Remote towers in demanding environments

Experiences gained by common DFS/Frequentis project
Contents

- Remote tower project DFS
- DFS/Frequentis validation experiences
- Frequentis smartVISION
Overview of DFS remote tower project

Main objectives

- Cutting costs in the long term:
  - using new technologies and procedures
  - optimizing staff scheduling and making it more efficient

- Step-by-step relocation of aerodrome control services from the airports of:
  - Saarbrücken (SCN)
  - Erfurt (ERF)
  - Dresden (DRS)
  …to a Remote Tower Centre in Leipzig (LEJ)

- Provision of the necessary technologies
Location-independent provision of airport control services
DFS remote tower – camera surveillance and control system

- Saarbrücken (15,000 movements/year)
- Erfurt (~10,000 movements/year)
- Dresden (~30,000 movements/year)

Additional extension of further airports and contingency centre

2014: Launch of public procurement process

2015: Frequentis contract award

Performing 4 operational validations so far in 2015/2016
## Motivation

**Productivity enhancements**

<table>
<thead>
<tr>
<th>Human resources</th>
<th>• Reducing costs using human resources more efficiently and pooling operational, technical and administrative support functions</th>
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<tbody>
<tr>
<td>Engineering</td>
<td>• Reducing operating and maintenance costs using uniform infrastructure and harmonising the ATM technology for the aerodrome control towers to be relocated</td>
</tr>
<tr>
<td>Further synergies</td>
<td>• Reducing staff costs in the long term optimising the operational staff scheduling on the basis of the further development from the single to the multiple remote approach</td>
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</tbody>
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DFS/Frequentis project RTC functionality

- Location-independent aerodrome control services with a camera surveillance and control system

- Dedicated "remote tower" sector family with a uniform authorisation concept for the RTC airport

- Integration of the Clearance-Delivery-Function at one working position for all aerodromes
Challenges and success factors

Proof of compliance of the RTC project with EU regulations and ICAO requirements

Provision of the necessary infrastructure and technology

Use of new technologies and procedures

Change of paradigm in the provision of aerodrome control services: cultural change for controllers

Innovation
26 DFS tower controllers at the German Aerospace Centre (DLR)

- Milestone 1: simulation 1 airport vol.: 12 aircraft/45 min. alone, 23 aircraft/45 min. with support
- Milestone 2 scope of controller unit endorsements: simulation: handling 3 airports + PG remote complexity, facing north/south, sector family structure, unit endorsement concepts
- Milestone 3: workshop to work out suggestions for solutions/recommendations

Conclusion:
- Workload and situational awareness are acceptable
- Solutions/ Recommendations included in the further project steps
Tender process

- After an extensive tender process, DFS selects Frequentis remote tower technology (off-the-shelf product)

- Next steps: solution validation and certification for operations

- Operational and technical validation phase in Saarbrücken (SCN):
  - Operational requirements (use cases from the Manual of Operations) for the Air Traffic Services to be checked in Saarbrücken (SCN)
  - Currently: Customisation of the selected off-the-shelf product to meet the specifications and requirements of DFS
Validation experience
Frequentis and remote TWR – more than five years of experience

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early concept definition</td>
<td>Technology research</td>
<td>Solution definition</td>
<td>Operational validation Zeltweg / Dresden / Oman</td>
<td>DFS evaluation</td>
<td>DFS contract Validation cycles</td>
</tr>
</tbody>
</table>

- **Research and development**
- **Intensive field testing**
- **Customer rollout**
2013 – Introduction of IR & Tracking Technology to ATCOs

- IR Performance during different weather conditions
- Demonstration of 360° IR panorama based Object Detection and Bounding
- Line of Sight Tracking via PTZ Camera
- Laser Range Finder Technology – for precise distance measurement
Challenge: Monitoring of VFR Traffic
High Performance IR Panorama with object detection and PTZ tracking
2014 – Test Installation Visual / IR sensors

- Focus on comparisons of visual and IR panorama for **VFR detection**
- Integration with Surveillance System (MLAT System)
DFS-Frequentis common spiral project execution plan

- Validation targets
- Iterative validations
- Feedback & planning for next validation
- Lessons learned
- Controller input
- Validation System

Validation 1 – n
Project validation – Visual capabilities for situational awareness
June 2015

- Visual Capabilities for Situational Awareness
- Interaction concepts
- Monitor types & sizes
- Visual/IR bounding & tracking
- Frame rate >25 fps is essential
- Camera adjustment for optimal air/ground coverage
- Further focus on HMI
- Controller input
- Lessons learned
- Validation

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**Project validation**

**September 2015**

- **Validation targets**
- **Controller input**
- **65” monitor concept**
- **Improved visual & IR panorama**
- **In-picture gesture PTZ interaction**
- **Focus on reduced distance/size & image quality**
- **Avoid even number of displays**
- **Change in hot spot camera concept**

Large display size is not necessarily more usable.
Project validation

November 2015

Validation targets

Integration of all auxiliary & surveillance screens

Validation

PTZ control via map display

6 curved monitor concept (IR + Visual)

Improved bounding & tracking

Further info. augmentation for panorama

Improved concept for 360° panorama navigation

Lessons learned
Project validation
January 2016

Validation targets

Validation

Validation of enhanced camera cleaning system

Switch between Visual & IR

Continuous 360° panorama panning

Waiting for Feedback

Controller input

Lessons learned
smartVISION Overview
Remote Tower Market Segments

Airport Movements

LARGER AIRPORTS
- Contingency operation
- Apron management

MIDSIZE AIRPORTS
- Mixed Traffic VFR, IFR
- Ground & Control Zone
- Limited Radar Coverage
- DFS References: Dresden, Saarbrücken, Erfurth

SMALL AIRFIELDS

System Performance & Complexity

Airport Movements

- > 150'000
- 70’-150’
- 10’-70’
- 5’-10’
- < 5’000
### Fully Adaptable to Individual Customer Needs

#### Solution Profile – Remote Tower

**Capabilities of panorama view**
- Panoramic view
- for selected sectors
- Standard housing
- Wiper based cleaning

**Capabilities of PTZ view**
- COTS PTZ
- Visual zoom
- Optional light gun

**System functions**
- Manual PTZ control
- Predefined positions
- PTZ assignment via Pano
- Static video overlays

**Capabilities of panorama view**
- 360° Visual + IR
- Extended vertical view
- Special protection housing
- High pressure cleaning

**Capabilities of PTZ view**
- VIS zoom
- Cooled IR Zoom
- Secondary PTZ & light gun
- Mechanical stabilization

**System functions**
- Automatic object detection & alerting
- PTZ auto tracking
- Surveillance integration
- Safety Net functions
- Dynamic Information overlay

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**Basic | Airfield ground monitoring**

- **Advanced | Ground & control zone monitoring**

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**System functions**
- Cost optimized
- Performance optimized
Remote Virtual Tower – more than just visualisation
Solution overview & competences

Enable remote capabilities

IP network (Voice, Data, Video)

Contingency solution

Remote tower centre

Competences

Airport
- Tower automation
- MET, Nav Aids & AF Lights integration
- Voice com / radio integration
- Camera & video processing technology

Control centre
- Console & control room design
- Human factors / usability
- Integrated controller working position

ATM networks & recording
- ATC grade network design
- Bandwidth management
- Network contingency solutions
smartVISION – enhancing the tower view
Use of IR technology, object tracking & augmentation

Flexible presentation / compact working position

Enhanced high quality 360 degree visual & IR view

PTZ camera line of sight tracking (follows objects automatically)

Integrated control panel for improved situation awareness

Automatic detection of multiple objects in panorama view

Video based safety NET to alert critical situations

Label overlay in visual view (based on surveillance data)

Bandwidth optimized network concept
"Enhancing airport view”
Frequentis virtual remote tower: benefits

- Scalable solution concept **designed to cost**
- Adaptable for different **customer use cases**
- Provision of Turn Key Solution including all elements of a remote tower solution
- Prepared for Multi Airport Handling