

The Effect of a Highly Automated Environment on Human Behaviour

*Plans and first Results of the WP-E project
ADAHR*

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*First SESAR Innovation Days
Toulouse, 29NOV – 01DEC 2011*



Consortium



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Outline

ADAHR Objectives

The approach

Gaming Technique

First results: Roles and Responsibilities

Next Steps

Objectives

**Automation applied to an inefficient
operation will magnify the inefficiency**

operation will magnify the inefficiency

(Bill Gates)



Problem Statement

Major issue in ATM is impact of automation and new technologies on human operator

- Automated systems must be compatible with human capabilities

One of key focuses of SESAR:

- Role of the human and their relation with advanced automation tools to work:
 - Safely
 - With an appropriate workload
 - With a high level of situational awareness.

Previous and current work

- Some knowledge about how automation impacts on workload and performance of an actor
- But little is known about how automation impacts on interaction and situational awareness among several actors with different interests

Impact of automation on human roles and interactions in 2020-2050?



Objectives



To assess the behaviour of ATM human actors
in a highly automated environment



Research Questions:

- How does automation impact roles and responsibilities?
- How does automation impact human interaction?
- Which automation functionalities should be prioritized in SESAR?
- What requirements are needed to promote the acceptance of high levels of automation?



Approach

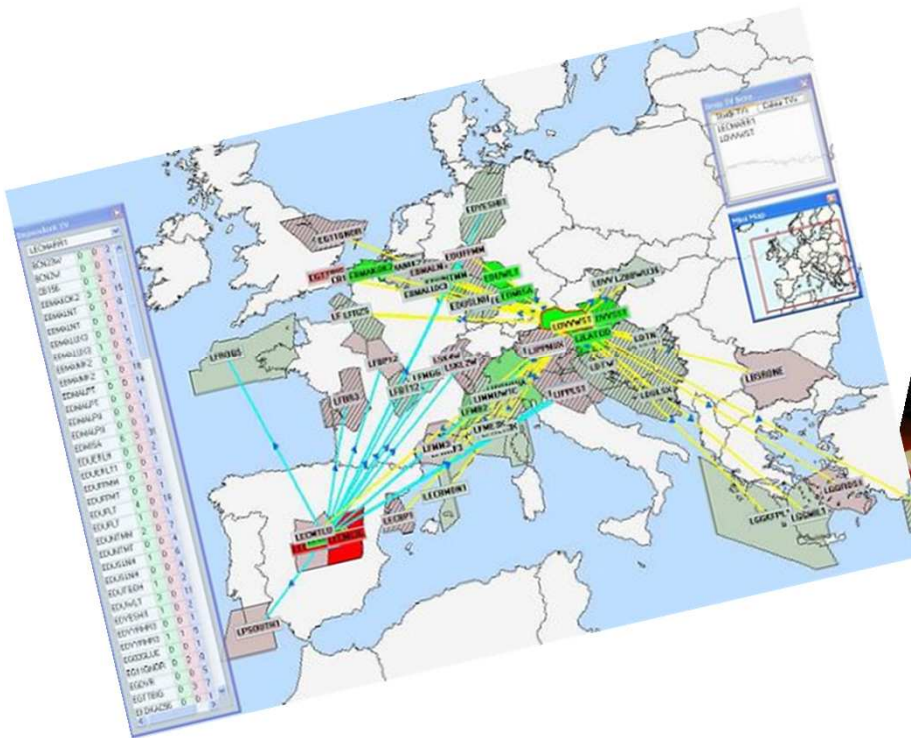


Environments



Airspace Organization and Management

Airport Operation Centre



Gaming Technique



What is Gaming?



Low-cost human in the loop activity to assess feasibility and operability of immature concepts



Simulate decision making processes and H-H / H-M interactions;



Experts are 'around a table' playing different roles as they were living real processes (AOCs, Pilots, AMC, Network Manager,...);

Every role has a particular scope, objectives and strategies during the process;

Scenario running in real-time (or even slow time);



Promoting non-routine thinking, thus enabling out-of-the-box thinking.





Common elements of Gaming



Game Master

Players (roles, objectives)

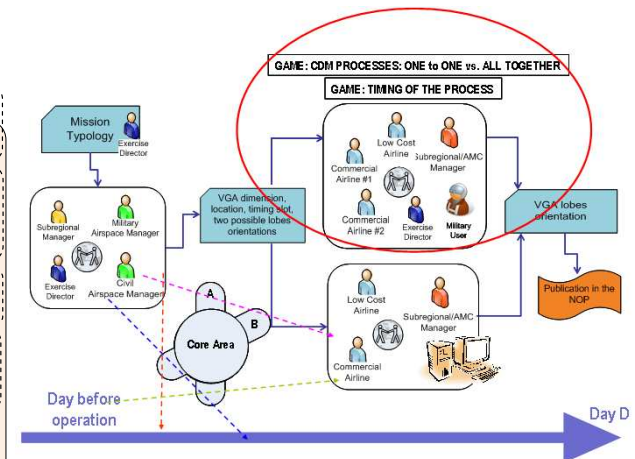
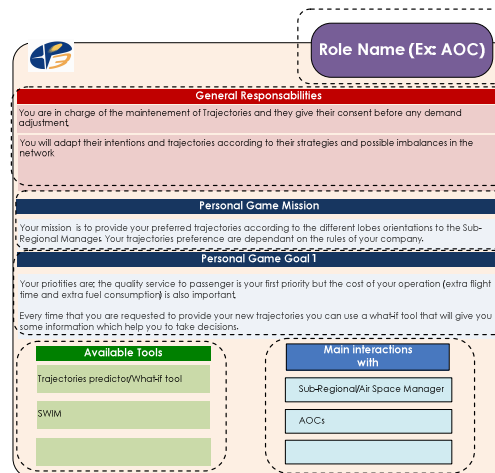
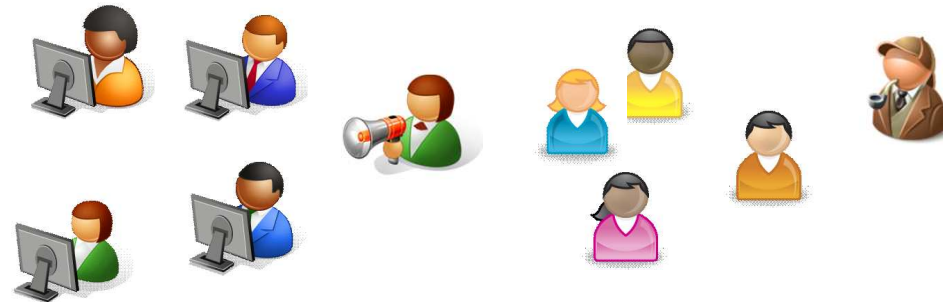
Observers and Assistants

Game Scenario

Rules

Tools to collect outcomes

Questionnaires
Comment Sheets
Debriefing
Platform Data reports





Paper-Based vs. Platform-Based Gaming



Paper-Based

- Relatively easy and low-cost (use of basic office material)
- Support and complement the platform-based games
- First assessment of Roles, Responsibilities and Interactions



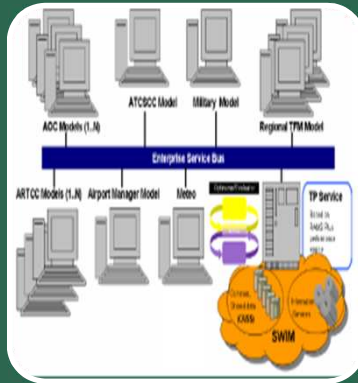
Platform-Based

- Use of hardware platform
- More realistic context
- More complex game rules
- Also quantitative results





Platform-based Gaming



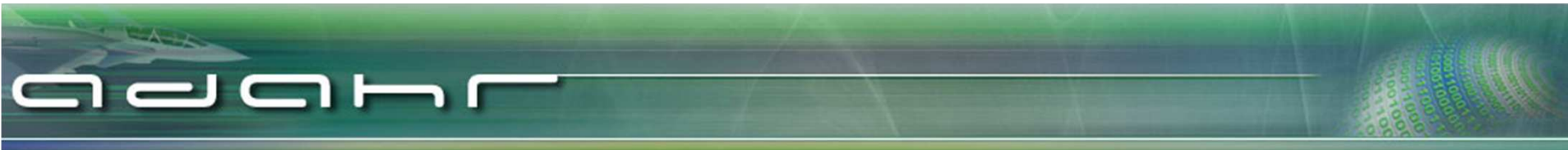
CHILL

- Collaborative Human-In-The-Loop Laboratory
- Used in Airspace Organization and Management Gaming (DCB)
- Different categories of actors work together
- Suite of interoperable modelling services and components

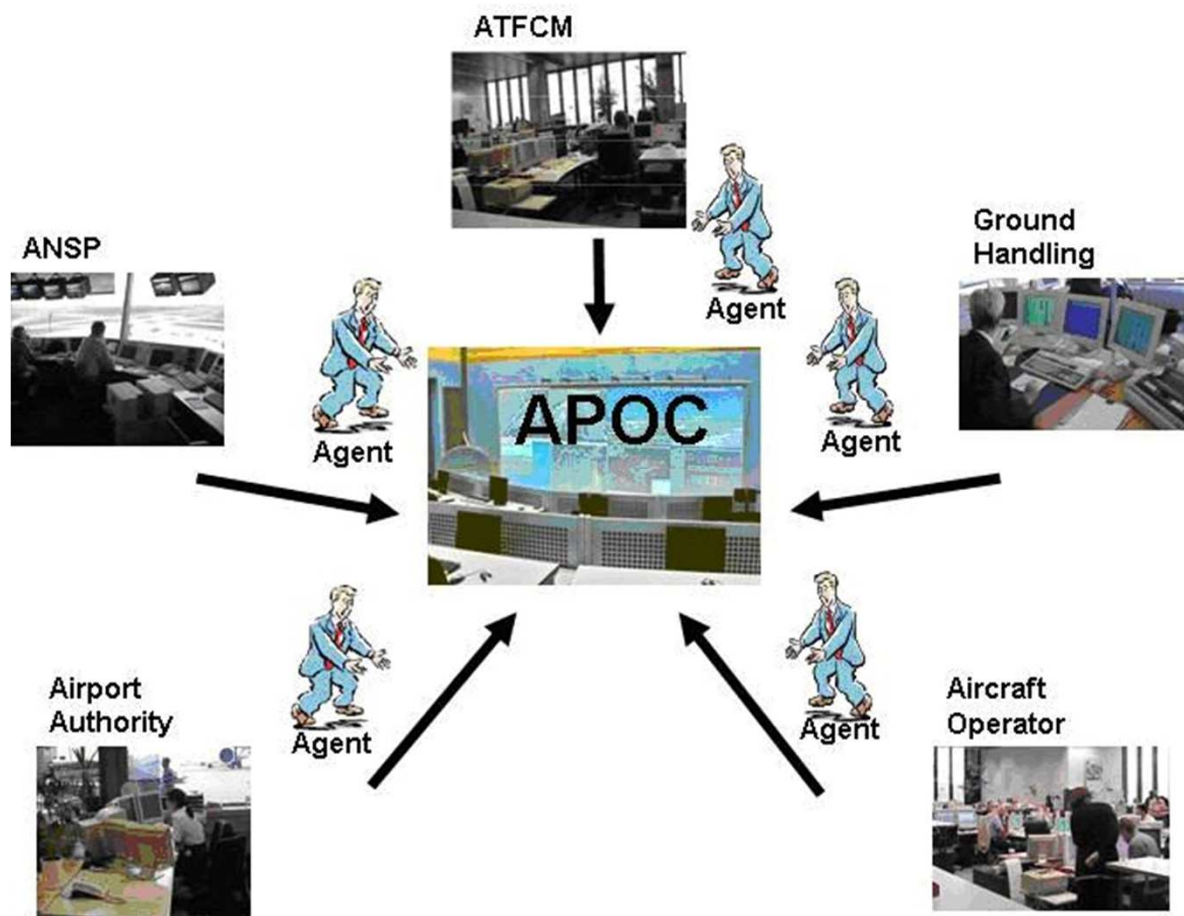


ACCES

- Airport Control Center Simulator
- Used in APOC Gaming (AOP)
- Several operator working positions with CDM and TOP
- Situation overview by video-wall



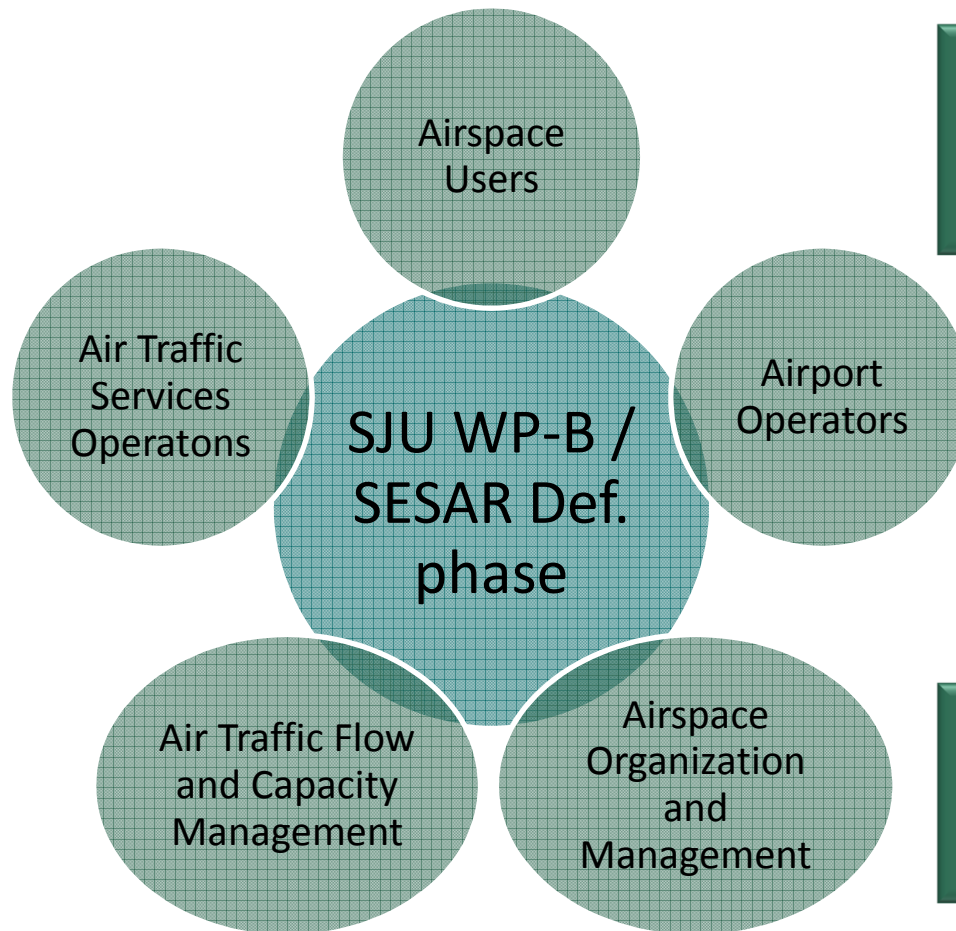
Focus: Interaction / CDM



First Results: Roles & Responsibilities



Actors and Roles 2020



Global role description
Interaction with other roles

Relevance for two environments
Foreseen future impact of LoA



Filter



Expected future of ATM

- Literature where available (strategic papers)
- Consortium partners expectations



Level of Automation (LoA)

- Corresponds to level of automated decision making
- Several taxonomies : Parasuraman, Endsley and Kaber
- LoA in one system not necessarily at same level at any point in time



Capacities of gaming platforms

- Can (changed) role be simulated?
- Can platform be adapted?





Future Roles and Responsibilities (2020/2035/2050)



AOM roles

- Multi Sector Planner
- Executive and Planner controller
- Airspace Manager
- Local Traffic Manager

APOC roles

- Airport Duty officer
- Airport CDM project manager/APOC Supervisor
- Ground Handling Agent
- Aircraft Operator Agent

Task description

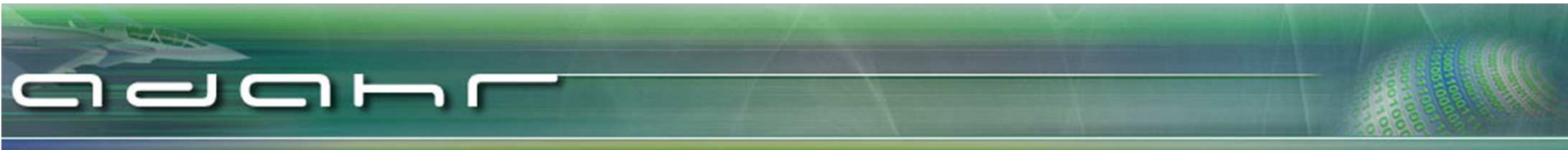
[D1.1 on Website](#)

Interaction with other roles

Requirements for simulation environment / platform

Indicators to measure impact of the changing role on the actor

Next Steps



Progress



Roles & Responsibilities
2020

LoA

Roles & Responsibilities
2035, 2050



2012

Execution

Gaming

Role Name (Ex AOC)

General Responsibilities	
You are in charge of the implementation of trajectories and the game flow, control and any manual adjustment.	
You will adapt their intentions and trajectories according to their strategies and possible imbalances in the network.	
Personal Game Mission	
Your mission is to provide your preferred trajectories according to the different tasks operations to the Sub-Regional Manager. Your trajectories preference are dependent on the rules of your company.	
Personal Game Grid 1	
Your possible use the quality service to prevent to use that priority but the cost of your operations (risk, fuel time and extra fuel consumption) is also important.	
Every time that you are requested to provide your new trajectories you can use a workload tool that will give you some information which help you to take decisions.	
Available Tools	Main Interactions with
Trajectories prediction tool	Sub-Regional Manager
SWIM	AOCs

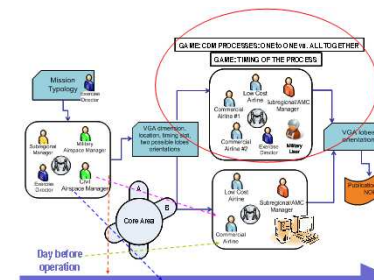
Paper-based



Platform-based

Preparation / Adaptation

Scenarios for
2 ENVs.





More info



www.adahr.eu

SESAR WPE
LONG TERM AND INNOVATIVE RESEARCH

This project has been funded with support from the SESAR Joint Undertaking

ADAH
Assessment of degree of automation on human roles

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Description

ADAH will assess the human factors aspects, (including potential benefits), dealing with changes in the roles, their interactions, situation awareness and their responsibilities in the future operational environment where automation has reached a high level of implementation. The integration of airborne and ground-based systems, the evolution of the human role and the transitions to higher degrees of automation will be taken into consideration in this project.

Added Value

Thanks to ADAH there will be a better knowledge of human interactions and a better description of the roles of human operators in a highly automated ATM environment. Expected results of ADAH are:

- A better understanding of the impact of automation in the interactions between different actors.
- An insight on the changes in stakeholder's strategies according to the level of automation.
- To prove and demonstrate the benefits of the introduction of higher automation levels in the ATM environment.
- Recommendations on early introduction of higher automation levels.
- Definition of roles and responsibilities of the human actors according to different automation higher automation levels.
- Identification and pre-specification of tool's functionalities that support the introduction of higher automation levels.

Objectives

The main objective of ADAH is to assess the behaviour of different ATM human actors in a highly automated environment. This objective will be achieved through the:

- Identification of mechanisms that enhance the trust of the human actors in automation.
- Analysis of the impact of automation in the interaction between human actors.
- Analysis of the impact of automation on the new roles and responsibilities foreseen by the levels of automation addressed, especially in terms of workload and situational awareness.
- Analysis of the tools supporting the ATM human actors' duties.

To perform this assessment, the ATM-innovative validation technique so called "Gaming" techniques are essentially human-in-the-loop activities, but they are suitable for concepts such as SESAR where the decision-making processes of several actors are a key factor.

A set of scenarios addressing different automation levels will be defined and presented to several actors. As an outcome of the Gaming Exercises final stages of SESAR (beyond 2020) will be performed and recommendations regarding transition problems and when to deploy the automation will be proposed (e.g. bring forward to Service Level 4 one technology that initially was foreseen in Service Level 5 due to its impact on the human performance). The other set of outcomes will improve the roles and responsibilities in relationship with different levels of automation at the timeframe beyond 2050.

Three different platforms will be used for assessing the impact of high automation levels in the human behaviour. There will be one "Paper Based Platform" and two "Hardware Based Platforms". Each Hardware Based Platform will address two different environments:

- Airspace Organisation and Management.
- Airport Operations Centre.

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