Innovations in air traffic services

Session introduction
Oznur Uygur
SESAR Joint Undertaking
SESAR: Technological pillar of Single European Sky and key enabler for the Aviation Strategy

Bucharest, 27-30 May 2019
SESAR Innovation Pipeline: integrated approach

SESAR INNOVATION PIPELINE

Air traffic management research & innovation 2018 highlights

EXPLORATORY RESEARCH
- Explores new concepts beyond those identified in the European ATM Master Plan or emerging technologies and methods. The knowledge acquired can be transferred into the SESAR industrial and demonstration activities.

INDUSTRIAL RESEARCH & VALIDATION
- Assesses and validates technical and operational concepts in simulated and real operational environments according to a set of key performance areas. This process transforms concepts into SESAR Solutions.

VERY LARGE SCALE DEMONSTRATIONS
- Tests SESAR Solutions on a much larger scale and in real operations to prove their applicability and encourage the early take-up of solutions.

Bucharest, 27-30 May 2019
Solution-oriented approach
What is a SESAR Solution?
Solution-oriented approach

What is a SESAR Solution?

SESAR Solution: Programme output of R&I activities which relates to either an operational or a technological improvement which have been designed, developed and validated in response to performance needs identified in the European ATM Plan.

There are two types of SESAR Solutions:

- SESAR ATM Solutions
- SESAR Technological Solutions
DELIVERING TIMELY SOLUTIONS

- 63 SESAR Solutions and candidate solutions in the pipeline
- 40+ already under deployment across Europe
- Disseminated through EU aviation standards
- Clear associated benefits: safety, efficiency, capacity and the environment
- Globally applicable
SESAR 2020 Projects to be presented in this session

TO BE FREE
OPTIMISING FREE ROUTE OPERATIONS

GRADE

Bucharest, 27-30 May 2019
Thank you!

SESAR
Towards virtualisation in air traffic management

SESAR PJ16 CWP HMI
Technical perspective
Thomas Buchanan, Skyguide
Operational perspective
Maurizio Romano, Technosky
What is a virtual centre?

- A virtual centre is a single ATSU or a grouping of collaborative Air Traffic Service Units (ATSU) using data services provided by an ATM Data Service Provider (ADSP). The concept integrates at least geographical decoupling between ADSP (s) and some ATSU (s), through service interfaces defined in Service Level Agreements. One ATSU may use data services from multiple ADSPs, just as an ADSP may serve multiple ATSUs.

- The objective of a virtual centre is to allow decoupling that could deliver the flexibility and performance aspects of the services to ensure the ability of the virtual centre solution to, at least, support or to improve the operational performance.
A picture is worth more than 1000 words
A picture is worth more than 1000 words

two centres – one system
A picture is worth more than 1000 words

Remote ADSP configuration 2 & delegation of airspace

Airspace 1 - Upper
Airspace 1 - Lower

Airspace 2 - Upper
Airspace 2 - Lower

ATSU 1 a
ATSU 1 b
ATSU 2 a
ATSU 2 b

ADSP2

two centres – one system
A picture is worth more than 1000 words

Remote ADSP configuration 2 & merging of airspace

Airspace 1 - Upper

Airspace 1 - Lower

Airspace 2 - Upper

Airspace 2 - Lower

ATSU 1 a

ATSU 1 b

ATSU 2 a

ATSU 2 b

ADSP2

two centres – one system
Architecture view from a SESAR perspective

ATCaaS

TECHSUP - Technical Supervision
CHMI - Controller HMI Management
VC ATSU - VC ATSU

Support Functions

ATC ADSP Voice ADSP

SUPP - Support Functions

TECHSUP - Technical Supervision

VoiceaaS

AGVC - Air-Ground Voice Communications
GGVC - Ground-Ground Voice Communication
TECHSUP - Technical Supervision

Support Functions

ATC ADSP Voice ADSP

Sup = Data Management only (i.e. not HMI)
VC from various angle

Virtual Centre

Business drivers & use cases
A. Cost effectiveness
   - Rationalization of infrastructure
   - Competition in technical evolution
   - Shared ATCO training
B. Business continuity
   - Data center outage
   - ATCOs not available
C. Operational flexibility
   - Static delegation of airspace
   - Dynamic cross-border ATCO resource allocation

Roadmap
A. System life cycle
B. Scope
C. Architecture
   - Quality of service
   - Security
D. Legal
   - Military ATC cross border delegation (sovereignty)
   - Data storage abroad
E. Training
   - Recurrency training
   - ATCO certification
   - Harmonization
F. Business models

Standardized: Methods of operation
Standardized: Operational information
Standardized: Operational procedures
Standardized: Technical means
Standardized: Equipment

En-route, TMA, Tower, ATFCM

Performance driven
Model driven
Fragmentation to integration
Virtualization

ATSU
ADSP
Open standards
Vendor independent
SOA
Quality of service
Security

Cross-border service provision

Bucharest, 27-30 May 2019

Performance driven
Model driven
Fragmentation to integration
Virtualization

ATSU
ADSP
Open standards
Vendor independent
SOA
Quality of service
Security

Cross-border service provision

Bucharest, 27-30 May 2019
Delegation of Airspace among ATSU
Potential Uses case for Delegation of Airspace

Delegation of Airspace based on Traffic / NM

Delegation of Airspace Cross Border

ATSU1

ATSU2

ATSU 1

ATSU 2

ATSU 1+2

ADSP 1

ATCFM

Bucharest, 27-30 May 2019
Contingency Uses Cases

Todays Contingency solutions

- Outage due to travelling of ATCOs and system setup at aiding unit
- Less capacity: less positions, maybe different system

Contingency in a Virtual Centre Environment

- Other ATSUs can help immediately using Airspace Delegation
- Reduced outage
- Better capacity
- Migration of ATCOs in case of long-term failure

Bucharest, 27-30 May 2019
Thank you!
Cross-border Free Routing in very high complexity environments

SESAR PJ06

Florence Serdot-Omer
DSNA
The Free Routing concept enables **Airspace Users** to fly as close as possible to their **preferred trajectory**, without being constrained by fixed airspace structures or fixed route networks.
Technical goals

Develop and validate the Free Routing concept within cross-border high & very high-complexity environments

• Support implementation of European Regulation IR No 716/2014 - PCP AF#3 - Free routing available at and above FL310 in ICAO EUR region

• Research the benefit and impact of expanding the Free Routing concept to the lowest limit possible while accommodating all Airspace Users concerned.
The main achieved & expected results

Operational Concept description
Safety Assessment
Perf. Assessment
Human perf. Assessment
CBA
SESAR Solutions
The main achieved & expected results

- **Improve fuel efficiency**
- **Reduce CO2 emissions**
- **Improve flights predictability**
- **No negative effect on airspace capacity and safety**
Potential gaps and challenges

Find the balance!

Maximum freedom and performance for Airspace users vs safety/capacity

Bucharest, 27-30 May 2019
Cross-cutting issues (tech & non-tech.)

Allow the largest possible FRA in Europe with minimum structural constraints

- Improve systems’ interoperability
- Manage airspace complexity
- Optimize traffic management with minimum Free Routing Airspace constraints
- Improve Air Traffic Controllers tools
- Improve flight planning for wide range of airspace users
Impact

- Improves ATM performance
- Reduces airspace user’s costs
- Supports a less fragmented European airspace
- Improves accessibility and equity for a wider range of Airspace Users.
- Allows a greener airspace
Useful info and acknowledgements
Useful info and acknowledgements

Florence Serdot-Omer - DSNA
Florence.serdot-omer@aviation-civile.gouv.fr
Tel: +33.562.143.475

http://www.sesarju.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 824238

Bucharest, 27-30 May 2019
Thank you!

SESAR
Demonstrating GNSS navigation solutions for increased general aviation and rotorcraft airport accessibility

SESAR GRADE large scale demonstration

Antonio Vitale
Centro Italiano Ricerche Aerospaziali (CIRA)
Scientific & technical goals

• **SESAR to date has targeted improvements that mainly address the needs of Commercial Aviation sector**

• **General Aviation and Rotorcraft shall benefit from improvements developed by SESAR, too**

• **GRADE goal is to demonstrate the capability of GA and RC to exploit SESAR Solutions based on GNSS technology**

• **This capability will allow defining flexible procedures for:**
  • an efficient and non-discriminatory use of the sky
  • an improvement of the airports capacity
  • a reduction of the air transport environmental impact
Scientific & technical goals

- **Fixed wing GRADE demonstrations concern**
  - Solution #51 – “Enhanced terminal operations with LPV procedures”
  - Solution #55 – “Precision approaches using GBAS CAT II/III”
  - Solution #103 – “Approach Procedure with vertical guidance”
Scientific & technical goals

- Rotorcraft GRADE demonstrations concern
- Solution #113 – “Optimised Low Level IFR routes for rotorcraft”
Scientific & technical goals

The GRADE demonstrations consist of:

- Flight Trials to be conducted at 2 sites and by using 3 aircraft equipped with non-certified on-board avionics
- Preparatory Real-Time Simulations with Hardware and Human in the loop

The GRADE demonstrations aim to:

- assess the operational acceptability of the SESAR Solutions from the perspective of both pilots and ATCOs
- show the capability of the proposed system to provide all the info needed to conduct safely the flight
Expected results

• Provide more accurate positioning of GA and RC in the TMA
• Increase pilot situational awareness

• Reduce approach minima for GA w.r.t. NPA procedures
• Reduce GA runway occupancy time and spacing between arrival aircraft
• Displace IFR rotorcraft from active runways

• Allow shorter approach range and more flexible arrival paths for GA

Improve safety & equity (non-discriminatory use of the sky)

Improve airport capacity

Reduce environmental impact
The main achieved results

• 2 Real Time Simulation exercises completed

• 75 GA approaches on Capua airport (Italy) and 12 RC patterns on Braunschweig area (Germany)

• Several flight conditions tested, involving:
  • 5 test pilots
  • 4 ATCOs + 1 ATC Supervisor
  • 3 human factors experts
  • 2 pseudo pilots
  • Several technical experts

• Big amount of data collected
The main achieved results

Preliminary validation of:
- **GNSS based navigation algorithms able to guarantee the RNP**
- **Portable non-certified Primary Flight Display to support pilot decisions and operations**
The main achieved results

- **Preliminary finding from the analysis of RTS:**
  - SESAR Solutions feasible and acceptable
  - Navigation precision always within RNP 0.3

- **GA RTS demo**
  - Positive affect on workload and situational awareness of pilots and ATCOs
  - Reduction of the fuel burn and increased airport throughput w.r.t. RNAV
  - Adequate training for pilots and ATCOs is mandatory

---

**GNSS based curved and continuous descent approach had an impact on my work (ATCO)**

<table>
<thead>
<tr>
<th></th>
<th>Very negative</th>
<th>Negative</th>
<th>Positive</th>
<th>Very positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**I was able to execute the required procedure (pilot)**

<table>
<thead>
<tr>
<th></th>
<th>Very imprecisely</th>
<th>Imprecisely</th>
<th>Accurately</th>
<th>Very accurately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The main achieved results

- **Preliminary finding from the analysis of RTS:**
  - SESAR Solutions feasible and acceptable
  - Navigation precision always within RNP 0.3

- **RC RTS demo**
  - Large variation of subjective workload
  - Pilots skeptical about safe separation in turn phase during approach and missed approach
  - Mitigation by using advanced PinS for manual flight
Potential gaps and challenges

- Development and implementation of GBAS GAST-D service for providing signal integrity to deliver the performance necessary for Cat II/III minima in airport environment

- Regulatory adaptations with the certification authorities to enable wider deployment of GNSS technologies for GA & RC

- In-flight demonstration of GA and RC capability to integrate efficiently in the TMA with Commercial Aviation (in spite of different aircraft performance)

- GRADE is sharing experiences and lessons learnt with other SESAR co-financed projects (GAINS, PJ01 EAD) that are facing these challenges, to increase the overall impact of SESAR
Expected impact

• Improve airport accessibility of GA and RC, while reducing environmental impact, guaranteeing safety and requiring minor affordable changes to the current on-ground infrastructure

• Provide recommendations on regulation and standardization initiatives, industrialization and deployment of technologies enabling the GNSS exploitation by GA and RC

• Contribute to increase the relevance of the GA and RC sectors in Europe, by improving passengers’ mobility and by using the airspace in flexible, balanced and optimized way
Useful info and acknowledgements

GRADE Project
http://www.gradeproject.eu
Mr Antonio Vitale
a.vitale@cira.it
Tel: +39.0823.62.3549

This project has received funding from the SESAR Joint Undertaking under the European Union’s Horizon 2020 research and innovation programme under grant agreement 783170
Thank you!