SESAR Exploratory Research

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LOOKING AT THE FLIGHT AS A WHOLE, WITHIN A FLOW AND NETWORK CONTEXT
SESAR to enable step-change in system capabilities

**Automation of routine tasks**
Automation and use of data communication to ease controllers & support staff workload

**Integration of all vehicles**
All air vehicles fully integrated in ATM environment (incl. RPAS)

**Flight-centric operations**
Air users fly their preferred, more direct route in a flow and network context

**Integrated systems**
Lean and modular systems, easily upgradeable and interoperable

**Sharing of information**
Information shared digitally via common information platform

**Virtualization**
Virtualization allowing dynamic capacity management
Changes to ATM

Delivering best-in-class, globally interoperable and high-performing Air Transport for Airspace Users and Citizens

- Enabling the delivery of safe, cost-efficient and environmentally responsible Air Vehicle & ATM operations, systems and services

High Performing Airport Operations

Capacity, Safety, Environment, Efficient, Effective, Networked

Optimised ATM Network Services

Collaboration, Balancing Demand & Capacity, Environment, Efficiency

Advanced Air Traffic Services

Synchronisation, Capacity, Safety, Environment, Cost

Enabling the Aviation Infrastructure

- Providing shared technical services across the aviation domain
- Communications, positioning, navigation, timing and SWIM information
- Air vehicle operations, systems & services
ATM Research in Europe

• HORIZON Transport Challenges smart, green and integrated transport
• FlightPath 2050 - five challenges to aviation beyond the 2050 Horizon
• SESAR 1 WP-E Long-term and innovative research
• SESAR 2020 Exploratory Research (Budget = 85 Million Euros)
Exploratory Research Challenges

• Challenge 1 - Meeting Societal and Market Needs
• Challenge 2 - Maintaining and Extending Industrial Leadership
• Challenge 3 - Protecting the Environment and the Energy Supply
• Challenge 4 - Ensuring Safety and Security
• Challenge 5 - Prioritising Research, Testing Capabilities and Education
SESAR exploratory research drives the development and evaluation of innovative or unconventional ideas, concepts, methods and technologies; that can define and deliver the performance required for the next generation of European ATM system, and thus contribute to its successful evolution

Reviewed, updated and approved by the SESAR Scientific Committee
**SESAR 2020 R&I Pipeline**

- **Exploratory research**: Explores novel concepts, ideas and emerging technologies in order to stimulate creativity in the ATM research domain.
- **Applied research**: Takes accumulated knowledge and theories and applies them to practical ATM challenges.
- **Development (Release process)**: Takes concepts through a rigorous validation process resulting in new SESAR solutions.
- **Demonstration Activities**: Showcases solutions in a real operational environment involving multiple stakeholders across Europe.
- **SESAR Solution Packs**: Documentation that comes with each SESAR solution is packed together and made available online to support further take-up by industry.
SESAR Exploratory Research Objectives

• To contribute to the European ATM Master Plan towards long term objectives beyond 2035 (i.e. 2050 timescale)
• To contribute to the identification of innovative solutions not yet identified but which would accelerate the realisation of the SES targets
• The delivery sustainable healthy research activities across a range of research networks in Europe
SESAR 1 Long-term Research

- Long-term research in SESAR1 conducted under the frame of WP E.
- A total of 40 projects of which 26 are ongoing and 14 are closed.
- The three Research Networks coordinate research, 20 PhD.
- HALA! – Towards Higher Levels of Automation in ATM.
- Complex World – Mastering Complex Systems Safely.
- ALIAS – Addressing the Liability Impact of Automated Systems.
SESAR 1- Encouraging scientific excellence in ATM

With guidance from SESAR Scientific Committee

- Towards Higher Level of Automation in ATM: 17 Projects, 13 PhDs
- Mastering Complex Systems Safely: 11 Projects, 7 PhDs
- System Architecture & System Design: 3 Projects
- Enabling Change in ATM: 6 Projects
- Focussing on:
  - Business Agility
  - Decision Support
  - Environment & Meteorology
  - CNS/ATM (Automation)
  - Operating Concepts
  - The Human Factor
- Information Management, Uncertainty & Optimisation: 3 Projects

FROM INNOVATION TO SOLUTION
• The transfer of long-term research results is difficult into the Industrial Research activities of the main SESAR program

• SESAR 2020 will aim at better bridging the results from Exploratory Research through Industrial Research, Large Scale Demos towards implementation/industrialisation readiness

• Strengthen the link of the ATM research community and SESAR stakeholders through ATM Applications Oriented topics in SESAR 2020
SESAR 2020 Exploratory Research Call

SESAR 2020 ER 1st Call launched 25th of March 2015
• Call closed on 25th of June 2015
• H2020 Open Call - Research & Innovation Action (RIA)
• ER 1st Call covers 11 Topics
• 20,6 Meuro co-financing budget
• 100 % co-financing of eligible costs
• Projects beginning early 2016

SESAR 2020 Future Exploratory Research Calls
• SESAR 2020 ER 2nd Call is planned for end 2016
• SESAR 2020 ER 3rd Call is planned for 2019
• **Automation of the ATM systems**- new paradigms for human-machine interaction, integration of RPAS or highly autonomous aerial vehicles, degradation of automation and impact on ATM performance including safety & security, automation failure scenarios

• **Data Science & Information Management in ATM** – applying complexity and data science in ATM, automating the extraction of knowledge of raw data, cyber-security, using Ontology engineering models in a network environment

• **Environment & Meteorology in ATM** – 4D trajectories taking into account environmental considerations, airborne and ground MET capabilities integration in ATM processes, weather uncertainty impacts 4D trajectories, impact of climate change
• Challenges of change
  - evolving market pressures
  - new market entrants
  - new business models
  - variable pricing mechanisms for demand-capacity balancing
  - unbundling ATM services
  - lessons learnt from other industries
  - impact on ATM system architecture
High Performing Airport Operations - as the pressure increases on airports, new technologies are emerging that may offer significant potential for improved situational awareness for tower controllers.

Separation Management and Separation Standards - to define potential new separation standards and separation management techniques to allow a/c to be more closely spaced

CNS - is the use, or adaptation, of new technologies being developed outside ATM to support ATM CNS needs including analysis of the safety, performance and security implications for the ATM system, CNS are currently characterized by lack of integration, GNSS jamming/spoofing
• **Trajectory Based Operations (TBO)** - TBO is a key element of future ATM operating concepts. It is expected to provide the flexibility needed by airspace users to optimise their operations while simultaneously ensuring the predictability needed at ATM network level for maximum overall performance.

• **ATM Architecture** - research activities are expected to help better understanding and modeling how architectural and design choices influence the ATM system and its various behaviours.

• **ATM Performance** - to address change in the way Air Navigation Services (ANS) are regulated, operated, consumed and financed is now undergoing.
• **ATM Excellent Science & Outreach** - is curiosity-driven and explores unknown research areas. Referred to also as “**fundamental research**”, but also encourages scientists to develop innovative ideas and concepts for the future ATM evolution. Bridging ATM research with wider community and providing scientific support to ATM change, either directly or through connection to other funded research areas in other disciplines and sections if relevant.

• **ATM Applications Oriented Research** - aiming at supporting new concepts for ATM beyond those identified in the ATM Master Plan as well as help mature new concepts for ATM, emerging technologies and methods to the level of maturity required to feed into SESAR 2020 industrial research
SESAR 2020 Exploratory Research Topics

ATM Excellent Science & Outreach:
- ER-01-2015 - Automation in ATM
- ER-02-2015 - Data Science in ATM
- ER-03-2015 - Information Management in ATM
- ER-04-2015 - Environment & Meteorology in ATM
- ER-05-2015 - Economics and Legal Change in ATM

ATM Application-Oriented Research:
- ER-06-2015 - High Performing Airport Operations
- ER-07-2015 - Separation Management and Separation Standards
- ER-08-2015 - Communications, Navigation and Surveillance
- ER-09-2015 - Trajectory Based Operations
- ER-10-2015 - ATM Architecture
- ER-11-2015 - ATM Performance
SESAR 2020 1st ER Call Proposals Received

ATM Excellent Science & Outreach

60 proposals

ATM Application-Oriented Research

63 proposals

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<thead>
<tr>
<th>Topic</th>
<th>Proposals</th>
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<tbody>
<tr>
<td>Automation in ATM</td>
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<td>Data Science in ATM</td>
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<td>Information Management in ATM</td>
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<td>Environment and meteorology in ATM</td>
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<td>ATM Performance</td>
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SESAR-01-2015: Topic 1
SESAR-02-2015: Topic 2
SESAR-03-2015: Topic 3
SESAR-04-2015: Topic 4
SESAR-05-2015: Topic 5
SESAR-06-2015: Topic 6
SESAR-07-2015: Topic 7
SESAR-08-2015: Topic 8
SESAR-09-2015: Topic 9
SESAR-10-2015: Topic 10
SESAR-11-2015: Topic 11
SESAR 2020 1st ER Call distribution by entities

- Industry: 33.1%
- Aviation Auth.: 8.9%
- ANSP: 10.5%
- Research: 44.4%
- University: 2.4%
- Consultancy: 0.8%
SESAR 2020 1st ER Call Participation by Country

European Union

Non European Union
SESAR ER 1st Call Results-Part I

SESAR 2020 ER 1st Call Budget Distribution

ATM Excellent Science & Outreach 42%
ATM Application-Oriented Research 58%

FROM INNOVATION TO SOLUTION
ER 1st Qualified Projects per Topic

ER Projects per Topic

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FROM INNOVATION TO SOLUTION
ER Selected Proposals per Country

The bar chart shows the number of selected proposals per country. The country with the highest number of proposals is ES (Spain), followed by IT (Italy) and RS (Slovakia). Other countries have significantly fewer proposals.
• Highly competitive 1\textsuperscript{st} ER Call with good quality proposals building upon WP-E results
• Innovative research questions and challenges addressed in the proposals
• Proposals fully in-line with SESAR Vision for the future evolution of the European ATM
SESAR 2020 ER 2\textsuperscript{nd} Call

• How do we identify new disruptive research ideas and concepts relevant to the future evolution of ATM?
• How do follow-up on WP-E results and transfer these results into SESAR Industrial research?
• How can identify research direction addressing future ATM research challenges?
• How can we create a new long-term research roadmap of benefit to the future European ATM systems?
SESAR 2020 2nd Exploratory Research Call

- SESAR 2020 ER 2nd Call to be launched in late 2016
- SESAR ER Call Scope currently being defined
- Call expected to contain Transversal and ATM Applications Oriented topics
- H2020 open calls, so not limited to SJU Members
Transversal exploratory research activities, aims at the communication and application of research results through the establishment of knowledge network activities and the support for ATM related education of the future ATM skilled work-force:

- **Knowledge Transfer Network** - assessment, coordination and communication transfer of ER results
- **Future ATM Skilled work-force** - PhD, training network activities, Young Scientist Award
SESAR 2020 ATM Applications Oriented Research

- **High Performing Airport Operations** - Enhanced Runway Throughput, Integrated Surface Management, etc.
- **Optimized ATM Network Management** airspace management, etc.
- **Advanced Air Traffic Services** - Enhanced Air & Ground Safety Nets, separation, etc.
- **Enabling Aviation Infrastructure** – CNS, Common Services, etc.
- **ATM Operations, Architecture & Performance** - ATM Resilience, etc.
Conclusions

• SESAR Exploratory Research will be the driver behind innovative and disruptive research ideas
• More budget available in SESAR2020
• ER results will feed the next steps in SESAR Industrial Research
• The link between research and deployment is assured
• Its time to get involved
Thank you for your attention