

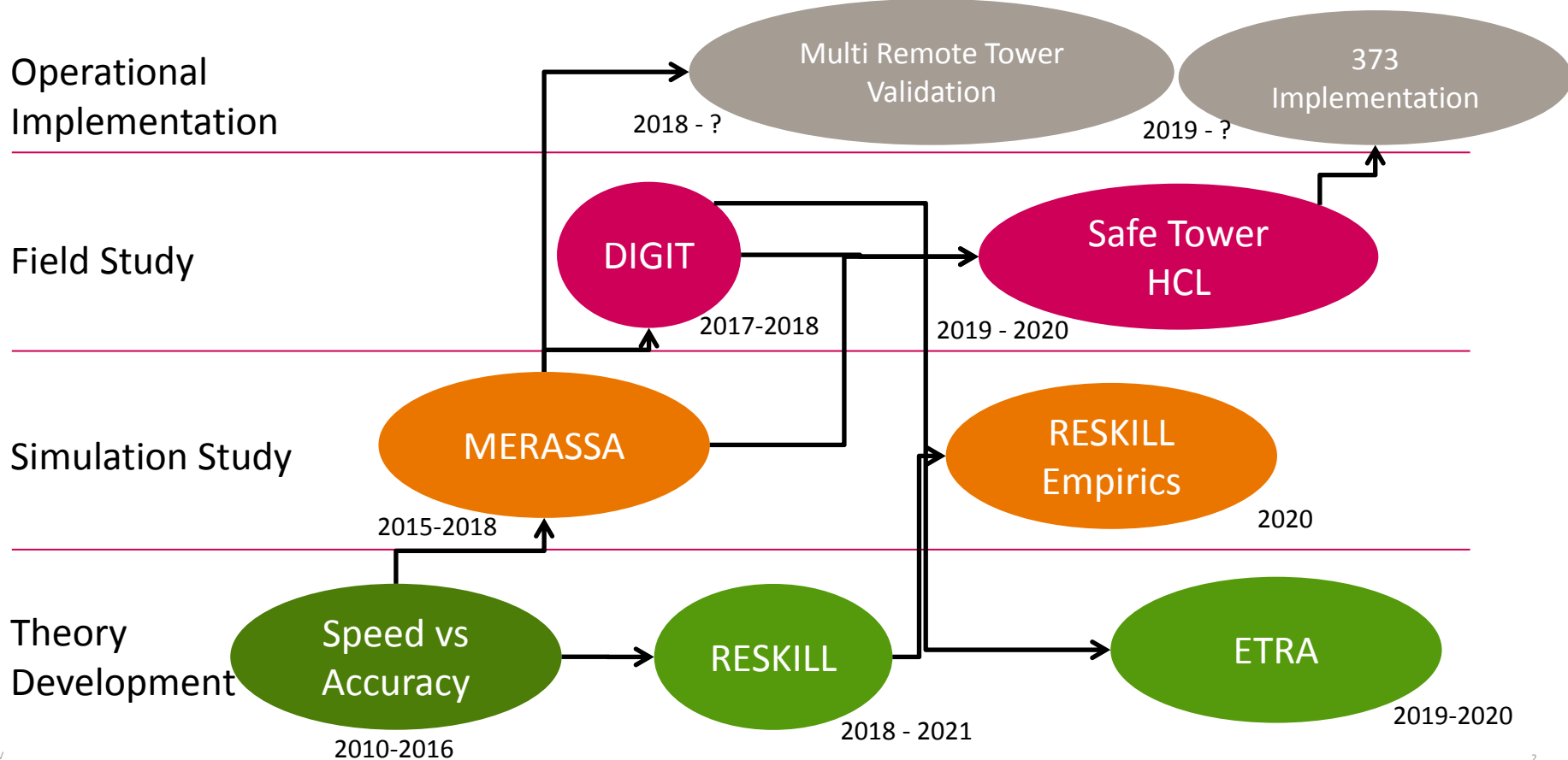


LOTHAR MEYER & MAXIMILIAN PEUKERT

MULTI REMOTE TOWER VALIDATION A SIMULATION STUDY

Per 7 februari 2020

Research Empiric Safety Assessment



LFV Multi Remote Tower Concept

- ✓ Simulation Study for validating the LFV Multi Remote Tower Concept
- ✓ One ATCO for Örnsköldsvik and Sundsvall
- ✓ Concept for Low-Density-Airports
- ✓ Possible Configurations
 - Control Zone only or
 - Control Zone plus TMA



Validation Objective

2 Test Configurations

- MCTR - Multi with only CTR Ö-Vik and Sundsvall
- MTMA - Multi with CTR + TMA Ö-Vik and Sundsvall

2 Baseline Configurations (Today Operations)

- SNN - Single CTR + TMA Sundsvall
- SNO – Single CTR + TMA Ö-Vik

Question:

- HPP - Effect on Working Procedures inc. Workload and Situational Awareness
- TFF - Effect on Technical Failure Procedures (combined technical – human error)

Multi Simulation Environment



Test Methods

✓ Stress Test Procedures (Live)

- Situation Present Assessment Method (SPAM)
- Secondary Task
- Conflict Induction

✓ Live Queries

- Workload ISA Measurement

✓ Pre- and Post Tests

- Psychomotor Vigilance Test (PVT)
- KSS Questionnaire

✓ Post Test Questionnaires

- NASA-TLX
- Situational Awareness Rating Technique (SART)
- Emotional Questionnaire (EMQ)
- Self-Assessment
- Availability of Operational-Relevant Information (Success Criteria)

-

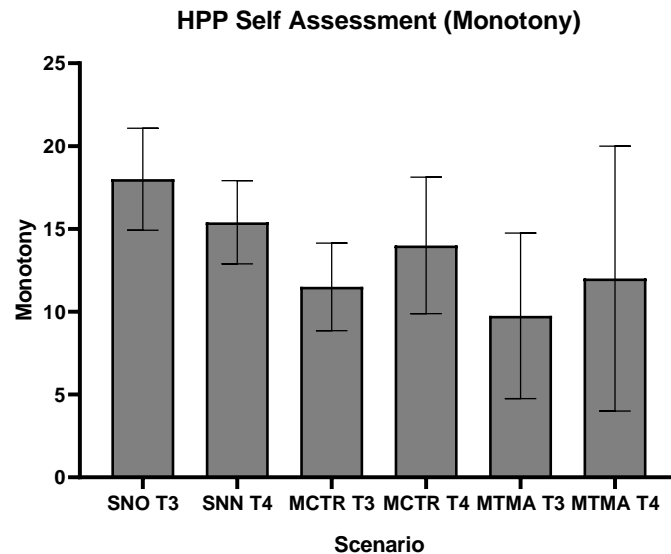
Sample Characteristics and Sim Crew

- ✓ 6 Air Traffic Controllers with endorsements at Ö-Vik and Sundsvall
- ✓ 3 Validation Leader + 3 Center Pilots
- ✓ 80 Minutes Scenario per Trial with low traffic volume
- ✓ Overview of number of movements

NAME	SINGLE ESNN	SINGLE ESNO	MULTI CTR	MULTI TMA
Scheduled Commercial Air Traffic	4	2	6	6
Light Aircraft (VFR)	1	1	1	1
Ground Vehicle	1	1	1	1

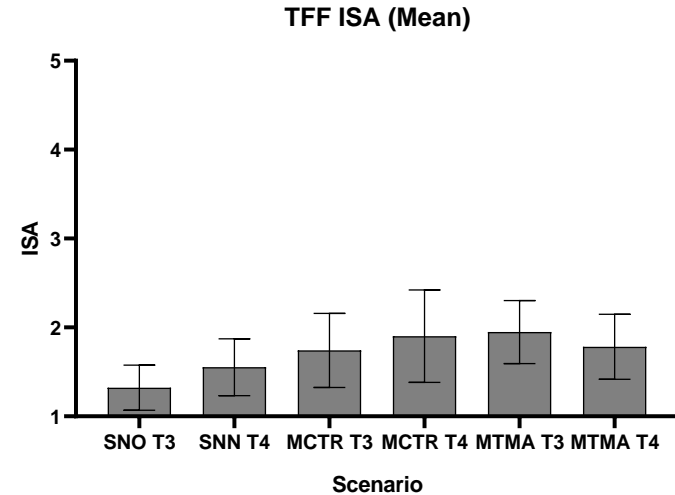
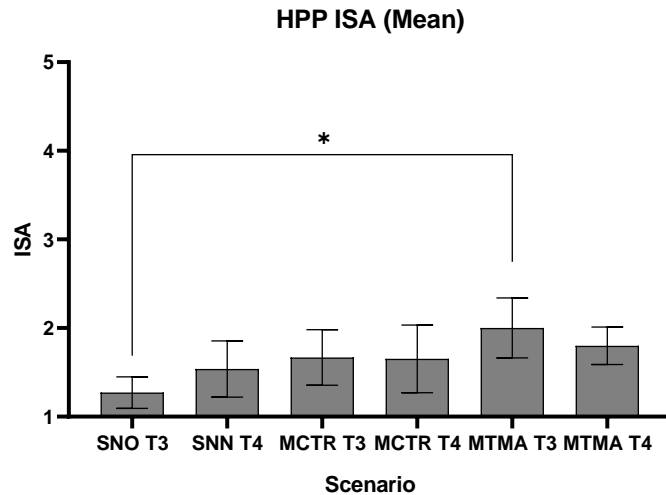
Results

- ✓ 63 trials were performed in the period May/June 2019 in Sundsvall
- ✓ Double checking information in Multi Configurations
 - QNH
 - Wind Direction
 - Wind Speed
- ✓ Less bored in Multi Configurations



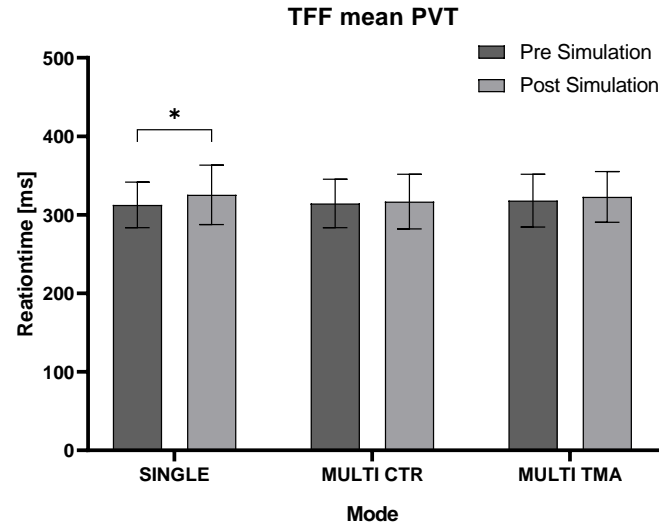
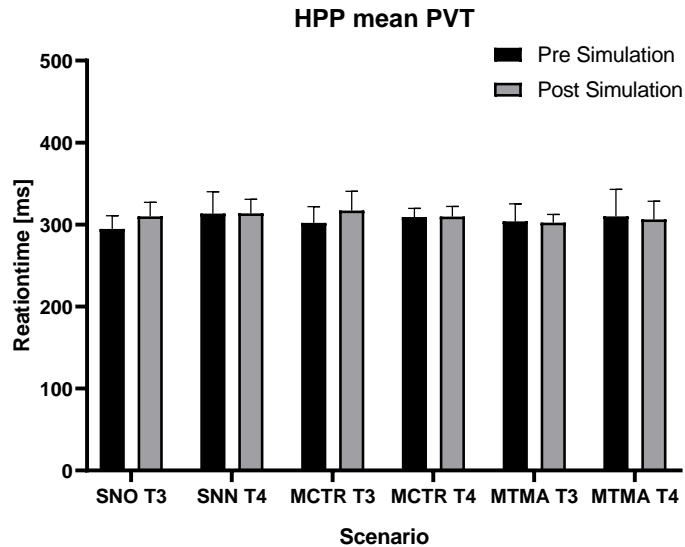
Results

- ✓ More Workload in Multi Configurations
 - From ISA 1 (under-utilized) to 2 (relaxed)



Results

✓ Higher Alertness in Multi Configurations (PVT)



Conclusions

- ✓ ATCOs are slowing down working speed at safety-critical tasks (e.g. QNH) as a result of feeling uncertain in an unfamiliar working environment (learning effect). The most probable motivation is to balance out work accuracy and quality by applying risk compensation strategies. The observed behaviour is best-described by the phenomenon of Speed-Accuracy-Tradeoff and further explained by Wilde's Risk Homöostase (Wilde,1982)
- ✓ Availability of operational-relevant information is satisfied in all configurations (no lack of availability)
- ✓ Multi Configurations provides moderate workload conditions to the ATCO that counteract against monotony, sleepiness and lack of alertness.
- ✓ No exhaustion of attentional resources observed (e.g. simultaneous movements). All situations were rated as manageable.

Thanks for Your Attention

Lothar Meyer - lothar.meyer@lfv.se

Maximilian Peukert - maximilian.peukert@lfv.se

