Dedicated to innovation in aerospace

Advanced simulation research infrastructures for Air Transport – Future generation

How we 'C' Simulation in the Vision?

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2nd Aeronautics ERA-Net AirTN Workshop on Aviation Research Infrastructures in Europe
25 Feb 2013, Brussels

Member of AT-One the ATM Research Alliance

Content : How we “C” Simulation

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AT-One Facts & Figures

- Strategic Alliance of
  the **DLR Institute of Flight Guidance** and
  the **NLR Air Transport Division**
- Shareholders:
  50% DLR, 50% NLR
- Locations:
  Braunschweig, Amsterdam, Brussels
- Total number of employees: ~ 300
- Annual turnover: ~ 35 M€
- Support background of
  an additional 1400 employees in Aviation Research

One of the largest ATM research organisations in the world

What did the IEG say about Air Transport simulation?

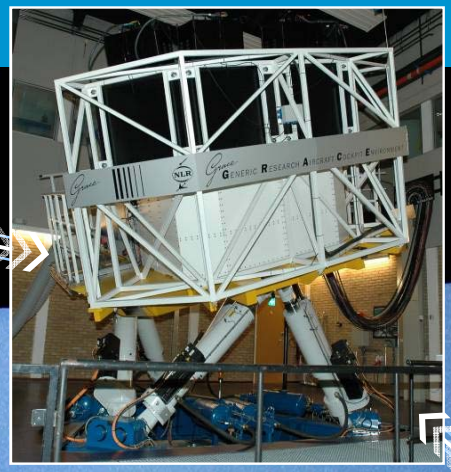
- To conduct the required RDT&E on these new systems an integrated ground and airborne simulation and test infrastructure is necessary consisting of:
  - Flight test aircraft and helicopters
  - Moving base and fixed base flight simulators
  - Radar simulators with ATCo positions
  - Tower simulators

- These facilities should be equipped so that they can be used in an integrated way to simulate with and without actual SESAR hardware in the loop, the new SES configurations.

Research infrastructure

ATC Simulator

Research Aircraft



Flight Simulator

Tower Simulator

External ATC + flight simulators or ops. systems

When & how do we use simulation?

- **Research & Development phase (lower TRL)**
  - Validate concept principles
  - Validate operability, acceptability, usability
  - Validate performance

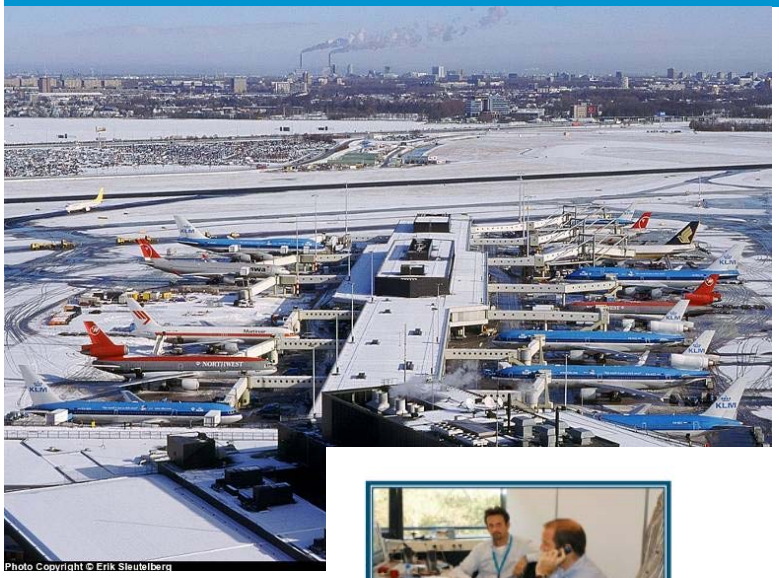
  - Fast time simulation
    - Air Traffic Optimisation
    - Optimisation of conflict resolution, avoiding collision risk
  - Real time simulation
    - Procedure development
    - Human factors

When & how do we use simulation? (2)

- **Implementation phase**
  - Accelerate the introduction of new technologies through simulation with stakeholders
    - Unmanned Aircraft Ground Control Station
  - Involvement of communities
    - Virtual Community Noise Simulator

- **Operational phase (high TRL)**
  - Training
    - Flight simulators
    - ATC training
    - Serious gaming
    - Embedded training
  - Multi-disciplinairy training to prepare for adverse weather conditions

Simulation for Cooperation
Complex Winter Training simulation



LVNL

KLM

Meteo

Schiphol

KLM Operations Control

Tower simulator

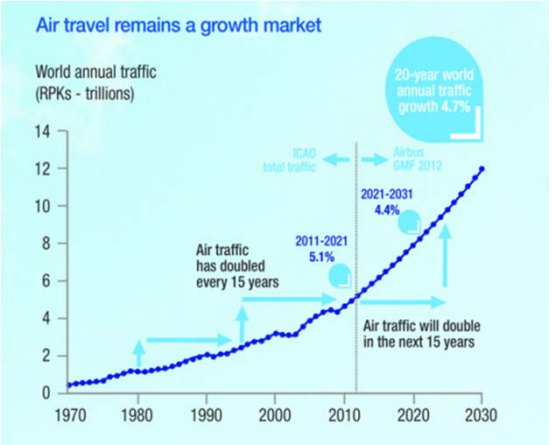
Exercise management
Kitchen crew
Technical support

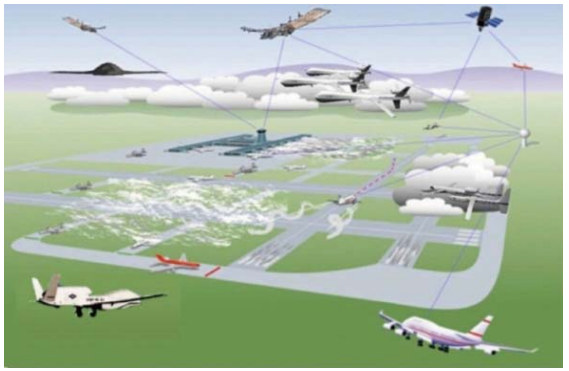
KLM Hub Control

Deicing
Gate planning
Apron control

Grand Challenges
Simulation is needed to prepare for the future!

- **More air traffic**
- **More passengers**
- **More aircraft**
- **Other platforms**
  - Integration of RPAS in non-segregated airspace
  - Personal Air Transport
- **Economic development**
- **Pressure on natural resources**
- **Climate change**





Challenges
The SRIA and simulation needs

- **Some SRIA goals:**
  - 90% of travellers within Europe are able to complete their journey, door-to-door within 4 hours
  - A coherent ground infrastructure is developed
  - Flights land within 1 minute of the planned arrival time
  - An air traffic management system is in place that provides a range of services to handle at least 25 million flights a year of all types of vehicles

Complexity

The role of simulation in the development of the future air transport system

MOBILITY

LOGISTICS

Passenger

Cargo

Airline

Application

Aviation

Technology and infrastructure

Aircraft

Airspace

Airport

CLEANSKY

SESAR JOINT UNDERTAKING

Technology Evaluator

Community

Pax

PPlane

Multimodal Transport

RPAS

Environment

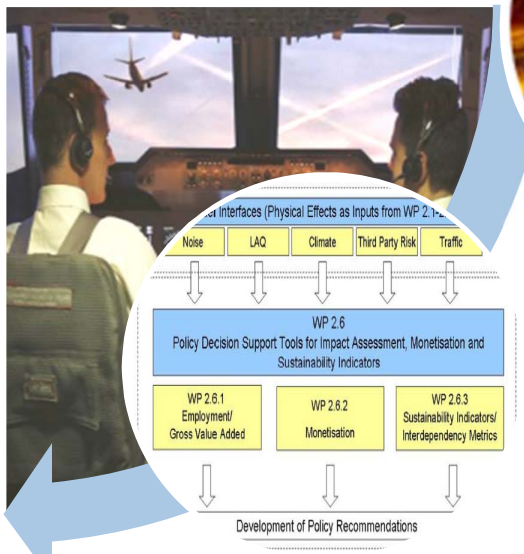
Completeness & Coherence
An integrated approach to Air Transport simulation

Serious gaming
FP7 MASCA

Noise Simulation

Agent based safety analyses
FP7 Resilience 2050

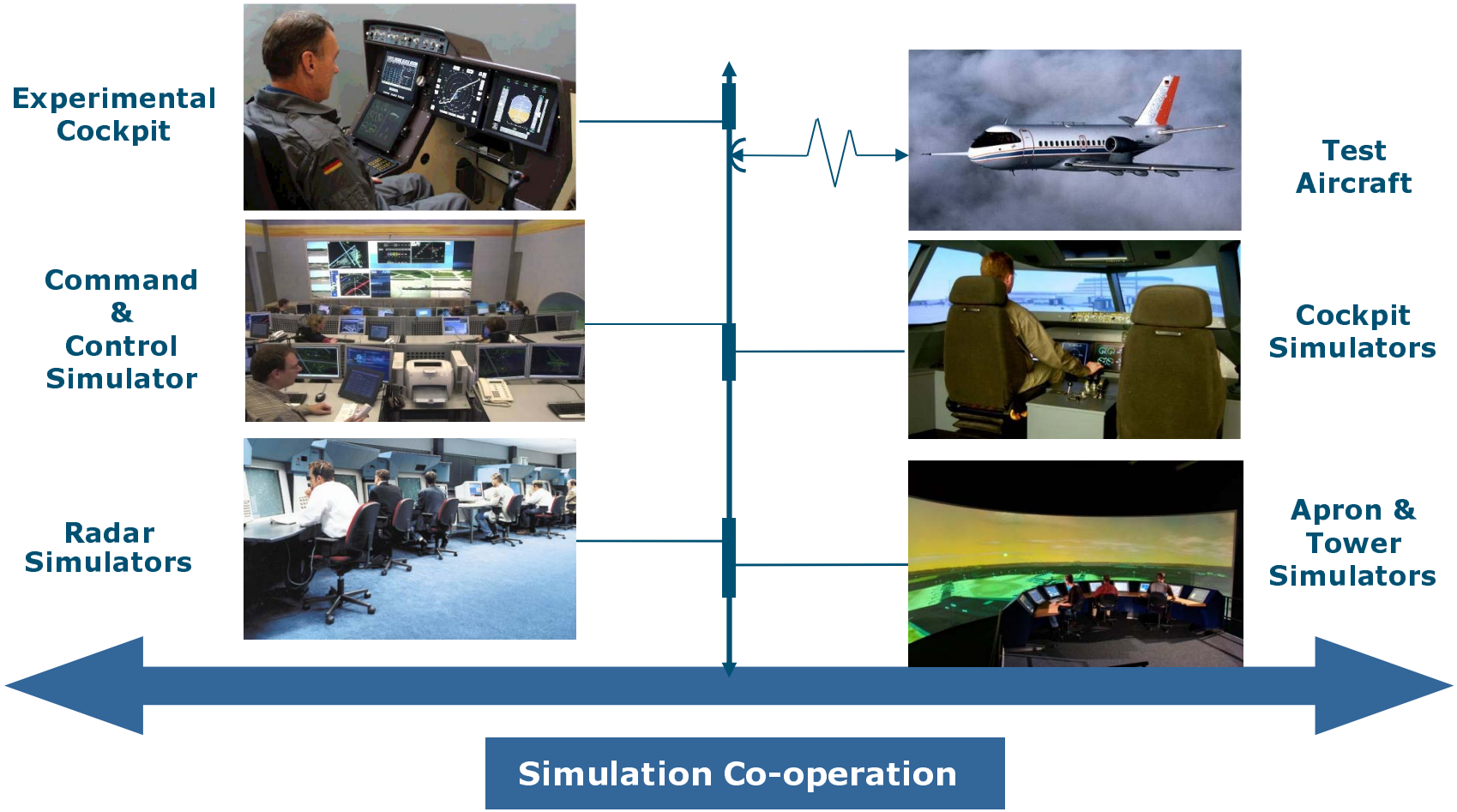
MUAGCS
Mature Unmanned Aircraft Ground Control Station



Environmental and Econ Aviation Modelling for Policy Analysis
FP7 TEAM-PLAY

Complex simulation through co-operation

Integrated Real Time Human In The Loop Simulation Facilities within AT-One



Conclusions
C's to meet the Challenges

- **More complex Air Transport System requires more complex simulations**

- **An integrated approach is needed**
  - Co-operation amongst stakeholders
  - Use traditional and additional simulation research facilities

- **Role for simulation to accelerate the introduction of new transport capabilities to achieve mobility goals:**
  - Traditional
    - Develop and evaluate new Technologies
  - Additional
    - Multi-modal Mobility Performance Assesment (i.r.t. Airspace and Airport capacity)
    - Serious Games to improve co-operation between various aviation stakeholders
    - Environmental & Safety Impact Assessment

- **Co-operation between industry, REs and governments (EU and National) is key**
  - Joint investments in strategic simulation infrastructure to meet the challenges of future aviation will be necessary

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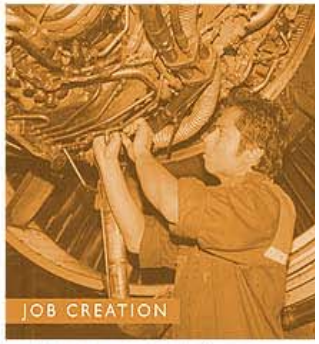


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