Open Day

Introduction to PJ05 “Remote Tower for Multiple Airports”

PJ-05 EXE-05.02-V3-2.4a&b (HungaroControl, FREQUENTIS, DLR)

Jörn Jakobi (AT-One/DLR PJ05 Project Coordinator)
DLR, Braunschweig
29/04/2019
Past ‘Multiple’ Research

First DLR Multiple trials (2010)

SESAR P06.09.03 & P06.08.04 (2014)
3 Aerodromes in PJ05
SESAR2020
PJ05 Remote Tower for Multiple Airports
DLR (AT-One)

WP2 Solution PJ.05-02
Multiple Remote Tower Module
LFV/COOPANS

WP3 Solution PJ.05-03
RTC with Flexible Allocation of Aerodromes to MRTMs
DFS
Validation Phases & Exercises

**PJ.05-02 Multiple Remote Tower Module (V2)**
HC (Braunschweig, Germany)
ON (Braunschweig, Germany)
COOPANS (Sturup, Sweden)
AVINOR (Asker, Norway)

**PJ.05-02 Multiple Remote Tower Module (V3)**
HC (Braunschweig & Budapest)
COOPANS (Växjö, Sweden)
AVINOR (Asker, Norway)
ENAV (Rome, Italy)

**PJ.05-03 RTC with Flexible Allocation of Aerodromes to MRTMs (V2)**
ON (Braunschweig, Germany)
COOPANS (Växjö, Sweden)
AVINOR (Asker, Norway)
DFS (Langen, Germany)

*End of Project Nov 2019*
Validation Scope (V3):

Proof of operational & technical feasibility for 1:3 multiple setting

2.4-V3a) Concept Validation through Simulation (Braunschweig)

2.4-V3b) Technical Performance Validation through PSM (Budapest)
Validation Set Up
## Experimental Design

<table>
<thead>
<tr>
<th>Scenario ID</th>
<th>N° AD</th>
<th>Duration</th>
<th>Mvmt/h</th>
<th>Time of day</th>
<th>Traffic Distribution</th>
<th>Type of Incident</th>
<th>IFR/VFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCN 1</td>
<td>3</td>
<td>50 min</td>
<td>20</td>
<td>Day</td>
<td>Uneven</td>
<td>Unplanned closure of AD (hydraulics leakage)</td>
<td>Mainly IFR</td>
</tr>
<tr>
<td>SCN 2</td>
<td>3</td>
<td>50 min</td>
<td>20</td>
<td>Day</td>
<td>Uneven</td>
<td>RWY Direction Change</td>
<td>Mainly IFR</td>
</tr>
<tr>
<td>SCN 3</td>
<td>3</td>
<td>50 min</td>
<td>20</td>
<td>Day</td>
<td>Even</td>
<td>Unplanned closure of AD (hydraulics leakage)</td>
<td>Mainly IFR</td>
</tr>
<tr>
<td>SCN 4</td>
<td>3</td>
<td>50 min</td>
<td>20</td>
<td>Day</td>
<td>Even</td>
<td>RWY Direction Change</td>
<td>Mainly IFR</td>
</tr>
<tr>
<td>SCN 5</td>
<td>3</td>
<td>30 min</td>
<td>20</td>
<td>Day</td>
<td>Even</td>
<td>AC emergency (engine failure, no fire)</td>
<td>Mainly IFR</td>
</tr>
</tbody>
</table>
# Traffic Scenario (SCN 1)

<table>
<thead>
<tr>
<th>EOBT/ELDT</th>
<th>CALLSIGN</th>
<th>AC</th>
<th>DESTINATION</th>
<th>SID</th>
<th>SQK</th>
<th>STAND</th>
<th>RWY</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:05:00</td>
<td>WZZ391</td>
<td>A320</td>
<td>Sofia (LBSF)</td>
<td>ERLOS</td>
<td>2</td>
<td>177</td>
<td>3</td>
<td>BR</td>
</tr>
<tr>
<td>08:07:00</td>
<td>EIN7EA</td>
<td>A320</td>
<td>Budapest (LHBP)</td>
<td>1733</td>
<td>4</td>
<td>173</td>
<td>4</td>
<td>BR</td>
</tr>
<tr>
<td>08:10:00</td>
<td>9AJM</td>
<td>C550</td>
<td>Budapest (LHBP)</td>
<td>1516</td>
<td>R15</td>
<td>151</td>
<td>15</td>
<td>BR</td>
</tr>
<tr>
<td>08:10:00</td>
<td>TRA72Q</td>
<td>B737</td>
<td>Rotterdam (EHARD)</td>
<td>114</td>
<td>R110</td>
<td>114</td>
<td>110</td>
<td>BR</td>
</tr>
<tr>
<td>08:20:00</td>
<td>WZZ9PU</td>
<td>A320</td>
<td>Budapest (LHBP)</td>
<td>3772</td>
<td>107</td>
<td>377</td>
<td>107</td>
<td>BR</td>
</tr>
<tr>
<td>08:22:00</td>
<td>DLR4TN</td>
<td>A320</td>
<td>Frankfurt (EDDF)</td>
<td>155</td>
<td>2</td>
<td>155</td>
<td>2</td>
<td>BR</td>
</tr>
<tr>
<td>08:22:00</td>
<td>AERSEDEI</td>
<td>FOL1</td>
<td>Budapest (LHBP)</td>
<td>1210</td>
<td>26</td>
<td>1210</td>
<td>26</td>
<td>RWY check, after oil leak</td>
</tr>
<tr>
<td>08:30:00</td>
<td>AEG550</td>
<td>SF34</td>
<td>Timisoara (LRTI)</td>
<td>2170</td>
<td>109</td>
<td>2170</td>
<td>109</td>
<td>BR</td>
</tr>
<tr>
<td>08:35:00</td>
<td>WZZ7BA</td>
<td>A320</td>
<td>Budapest (LHBP)</td>
<td>157</td>
<td>107</td>
<td>157</td>
<td>107</td>
<td>BR</td>
</tr>
<tr>
<td>08:35:00</td>
<td>HBVPA</td>
<td>C550</td>
<td>Paris (CDG) (LFPG)</td>
<td>2203</td>
<td>R16</td>
<td>2203</td>
<td>R16</td>
<td>BR</td>
</tr>
<tr>
<td>08:50:00</td>
<td>SWR252S</td>
<td>A320</td>
<td>Zurich (LSZH)</td>
<td>2172</td>
<td>R14</td>
<td>2172</td>
<td>R14</td>
<td>BR</td>
</tr>
</tbody>
</table>
Mid - Run
- ISA – Scale

Post – Run
- NASA-TLX
- SASHA
- AIM
- Safety
- Tailored questions

Debriefing
- open questions to:
  - acceptance and
  - recommendations for improvement
I.S.A. Workload over the time
Safety Assessment

Can the situation be solved without major impairment?
- Yes
  - No impairment: ATCO workload is low to easily achieve the desired performance.
  - Minor Impairment: ATCO requires a minor increased workload to achieve the desired performance.
- No
  - No impairment: Good
  - Minor Impairment: Fair

Impairment of efficiency
- Minor Unpleasant delays
- Moderate Disturbing delays
- High Very disturbing delays
  - ATCO responds with delay to pilot’s requests.
  - Situation leads to moderate delays in the traffic management.
  - Situation leads to strongly delays in the traffic management.

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

Cooper-Harper Scale

- **Frequency**
  - **1**: 1
  - **2**: 6
  - **3**: 4
  - **4**: 14
  - **5**: 5
  - **6**: 2
  - **7**: 16
  - **8**: 0
  - **9**: 0
  - **10**: 0

**Results**
- **N = 35**
- **M = 3.80**
- **SD = 1.24**
Myths to Multiple Remote Tower

• An ACTO is not able to work multiple

• *Multiple* needs new procedures

• *Multiple* only works with additional ground surveillance

• ATCOs do not like working *multiple*
Be prepared for the future!
PJ05 Remote Tower for Multiple Airports

Home

The modernisation of air traffic management is one of the main challenges of current aeronautics research. The Single European Sky ATM Research (SESAR) project defines, develops and deploys what is needed to increase ATM performance and build Europe’s intelligent air transport system. The current programme is SESAR 2020, running from 2016 to 2024 with a budget of 1.6 billion Euro, supports projects to deliver solutions in four key areas, namely airport operations, network operations, air traffic services and technology enablers.

Part of SESAR 2020 is the Project PJ05 “Remote Tower for Multiple Airports” with focus on the safe and efficient airport of the future. By bringing the concept of remotely controlling multiple airports to a higher maturity level, the SESAR project aims at providing small and medium sized airports with more cost-efficient and secure tailored air traffic services.
Jörn Jakobi (PJ05 Project Coordinator)
DLR Institute of Flight Guidance
Braunschweig, Germany
Joern.Jakobi@dlr.de

www.remote-tower.eu