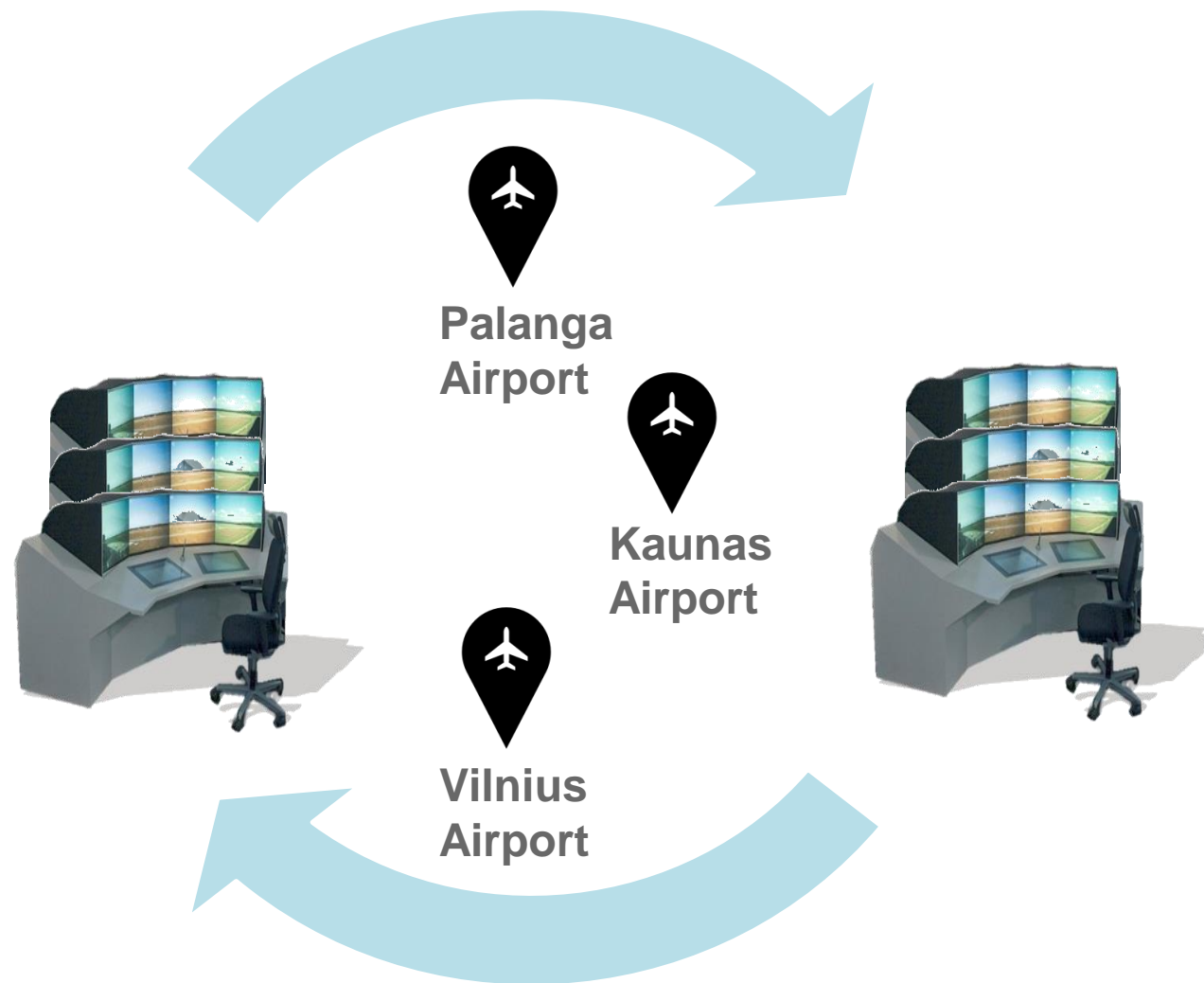
- ATS provided to 3 small-sized airports
- DLR real-time simulation platform
- Frequentis smart strip planner prototype

Participants:

- 6 ATCOs from Oro Navigacija (ON)

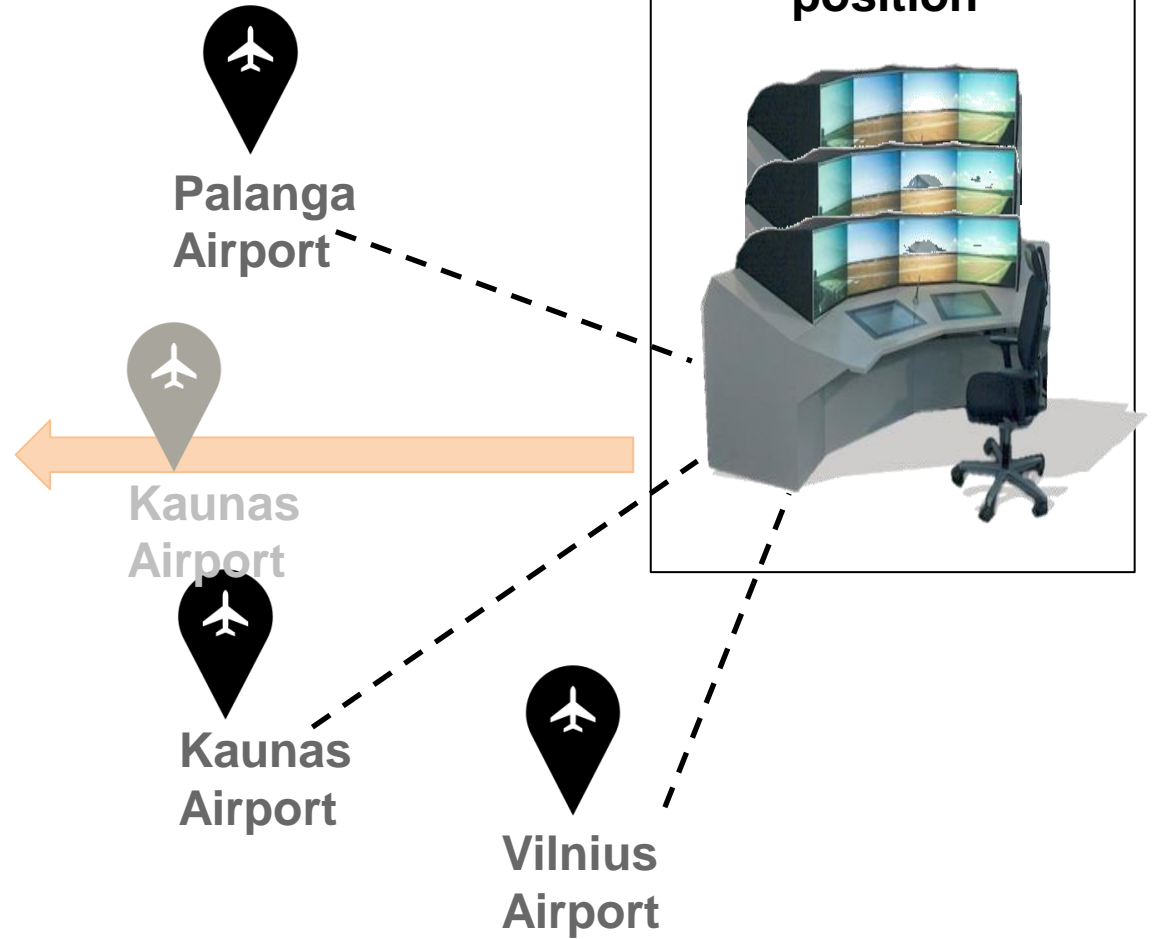
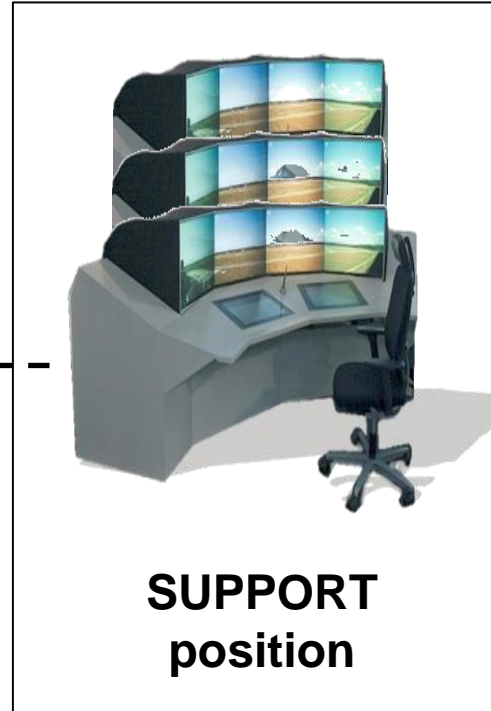
Split & Merge procedures:

- Overload: split & merge of Kaunas
- Emergency: split of Kaunas & Palanga



Hand-over procedures


Kaunas
Airport



Key Parameters for PJ.05.03

Traffic volume

- ~ 25 + 3

Traffic complexity

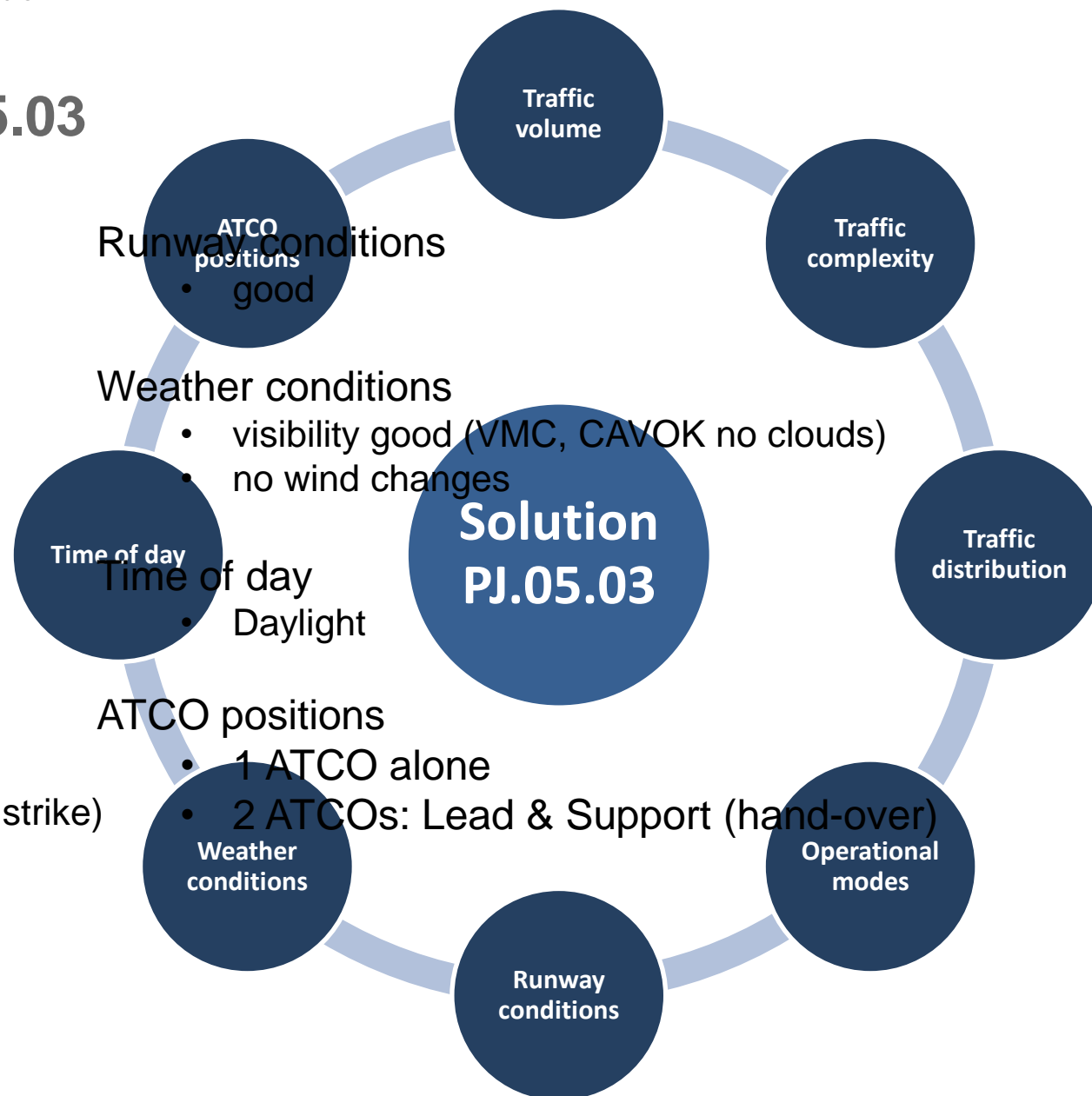
- mainly IFR (90%)

Traffic distribution

- uneven
(50% / 25% / 25%)

Operational modes

- normal operations
- unplanned RWY closure (bird strike)
- emergencies



Scenarios with Independent Variables

Scenario ID	No. of ADs for LEAD	Time	Hand-Over	Type of Incident
Training	3 - 2	00:40	Split	none
SCN 1	3 - 2 - 3	01:00	Split & Merge	high traffic load, bird strike
SCN2	3	01:00	none	high traffic load, bird strike
SCN3	3 - 1	00:40	Split	emergency
SCN4	3	00:40	none	emergency



Agenda for the Exercise Days

Begin	Day 1	Day 2
08:30	Briefing	
09:30	Training	Run 2
10:30	Training	Run 3
11:30	Run 1	Run 3
12:30	Lunch	Lunch
13:30	Run 1	Run 4
14:30	Run 2	Run 4
15:30	Debrief	Debrief
16:30		

ATCO 1
ATCO 2



ATCO Task

- active ATC as usual
- workload rating every 5min (ISA scale)



	1	2	3	4	5
Workload Heading	Under-Utilised	Relaxed	Comfortable Busy Pace	High	Excessive
Spare Capacity	Very Much	Ample	Some	Very Little	None
Description	Nothing to do. Rather boring.	More than enough time for all tasks. Active on ATC task less than 50 % of the time	All tasks well in hand. Busy but stimulating pace. Could keep going continuously at this level.	Non-essential tasks suffering. Could not work at this level very long.	Behind on tasks; losing track of the full picture.



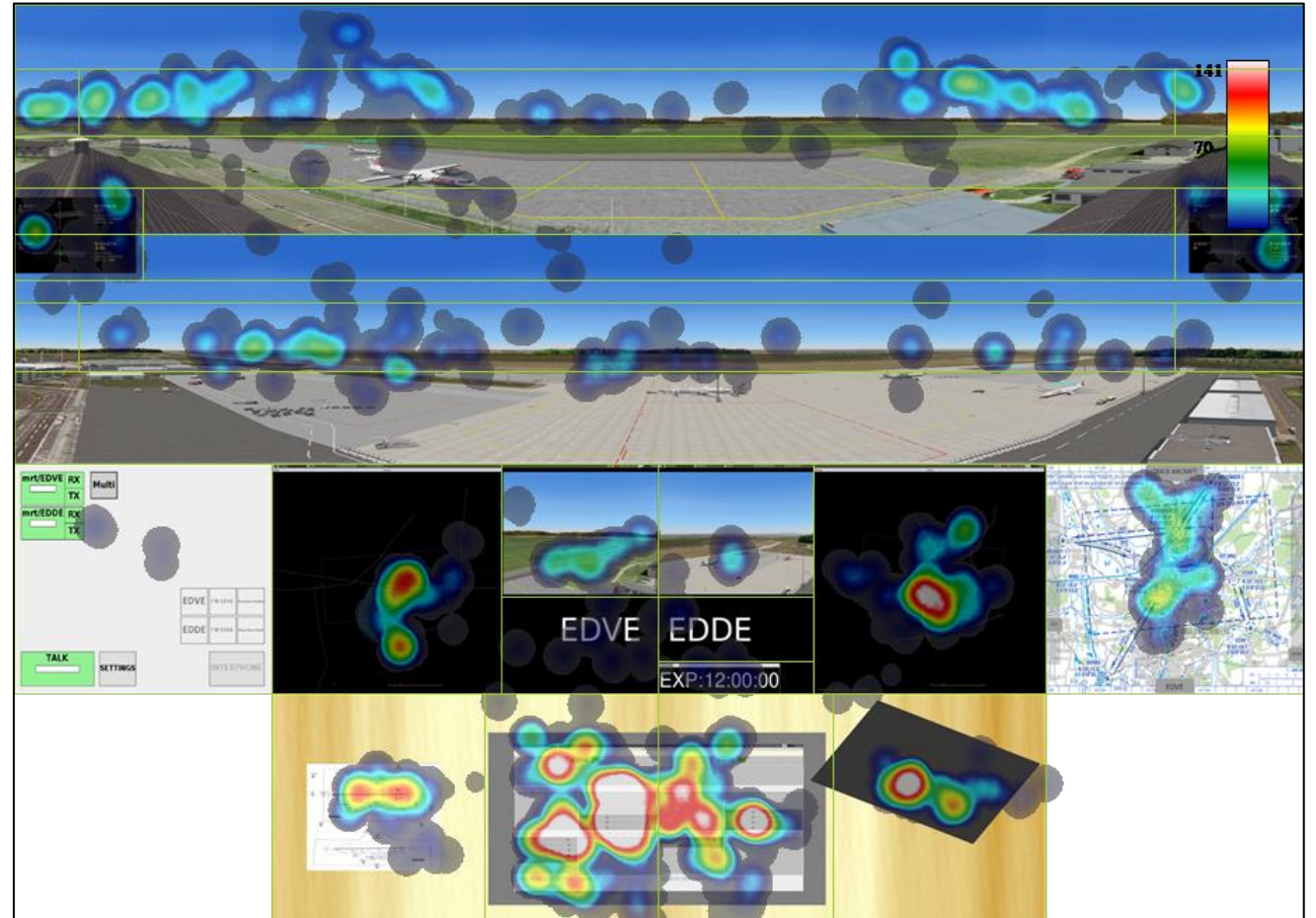
Communication

- ATCOs and pseudo-pilots: use airport designator in every initial call
→ additional safety measure to enhance situational awareness
- radio communication collected to analyse:
 - airport designator usage
 - length and frequency of calls



Eyetracking

- discover scanning patterns
- correlate safety critical clearances with information gathered



Papenfuss, A., & Friedrich, M. (2016). Head Up Only – A design concept to enable multiple remote tower operations. Institute of Flight Guidance, German Aerospace Center, Braunschweig.



Questionnaire Data & Debriefing

Questionnaires after each scenario and after the simulation covering...



human performance



safety



capacity



cost efficiency

ID	Question
PE01	I was generally able to perform the necessary ATC tasks.
PE02	My situational awareness was sufficient at any time.
PE03	I was generally able to prioritize tasks.
PE04	I was generally able to set up a traffic sequence (e.g. VFR into IFR; sequence on final).
PE05	I was able to identify all relevant aircraft.

... and additional debriefing interviews



Questionnaire: Challenging Situations



Can the situation be solved without major impairment?

YES

No impairment Good	ATCO workload is low to easily achieve the desired performance.	1
No impairment Good	ATCO workload is adequate to achieve the desired performance.	2
Minor impairment Fair	ATCO requires a minor increased workload to achieve the desired performance.	3

NO



Can the situation be solved by measures reducing capacity?

YES

ATC influences capacity

Impairment of efficiency

Minor Unpleasant delays	ATCO responds with delay to pilot's requests.	4
Moderate Disturbing delays	Situation leads to moderate delays in the traffic management.	5
High Very disturbing delays	Situation leads to strongly delays in the traffic management.	6

NO



Can the situation be solved by measures reducing safety?

YES

ATCO workload is too high and should be reduced

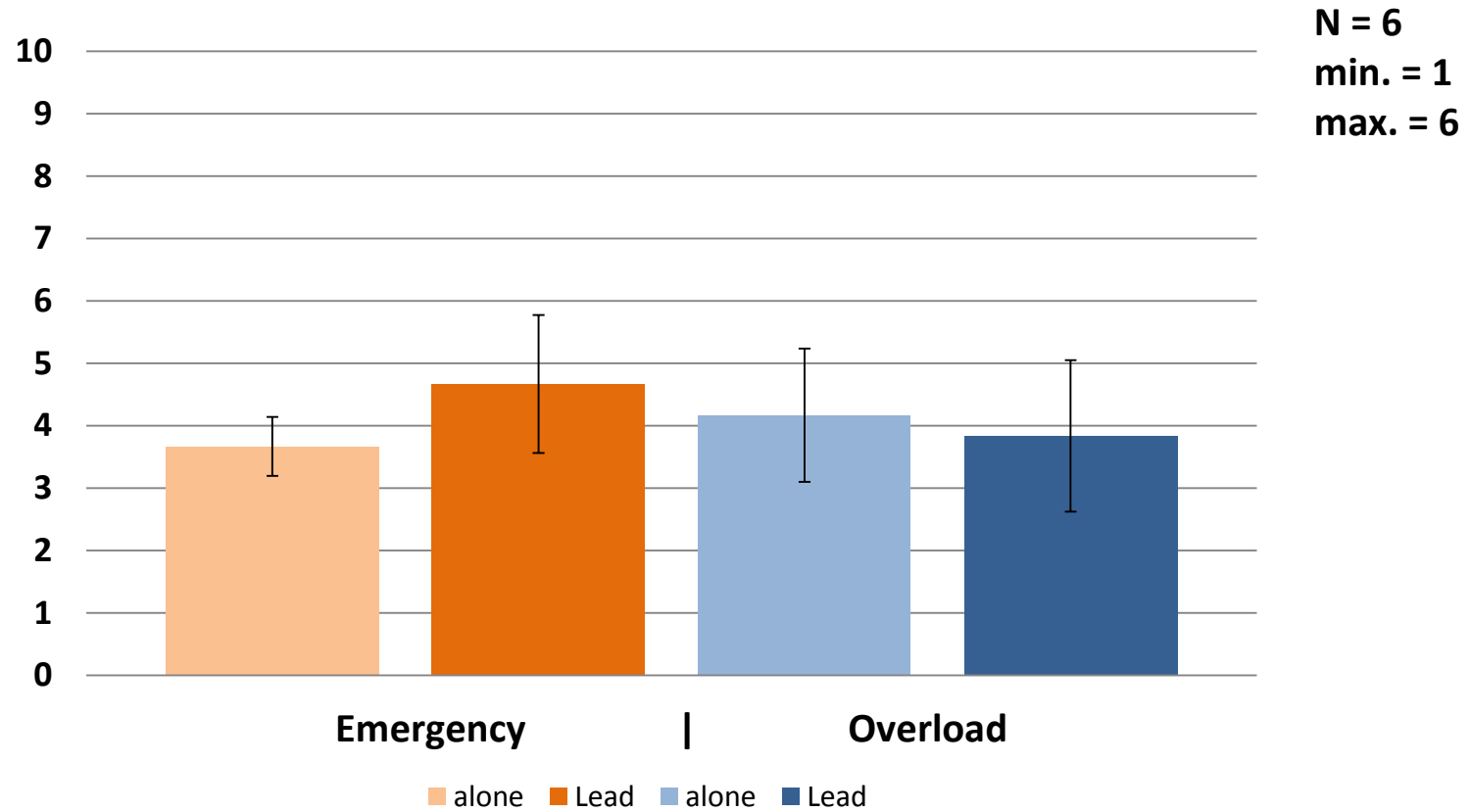
Impairment of safety

Impairments in prediction of traffic development	ATCO directs traffic sporadically, abruptly and does no longer plans ahead.	7
Impairments due to information processing	ATCO cannot build a complete picture of the traffic situation, confuses information and corrects himself/herself often.	8
Impairments due to information gathering	ATCO must neglect areas/information while monitoring and therefore misses aircraft.	9
Major Impairment	ATCO cannot longer control the traffic situation.	10

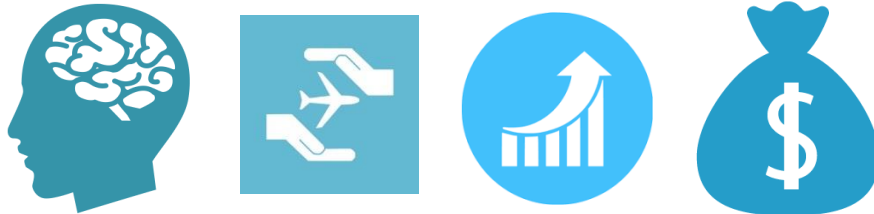
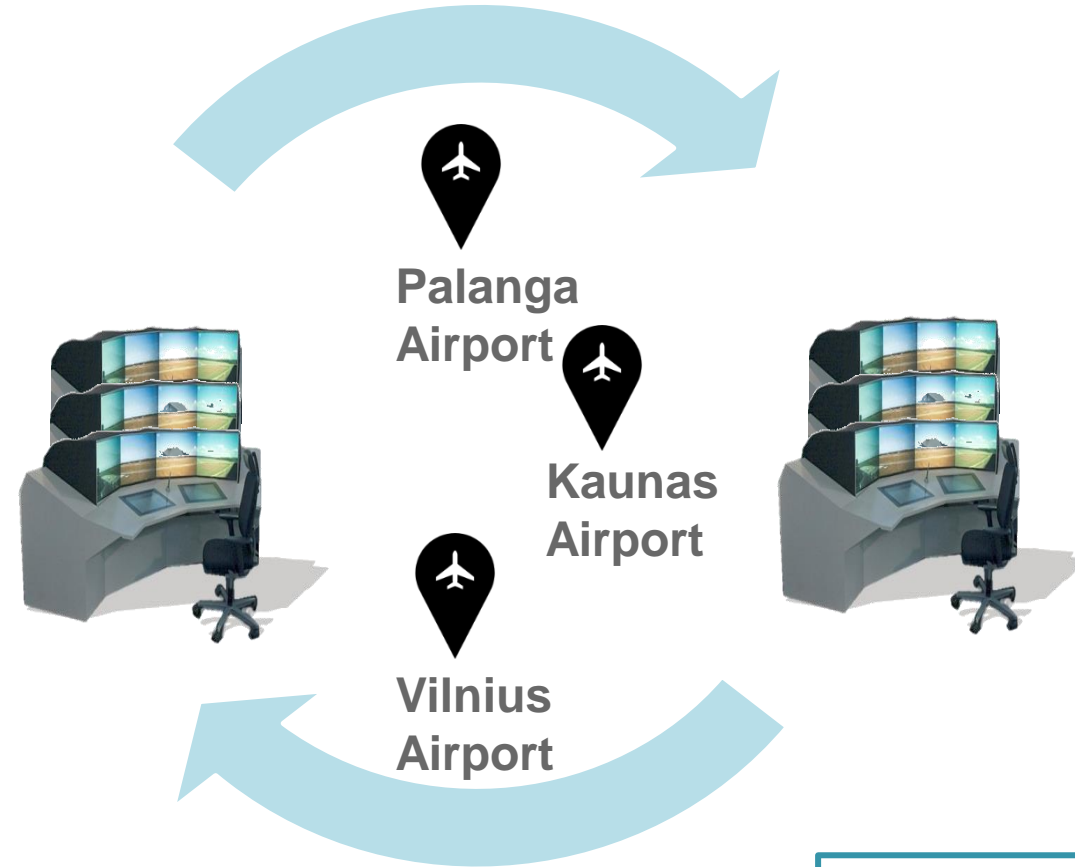
NO



Challenging Situations: First Results



Thank you for your attention!



Contact:

*Anneke Hamann
Institute of Flight Guidance
Human Factors
Anneke.Hamann@dlr.de*

