PJ05 Summary

Jörn Jakobi - DLR (AT-One)
SESAR2020 PJ05 Project Coordinator

PJ05 close out event – Stockholm - 14/11/2019
S2020 IR Work Programme

Industrial Research and Validation

High Perf. APT

- Increased Rwy & Airport Throughput
  - PJ02 PL: ECTL

Optimised Network Man.

- Integrated Surf. Mgt
  - PJ03a PL: ENAV

- APT Safety Nets
  - PJ03b PL: DSNA

Advanced ATS

- Advanced Airspace Mgt
  - PJ08 PL: ECTL

- Separation Mgt En-route & TMA
  - PJ10 PL: DFS

Enabling av. Infrastructure

- Enhanced ARR & DEP Mgt
  - PJ01 PL: NATS

- Enhanced ARR & DEP Mgt
  - PJ01 PL: ENAV

- Separation Mgt En-route & TMA
  - PJ10 PL: DFS

- Enhanced A &G Safety nets
  - PJ11 PL: ECTL

Val and Demo. Engineering

- Master Plan Maintenance
  - PJ20 PL: ECTL

- Optimised AU Operations (UDPP)
  - PJ07 PL: ECTL

- Trajectory based Free Route
  - PJ06 PL: DSNA

- Common Services
  - PJ15 PL: Indra

- Air vehicles systems
  - PJ13 PL: Leonardo

- 4D Trajectory Management
  - PJ18 PL: Indra

Content Integration

- PJ19 PL: ECTL

Transversal for Wave 1 and 2

- Master Plan Maintenance
  - PJ20 PL: ECTL

- Val and Demo. Engineering
  - PJ22 PL: ENAV

Enhanced ARR & DEP Mgt

- PJ01 PL: NATS

- Enhanced ARR & DEP Mgt
  - PJ01 PL: ECTL

- Separation Mgt En-route & TMA
  - PJ10 PL: DFS

- Enhanced A &G Safety nets
  - PJ11 PL: ECTL

- Optimised AU Operations (UDPP)
  - PJ07 PL: ECTL

- Trajectory based Free Route
  - PJ06 PL: DSNA

- Common Services
  - PJ15 PL: Indra

- Air vehicles systems
  - PJ13 PL: Leonardo

- 4D Trajectory Management
  - PJ18 PL: Indra

- Content Integration
  - PJ19 PL: ECTL
Past ‘Multiple’ Research

First DLR Multiple trials (2010)

SESAR P06.09.03 & P06.08.04 (2014)
PJ05 Project objectives and scope

PJ05 addressed remotely provided Air Traffic Services for **multiple aerodromes** and the **flexible allocation of aerodromes within an RTC**. By improved HMI of the remote tower modules, planning tools and split/merge procedures, air traffic controllers and supervisors will be able to:

- handle **two or more airports** simultaneously by **increased situational awareness**,  
- to coordinate **complex traffic patterns** and workload peaks by **flexibly allocating aerodromes**,  
- to **increase the overall efficiency** of aerodromes connected to an RTC.  
- **remote met observations** for all possible airports
Project objectives and scope

PJ05
Remote Tower for Multiple Airports
DLR (AT-One)

WP1 Project Management
DLR (AT-One)

WP2 Sol PJ.05-02
Multiple Remote Tower Module
LFV/COOPANS
EXE-05.02-V3-2.2_COOPANS
EXE-05.02-V3-2.3_INDRA
EXE-05.02-V3-2.4_HC_a&b
EXE-05.02-V3-2.5_ENAV

WP3 Sol PJ.05-03
RTC with Flexible Allocation of Aerodromes to MRTMs
DFS
EXE-05.03-V2-3.1_ON
EXE-05.03-V2-3.2_COOPANS
EXE-05.03-V2-3.3_INDRA
EXE-05.03-V2-3.5_DFS

WP4 Ethics Requirements
DLR (AT-One)

WP5 Solution PJ.05-05
Advanced Automated MET System
LPS (B4)
Validation Perspective (oper. solutions)

PJ.05.02 – Solution 2 (V2)
• To design and validate the provision of ATS on a RTM for two or more aerodromes simultaneously.
  
• PJ.05.02 – Solution 2 & V2
  • ON / FRQ / DLR (AT-One)
  • COOPANS / NATMIG / NLR (AT-One)
  • INDRA / AVINOR
  • HC / FRQ / DLR (AT-One)

• PJ.05.02 – Solution 2 & V3
  • COOPANS / NATMIG / NLR (AT-One)
  • INDRA / AVINOR
  • HC / FRQ / DLR (AT-One)
  • ENAV

PJ.05.03 – Solution 3 (V2)
• To design and validate the flexible use of the human resource and connected aerodromes flexible and dynamic in a RTC.
  
• PJ.05.02 – Solution 2 & V2
  • ON / THALES AS / FRQ / DLR (AT-One)
  • COOPANS / NATMIG / NLR (AT-One)
  • INDRA / AVINOR
  • HC / Thales AS
  • DFS / FRQ / DLR (AT-One)
PJ.05 high level life cycle

** Reporting Period 1 **

- 2016
- 2017
- Prototypes & tools development
- Interim OSED/TS and validation plan

** Reporting Period 2 **

- 2018
- Validation Exercises
- VALR
- Update of OSED/TS/CBA
- PJ.05-02: V2 Data Pack Delivery (end June 2018)

- 2019
- 05-02 V3 Validation Activities
- 05-03 V2 Validation & 05-05 TRL4 Verification Activities
- PJ.05-02 V2 Maturity Gate (02/2019)
- 3x Maturity Gate
- 3x Data Pack Delivery (end June 2019)
A typical Validation setup

**Mid - Run**
- ISA – Scale

**Post – Run**
- NASA-TLX
- SASHA
- AIM
- Safety
- Tailored questions
- Etc...

**Debriefing**
- open questions to:
  - acceptance and
  - recommendations for improvement
Safety Assessment

Can the situation be solved without major impairment?

- YES
  - No impairment (Good)
    - ATC workload is low to easily achieve the desired performance.
  - No impairment (Fair)
    - ATC workload is adequate to achieve the desired performance.
  - Minor Impairment
    - ATC requires a minor increased workload to achieve the desired performance.

NO

Can the situation be solved by measures reducing capacity?

- YES
  - ATC influences capacity

NO

Can the situation be solved by measures reducing safety?

- YES
  - ATC workload is too high and should be reduced

NO

Impairment of efficiency

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

Impairment of safety

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

Cooper-Harper Scale

Frequency

N = 35
M = 3.80
SD = 1.24
Splitting & Merging
CHECKLIST Handover

1. REQUEST from ATCO-HANDOVER to ATCO-TAKEOVER to take control of Aerodrome X (Y)
   ATCO-HANDOVER Handover Aerodrome X (Y)
   ATCO-TAKEOVER Go Ahead / Standby

2. ATCO-HANDOVER provides following information:
   * Relevant weather information (visibility, wind, etc.)
   * Runway in use (Runway condition)
   * Equipment failure (only if failures exist)
   * Aerodrome restrictions/closures (if any)
   * Traffic on Frequency (VFR/IFR) including
     * position
     * intentions
     * clearances

3. Actual HANDOVER
   ATCO-TAKEOVER Information copied. Taking over
   ATCO-HANDOVER Roger

* handover of an aerodrome should happen best in a “clean configuration”, that is, most probably no need to intervene for the next 30 seconds.
I.S.A. Workload over the time

- Baseline - 3 Airports 100% [Emergency]
- SPLIT - 1 Airport 50% [Emergency]
- SPLIT - 2 Airports 50%

Workload vs. Time (min)
I.S.A. Workload over the time

- **Baseline - 3 Airports 100%**
- **Split: 2 Airports 75%**
- **Split: 1 Airport 25%**
Communication/Dissemination via Social Business Media
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 service tailored air traffic services.
Main Conclusions from PM’s view 1/2

• Thales withdrawal and PJ05-05 creation cause additional not preplanned trouble and effort but greatly solved by all

• 12 exercises conducted as planned

• No immediate barriers in terms of operational feasibility
  • Safety not compromised
  • „Multiple“ identified as a normal contributor to complexity which is to be controlled like it is done today
  • Phraseology, degrade mode, emergencies, Panorama view design to be further tested in V3 phase
  • Split&Merging seems to be an excellent workload balance procedure (to be further tested in W2 V3!)
Main Conclusions from PM’s view 2/2

- Results are thoroughly reported
- Excellent com/diss of the activities and results
- Project successfully accomplished
- Ready for implementation and Wave2
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!