Towards Higher Levels of Automation in Air Traffic Management
• Introductions:
  – The Programme
  – The Guest Lecturers
  – The Audience
  – SESAR WP E
  – The HALA! Network and

• HALA’s White Paper / Position Paper - State of the Art and Research Agenda
HALA! SESAR Research Network

- What do we mean by **HIGHER LEVELS OF AUTOMATION IN ATM**?
- What is the current state of the art in Automation and what is the **AUTOMATION STRATEGY OF SESAR**?
- In which **AREAS** do we need to **RESEARCH MORE**?
- What are the **OBJECTIVE AND AIMS** of the NETWORK?...
- **BECOME PART OF THE NETWORK**
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>10:00 a 12:00</td>
<td>Welcome</td>
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<tr>
<td></td>
<td>Francisco Sáez. Director of the Course</td>
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<td>HALA! Research Network &amp; WP E</td>
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<td>Eduardo García. Principal Researcher. UPM/CRIDA.</td>
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<tr>
<td>12:00 a 12:30</td>
<td>COFFEE</td>
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<td>12:30 a 14:30</td>
<td>Single European Sky</td>
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<td>Jesús Pérez Blanco. Deputy General Director. CAA.</td>
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<td>SESAR Operational Concept &amp; Automation</td>
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<td>José Miguel de Pablo Guerrero. Director. CRIDA.</td>
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<td>14:30 a 16:30</td>
<td>LUNCH</td>
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<td>16:30 a 18:30</td>
<td>Managing Innovation</td>
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<td>Dirk Schaefer. Long-Term &amp; Innovative Research. EUROCONTROL.</td>
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<td>Problems of automation in space</td>
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<td>Frank De Winne. Astronaut. ESA, SESAR Scientific Committee</td>
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## The Programme

### TUESDAY 12TH OF JULY

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<td>ATM Invariants</td>
<td>Francisco Javier Sáez Nieto. Professor. UPM.</td>
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<td>Automation at the Airport</td>
<td>Maria de los Angeles Varona Ibañez. Airport Consultant. ISDEFE.</td>
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<td>12:30 a 14:30</td>
<td>ATC Automation: Facts and steps ahead</td>
<td>Jose María Berdoy Contreras. INECO.</td>
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<td>Keeping a safe ATM</td>
<td>Jesús Romero. Head of Safety Department. AENA</td>
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<td>16:30 a 18:30</td>
<td>Precision Trajectory Clearance (PTC). A New Separation Mode.</td>
<td>Luis Perez Sanz. Lecturer. UPM.</td>
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<td>Efficiency and Automation</td>
<td>Rosa Arnaldo Valdés. Lecturer. UPM.</td>
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<tr>
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<td><strong>Cognitive systems</strong>&lt;br&gt; Erik Hollnagel. Professor. MINES PARISTECH</td>
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<td>12:30 a 14:30</td>
<td><strong>Human Computer Interaction</strong>&lt;br&gt; Philippe Palanque. Professor. IRIT.</td>
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<td>16:30 a 18:30</td>
<td><strong>Automation to overcome human errors: true or illusion?</strong>&lt;br&gt; José Luis García Chico. Principal Researcher. CRIDA.&lt;br&gt; <strong>Intelligent systems applied to ATM</strong>&lt;br&gt; Juan Alberto Besada Portas. Lecturer. UPM.</td>
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<td><strong>Consequences of Flight Deck Automation</strong></td>
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<td>Oscar Elizalde. Pilot. SAFETRAIN.</td>
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<td><strong>Collaborative trajectory management applications …</strong></td>
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<td>Miguel Ángel Vilaplana. Technical Manager. BOEING R &amp; TE.</td>
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<td>12:30 a 14:30</td>
<td><strong>Decision Support Systems</strong></td>
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<td>Francisco Javier Ruano Contreras. Director. INDRA.</td>
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<td><strong>Unmanned Aircraft Systems Insertion</strong></td>
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<td>Francisco Navarro. Chief ATM Scientist. BOEING R &amp; TE.</td>
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<td><strong>LUNCH</strong></td>
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<td>16:30 a 18:30</td>
<td><strong>Validating Automation</strong></td>
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<td>Nicolás Suárez. Technical Manager. CRIDA.</td>
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<td><strong>WRAP UP</strong></td>
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Guest Lecturers

- Civil Aviation Authority
- R&D Managers
- Astronaut
- Pilot
- Automation Experts
- Professors
- Human Factors Experts
The Audience

- UPM students
- PhD Candidates
- Researchers and Engineers

INECO, CRIDA, Integrasys, DLR, Deep Blue...

UPM, Imperial College, TU Braunschweig, University of Naples “Federico II”, TU Darmstadt, University of Paul Sabatier, University of Bristol
Contrary to the United States, Europe does not have a single sky, one in which air navigation is managed at the European level. Furthermore, European airspace is among the busiest in the world with over 33,000 flights on busy days and high airport density.

The EU Single European Sky is an ambitious initiative launched by the European Commission in 2004 to reform the architecture of European air traffic management. It proposes a legislative approach to meet future capacity and safety needs at a European rather than a local level.

As part of the Single European Sky initiative, SESAR (Single European Sky ATM Research) represents its technological dimension. It will help create a “paradigm shift”, supported by state-of-the-art and innovative technology.
Development Work Programme

long-term research

Innovation
How WP-E works

WP-E uses two functional instruments:

• **Research networks** provide a structured way to build research knowledge, competence and capability that should serve the industry in the long term.

• **Research projects** will explore new ideas essentially for the long term but which may also be targeted at innovation applicable in short- and mid-terms.
RESEARCH NETWORKS

Theme 1: Legal Aspects of Paradigm Shift

Theme 2: Toward Higher Levels of Automation in ATM

Theme 3: Mastering Complex Systems Safely

Theme 4: Economics and Performance

SESAR Joint Undertaking

NOW

2020

FUTURE
• Automation
• HALA!

• Complexity
• Complexworld

UPM:          Innaxis:
A wide range for research.

HALA! RESEARCH NETWORK

INTRODUCTION TO HALA!

UPM – HALA! SUMMER COURSE
La Granja 11/7/2011
CONTENTS:

- Objectives of HALA!
- Main Activities (Call for PhDs, ATACCS,...)
- HALA! Management Team
- Participants
- Intended Audience
• HALA! (Higher Automation Levels in ATM) is a Research Network established within the framework of SESAR WP-E to spearhead long term and innovative research in automation in ATM in pursuit of the SESAR 2020 vision and beyond.

• In HALA! we believe effective automation can create a paradigm shift and that additional innovation in automation is needed to identify and investigate topics that might bring new solutions and to propose research activities not currently planned within the ‘mainstream’ SESAR workpackages.

• HALA! is open to academia, industries, research centers and individuals who are interested in participating to the research activities of the network.

• The meaning of HALA! in Spanish is "Go on! Get moving".
OBJECTIVES

- Go beyond traditional approaches on automation in ATM
- Offer better framework conditions for ATM research
- Cover ATM automation activities not currently addressed by the other work packages of the SESAR work programme
- Foster research in automation in ATM

Higher Levels of Automation in ATM
PhDs
- 2 Call for PhDs
- First call has already taken place
- Second Call for PhDs - June 2011

Conferences
- HALA! Annual conference (ATACCS)
- Summer School
- Joint Conference

Promote the Best Research in Automation in ATM

Progress on Automation
- White paper

Scientific collaborative platform
Pollinizer (facilitator) www.hala-sesar.net
Results of the First call for PhDs were announced the 6th of November 2010. These were the 6 selected Host Universities:

- **Imperial College London.** PhD Candidate: Gonzalo Tobaruela
- **Glasgow University and Boeing R&TE.** PhD Candidate: Enrique Casado.
- **IRIT, Toulouse and DEEP BLUE.** PhD Candidate: Martina Ragosta
- **Technische Universitaet Dresden.** PhD Candidate: Thomas Kunze.
- **Technische Universitaet Braunschweig.** PhD Candidate: Alexander Schwithal.
- **University of Naples “Federico II”.** PhD Candidate: Tirri Anna Elena

Selection of PhDs candidates was completed in March 2011
The second call for PhDs will be open to any university, research centre or company that wants to contribute to the objectives of HALA!. Research organizations in all relevant fields of research will not have to be participants of HALA! to submit their proposals.

Second Call for PhD proposals – Open Call – PROPOSED DATES

• Opening date: 15th of June 2011.
• Closing date: 5th of September 2011.
• Announcement of the results of the Second Call for PhD proposals. 7th of October 2011.
• Announcement of the results of the Candidate selection process. ASAP (before end of January 2012)
• Start date for the first cohort of PhD programme. Q1 2012.
ATACCS are scientific conferences that are going to be organized on the theme Automation in Command and Control Systems by HALA! SESAR Research Network.

**ATACCS’2011**

1st International Conference on Application and Theory of Automation in Command and Control Systems

- Submission deadline: March 21st, 2011
- Authors notification: April 18th, 2011
- Camera-ready due: May 9th, 2011
- Conference: May 26-27, 2011

Barcelona, Spain

Organized by: [HALA! SESAR Research Network](http://www.hala-sesar.net)

In cooperation with:

- [ASDA](http://www.asda-europe.org)
- [EUROCONTROL](http://www.eurocontrol.int)
- [EATRADA](http://www.eatrada.org)
- [ifip](http://www.ifip.org)
- [SIGCHI](http://www.sigchi.org)

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- 40 papers received
- 110+ Attendees
- Next Year in LONDON!
  (Imperial College)
Humans: Still the Best Computer of All?

Brian Wilson
26 May 2011

TextGen is going
are being built and
without waiting for

Centers are already
optimization
algorithms to specify
human - automation

Description of the
first flight ATV
SESAR Innovation Days

Toulouse
29th November – 1st December 2011
Hosted by ENAC
Currently there are over **80 Organizations** in the Network!

**300+ researchers** registered in the HALA! Network
HALA! SESAR Research Network

Welcome

HALAI (Higher Automation Levels in ATM) is a Research Network established within the framework of SESAR WP-E to spearhead long term and innovative research in automation in ATM in pursuit of the SESAR 2020 vision and beyond.

In HALAI we believe effective automation can create a paradigm shift and that additional innovation in automation is needed to identify and investigate topics that might bring new solutions and to propose research activities not currently planned within the “mainstream” SESAR workpackages.

HALAI is open to academia, industries, research centers and individuals who are interested in participating to the research activities of the network.

HALAI means in Spanish “Go on! Get moving”.

Improve Collaborative Tools:
- Discussion Forums
- PhD blogs

Improve Pollinizer Data:
- Data Repository
- Data Management
HALA! RESEARCH NETWORK

WHITE PAPER /
Position Paper
– State of the Art and Research Agenda

UPM – HALA! SUMMER COURSE
La Granja 11/7/2011
CONTENTS:

• Heritage in ATM and Automation
• The new paradigm shift in Automation in ATM
  • Overall system performance as main driver for ATM Automation
  • The three interdependent dimensions for the paradigm change.
• New roles assignment based on :
  • “best time”
  • “decision place”
  • “best player”
• HALA! main research areas
In the last years our knowledge has rapidly increased allowing us to focus our research resources to very specific areas. As a consequence we know far more about specifics and less about everything. Good examples of this trend are the Navigation and Airspace Management domains. Future ATM tools and technology may provide the users with all the required information about any flight at any moment, but how do we turn all that information into knowledge? Automation of this process will be a major goal impacting on all research fields. An effective management of our knowledge is actually a basic requirement to go on developing but ...can the knowledge really be automated? And does it worth it?
DEFINITIONS

**ATM**

Air Traffic Services +
Air Space Management +
Air Traffic Flow Management

**ATS**: the various flight information services, alerting services, air traffic advisory services and ATC services (area, approach and aerodrome control services);

**ATC**: maintain a safe distance between aircraft and obstacles within a confined airspace and also on the airport surface;

**ASM**: maximize, within a given airspace structure, the utilization of available airspace by dynamic time sharing and segregation of airspace among competing categories of users based on short-term needs;

**ATFM**: ensure an optimum flow of air traffic through areas during times when demands (is expected to) exceed the available capacity of ATC service

**Automation**

1. replacement of human workers by technology: a system in which a workplace or process has been converted to one that replaces or minimizes human labor with mechanical or electronic equipment

2. act of automating: the act of automating something, or the state of being automated
DEFINITIONS

ATM

Flight Trajectories Management

Automation

Improvement of Processes through the use of Technology
HERITAGE IN ATM AND AUTOMATION

State of the art of automation in safety critical applications

SESAR and NextGen automation strategy

Automation limits based on human performance consequences!

Automation vs. Human factors

Learn from other Safety Critical industries: nuclear industry, etc...
Shift from Airspace – Based operation towards a Trajectory – Based operation concept.

“In the ATM Target Concept it is recognised that humans will constitute the core of the future European ATM Systems operations.”

D3. – ATM Target Concept. SESAR.

Shift from a controller-based system towards a more distributed system.
NEW PARADIGM SHIFT IN ATM AUTOMATION

Focus on ATM Invariants

Automation driven by overall system performance

New role assignment based on:
- “best time”
- “decision place”
- “best player”
NEW PARADIGM SHIFT IN ATM AUTOMATION

ATM Invariants

Goals
- Safety (Separation Assurance)
- Efficiency (broad sense: user, provider & society)

Limitations
- Airport Capacity
- Atmospheric Behaviour
NEW PARADIGM SHIFT IN ATM AUTOMATION

The three interdependent dimensions for the paradigm change

New role assignment based on:

First dimension “BEST TIME” for decision making: Strategic vs. tactical planning layer

Second dimension “DECISION PLACE”: Controlled vs. autonomy.

Third dimension “BEST PLAYER”: Human vs. automated player.
First dimension “BEST TIME” for decision making: Strategic vs. Tactical layer questions to be answered

STRATEGIC VS. TACTICAL

- What is the impact of uncertainties in a system when most decisions are taken long time in advance?
- As ATM processes, at different planning layers, will have feedback to absorb unexpected changes: will the overall system (composed by different nested loops) maintain the required stability?
- Do strategic functions imply more complex and rigid operational scenarios?
- Can tactical decisions alone manage ATM goals and limitations?
- Other?
Second dimension “DECISION PLACE”: Controlled vs. Autonomy questions to be answered

CONTROLLED VS. AUTONOMY

• What is the level of correlation between complexity and centric controlled systems?
• Autonomy: where?, When? Are segregated airspace structures (UMAS/MAS) a solution?
• In which scenario (controlled or autonomous) will automation provide higher overall system performance?
• Is high traffic density/complexity a key factor limiting autonomy?
• Do tactical decisions imply autonomous and fully automated processes?
• Does strategic decision making imply centric controlled scenarios?
• Others?
Third dimension “BEST PLAYER”: Human vs. Automated player questions to be answered

HUMAN VS. MACHINE

- Should trajectory management (e.g., Trajectory deconfliction, even tactical decisions) be fully automated?
- To what extent do strategic decisions require human intervention?
- How can uncertainty be managed in automated systems?
- Are the current frameworks for automation, cognition and human factors enough to capture ATM singularities?
- Is a fully automated air transport system socially/psychologically acceptable?
- Can the ATM system be decomplexified through automation?
- How to deal with transition issues when implementing higher levels of automation?
- Does uncertainty require human centered decision-making?
HALA! Main Research Areas

Technical Support: Automation Complexity

Strategic vs. Tactical

Controlled Systems versus Aircraft Autonomy

New Roles Assignment

Social Impact: Economic Legal

Hierarchy of Automation in ATM
Please send your ideas to hala@hala-sesar.net or USE THE FORUMS INSIDE the HALA! Website!

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Thank you for your attention!