



SESAR Showcase

A Conference & Exhibition of SESAR 1 Results

Amsterdam, 14-16 June 2016





Advanced Flexible Use of Airspace (AFUA)

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Davide BARDELLI, LUFTHANSA SYSTEMS

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AFUA - the partners



Luftwaffe



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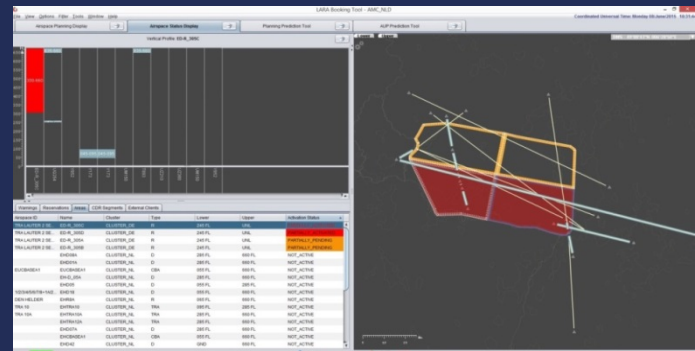
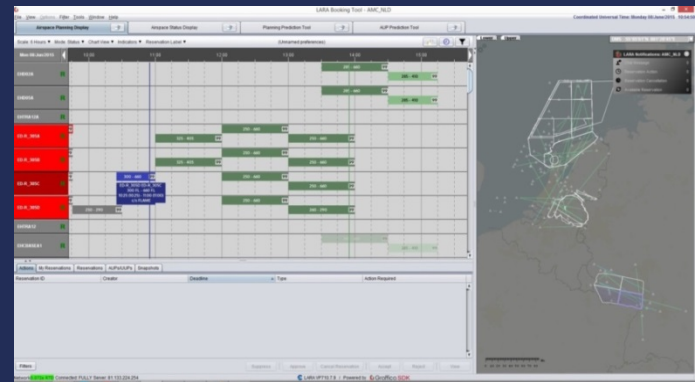
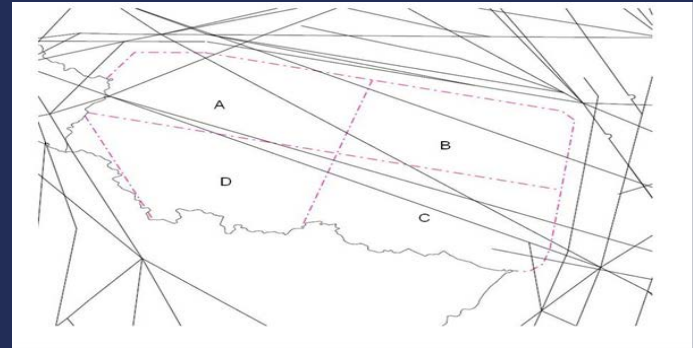
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Initial situation

- Airspace reservations: TSAs/TRAs
 - Non-optimal use of large volumes of airspace
 - Military needs may be better accommodated
- Real time airspace status different from planning (European Airspace Use Plan - EAUP)
 - E.g. military training mission finishes earlier than planned
 - Airspace remains still reserved as in EAUP and unused

2 new concept elements

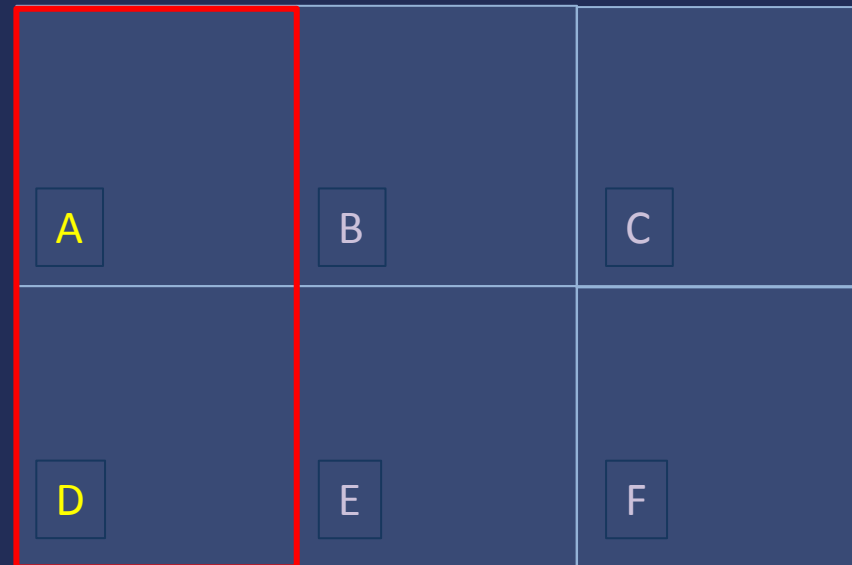
- Variable Profile Area or “VPA design principle”
- Sharing of Real Time Status of an Airspace (RTSA) amongst all stakeholders



Variable Profile Area

An Airspace Design principle based on:

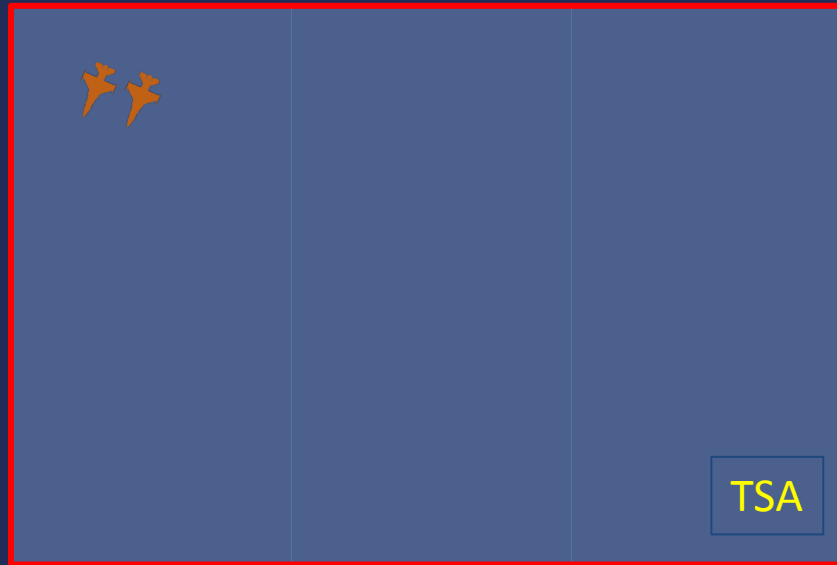
- flexible allocation and management of small fixed predefined modules of airspace
- used as an ARES individually or in combination, dependant on individual mission profiles to fulfil airspace users' needs



Variable Profile Area

ARES as a
“Standard” TSA

TSA active



Variable Profile Area

ARES VPA Design

modules **A** and **D** active



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Variable Profile Area, concept assessment

Validation exercises:

- Fast time simulation
- Model-based fast-time simulation

In:

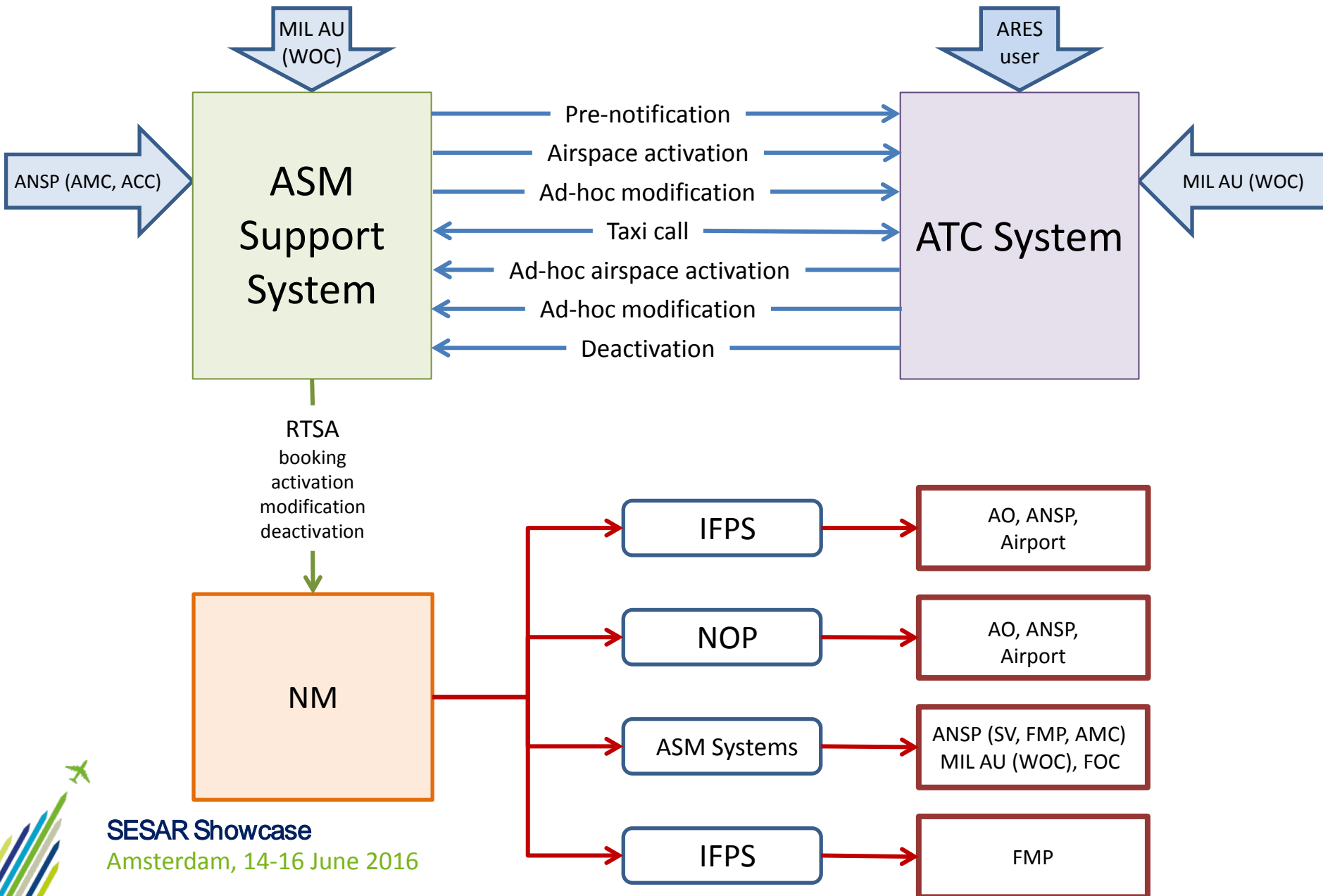
- Free route airspace (Finland)
- Complex and busy airspace (Belgium, Spain)

Variable Profile Area, concept assessment

Benefits:

- Reduced fuel burnt by civil flights
- Potentially reduced CO₂ emission for military flights
- Reduced total delay due to less affected flights by ATFCM measures
- Feasibility of defining VPA in dense and complex areas that can fulfil military needs

Real-time status of airspace



RTSA information sharing

Objectives

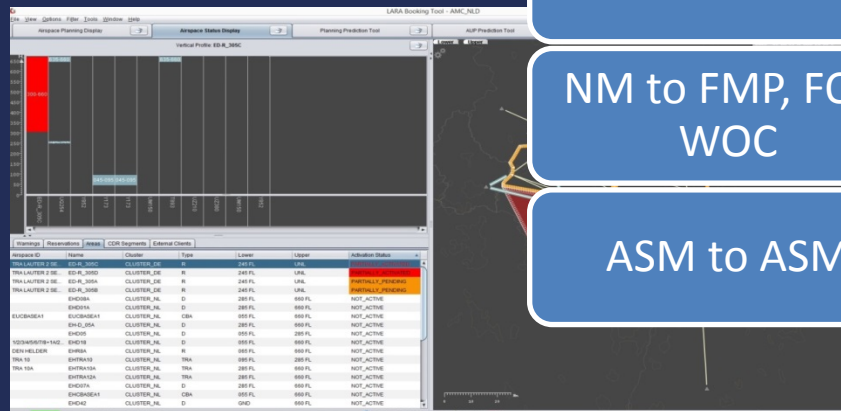
- System connectivity
- Sharing Real Time Airspace Status information
- Make better usage of air traffic capacity

ASM to ATC

ASM to NM

NM to FMP, FOC, WOC

ASM to ASM



RTSA information sharing

- Validation exercises
 - Live trial (2 exercises)
 - Real time simulation in shadow mode

RTSA information sharing, the FOC perspective

- Flight Operations Centre, a key function of AFUA
- It raises decision determinants that are not typically accessible by the other ATM stakeholders



RTSA information sharing, the FOC perspective

- Expectations and benefits

Cost effectiveness

Environmental sustainability

Safety

Flexibility

Collaborative environment



RTSA information sharing, the FOC perspective

- Collaborative decision making and automation, key success factors of AFUA within a trajectory- and collaboration-based ATM paradigm



AFUA conclusions

- Introduction of the 2 new AFUA concept elements benefits the performance of the European ATM
- Maturity of concept is at V3 level
- Concept elements are part of the PCP programme
 - Further system improvements are needed: tools for impact analysis and distribution mechanism of the real time updates

AFUA conclusions

For the industry

- NM provides B2B interfaces
- ASM tools can interconnect and connect to NM
- AIXM is the basis for exchanging airspace information and defining airspace planning

Thank you for your attention



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Free Routing and Direct Routing

Florence Serdot-Omer (DSNA)

Luigi Brucculeri (ENAV)



Free Route in SESAR : the partners



DSNA



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Operational objective

The combined operation of Flexible Airspace Management and Free Route **enable airspace users to fly as closely as possible to their preferred trajectory** without being constrained by fixed airspace structures or fixed route networks. [...] Free Route may be deployed both through the use of Direct Routing Airspace and through FRA”

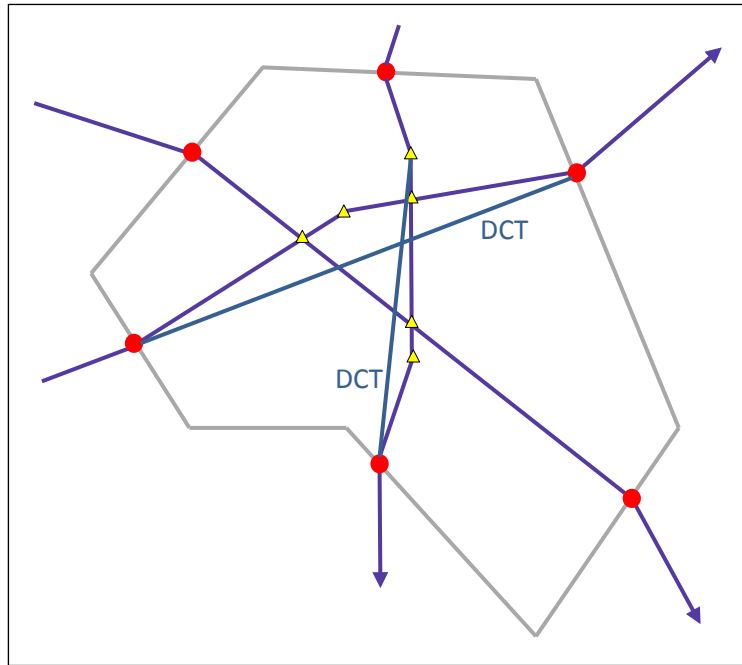
EU Regulation No 716/2014 (IR PCP- #AF3)



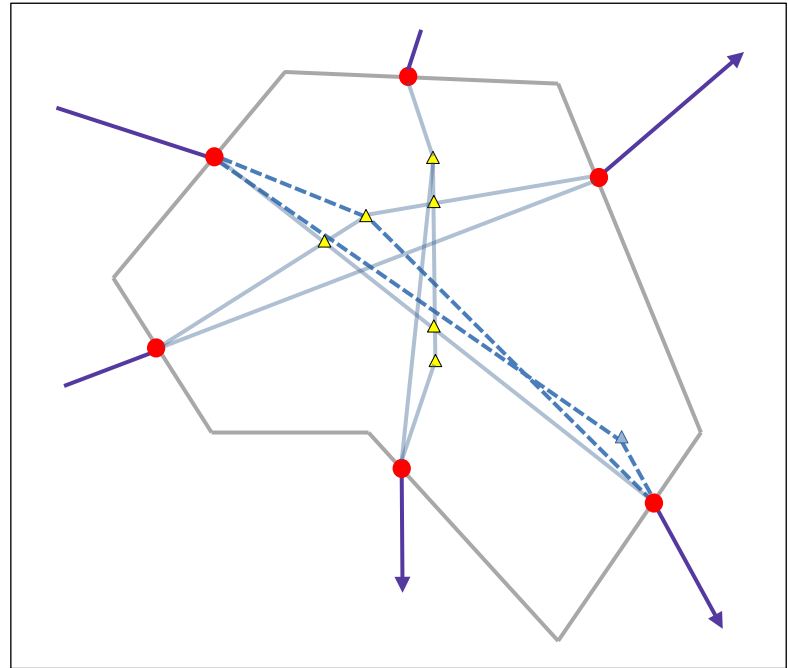
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Allowing multiple flight planning options



Direct Routing

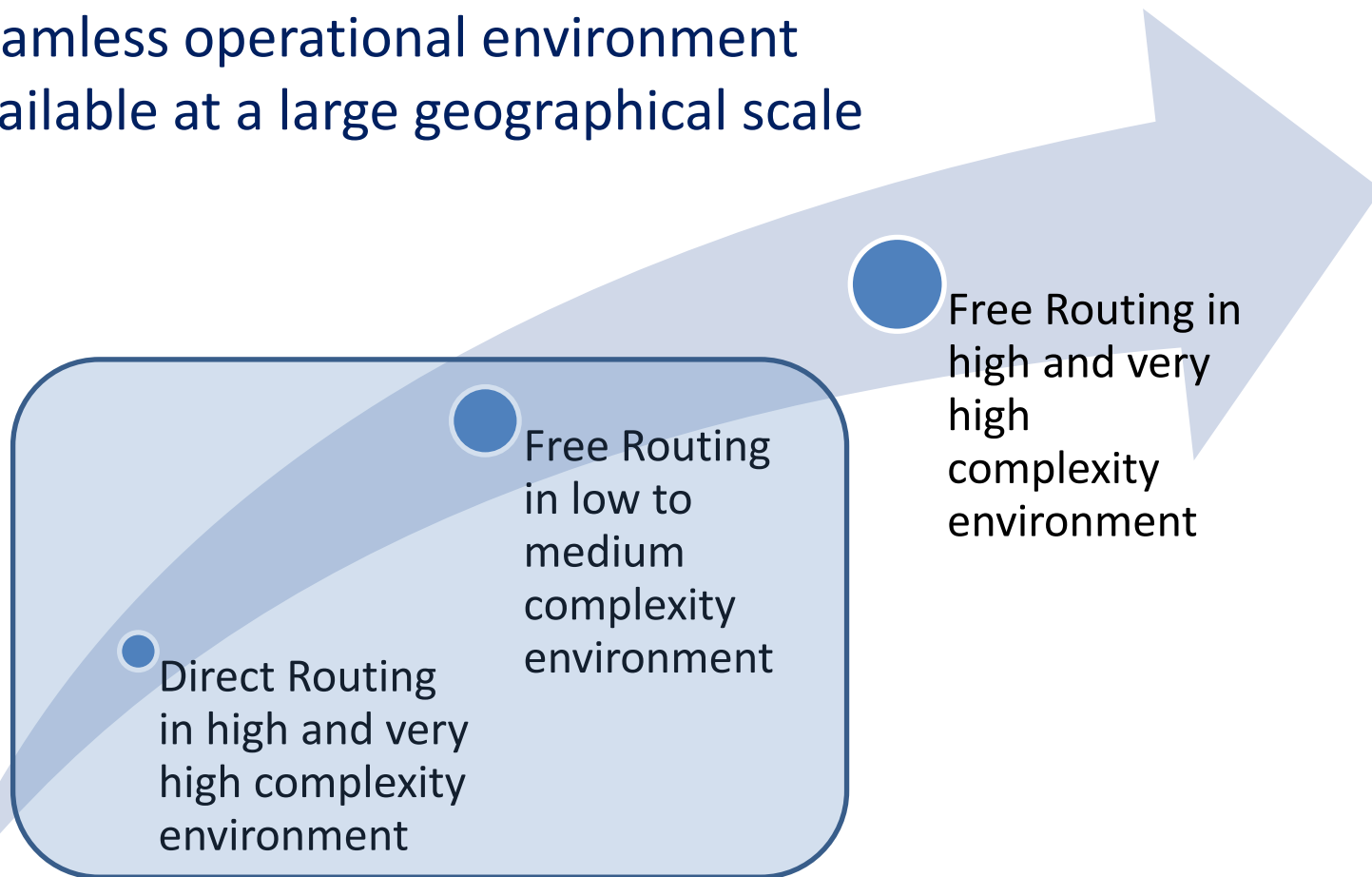


Free Routing



SESAR R&D scope

- Seamless operational environment available at a large geographical scale



SESAR validation activities

2014

2015

2016

**RTS – DCT
in FRAM**

V2- RTS
Conflict
detection
tools in FRA

**Live Trial - Free
Routing in NORACON**

V2 - RTS
PBN for
separation
purposes

V2- RTS
Realistic UPRs provided
by FOC
Conflict detection tools /
Complexity assessment /
IOP like coord.
Extended ATC Planner

V3 - RTS
IOP
Conflict
detection
tools
Extended
ATC Planner

WE FREE
Demo project

FRAMaK
Demo project

FREE SOLUTIONS LSD



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Highlights – DSNA/ENAV exercise

- **DSNA (Aix ATSU)**

Direct Routing & Free Routing concepts supported by an innovative approach to Conflict Detection aid to Tactical Controller and Planning Controller (MTCD & TCT), MONitoring Aid (MONA), and EAP concept.



- **ENAV (Rome and Milan ATSUs)**

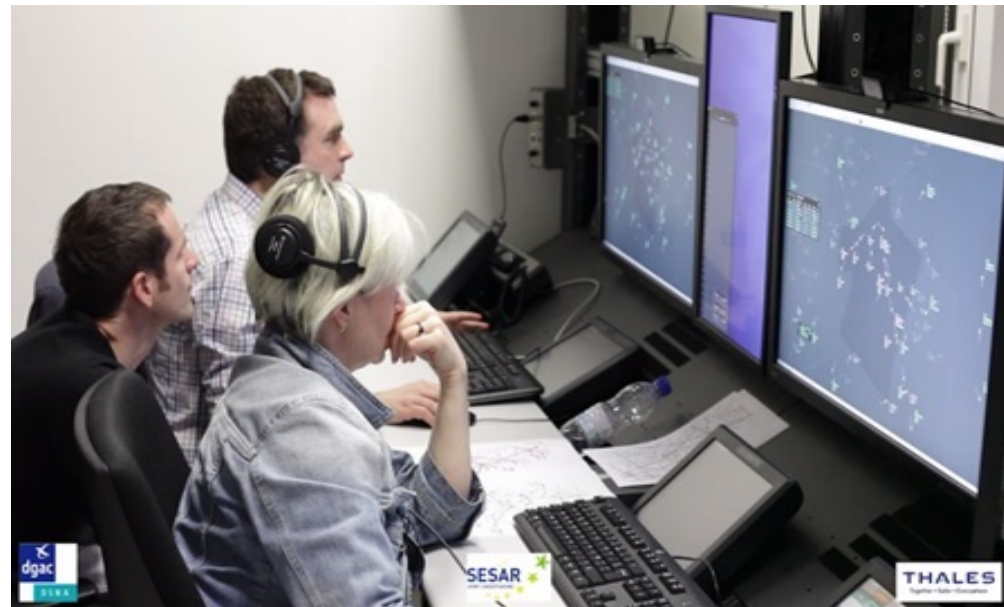
Direct Routing & Free Routing concepts, supported by Flight Object IOP mechanisms.



Operating environment - DSNA

4Flight platform including:

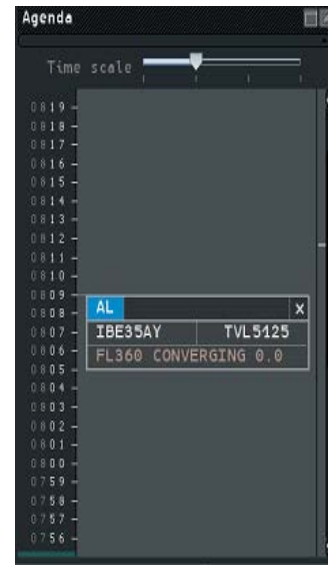
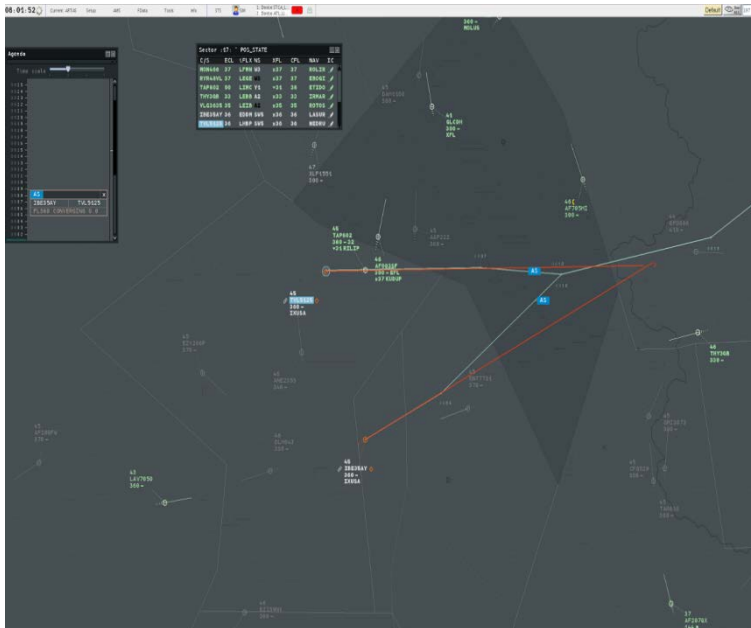
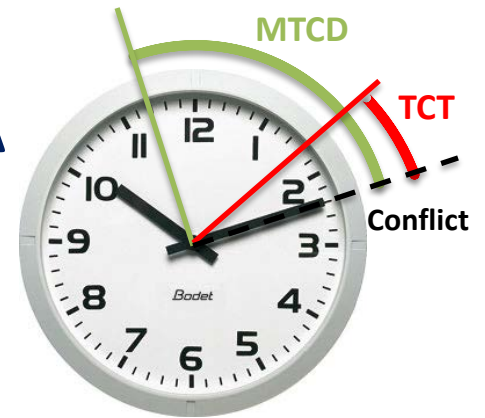
- Coflight
- HMIs (4 CWP positions)
- MTCD, TCT, MONA, TOPLINK
- Additional tools (extrapolation, SEP, electronic coordination tools...)
- Safety Net (STCA)



Operating environment - DSNA

Concept : ATCO remains responsible of separation

Tools may only support the ATCO



TCT

MTCD

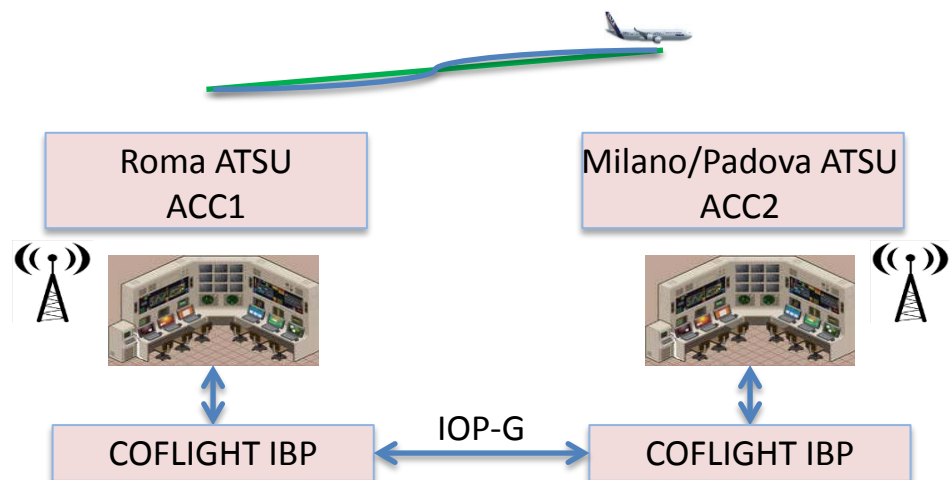
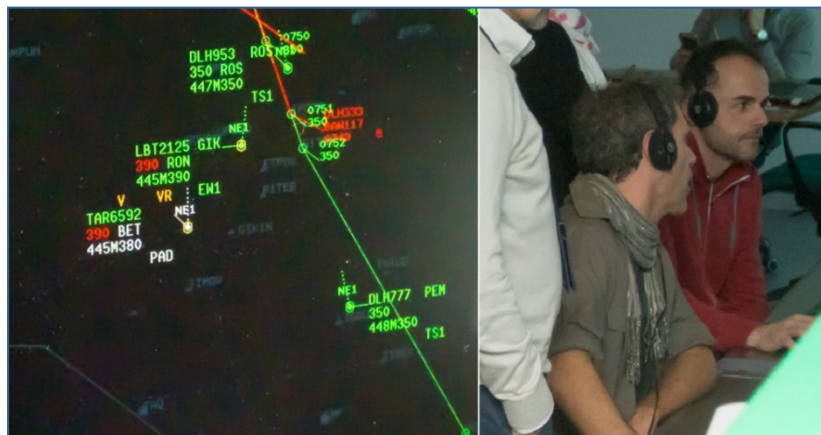


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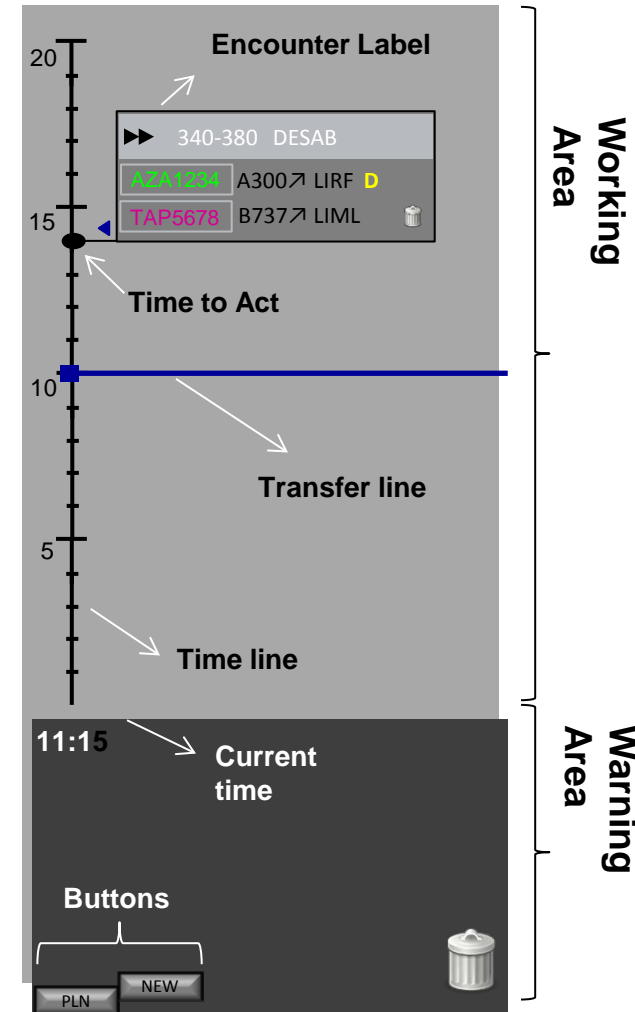
Operating environment - ENAV

ENAV Coflight based platform including:

- 2 x Coflight with IOP-able FDPS
- 6 x Controlled Sectors (12 CWP's for EXE and PLN ATCOs)
- Conflict detection tools and Safety Nets



Operating environment - ENAV



Main findings

Direct Routing Airspace

- Direct Route Design plays a significant role
- No significant changes in respect to current working methods
- Conflicts on sector boundaries for some direct routes
→ Inter-sector Coordination & Responsibility issues

Free Routing Airspace

- Increased number of Coordination / Transfer Points distributed over boundaries
- More Conflicts on sector boundaries
→ Inter-sector Coordination & Responsibility issues
- Convergence phenomenon of traffic flows
- Sector Shape also plays a significant role



Main findings

MTCD

- MTCD principle was judged as being very useful, especially in FRA
- However, proposed set of parameters need to be consolidated

MONA

- Design independent of the route network
- Added value, especially in FRA



Main findings

TCT

- Very useful, whatever the route network
- Backup tool

STCA

- Design is independent to the route network

Other tools

- **SEP:** High added value to detect & monitor conflict resolution
- **Electronic Coordination:** Significant need in DRA & FRA



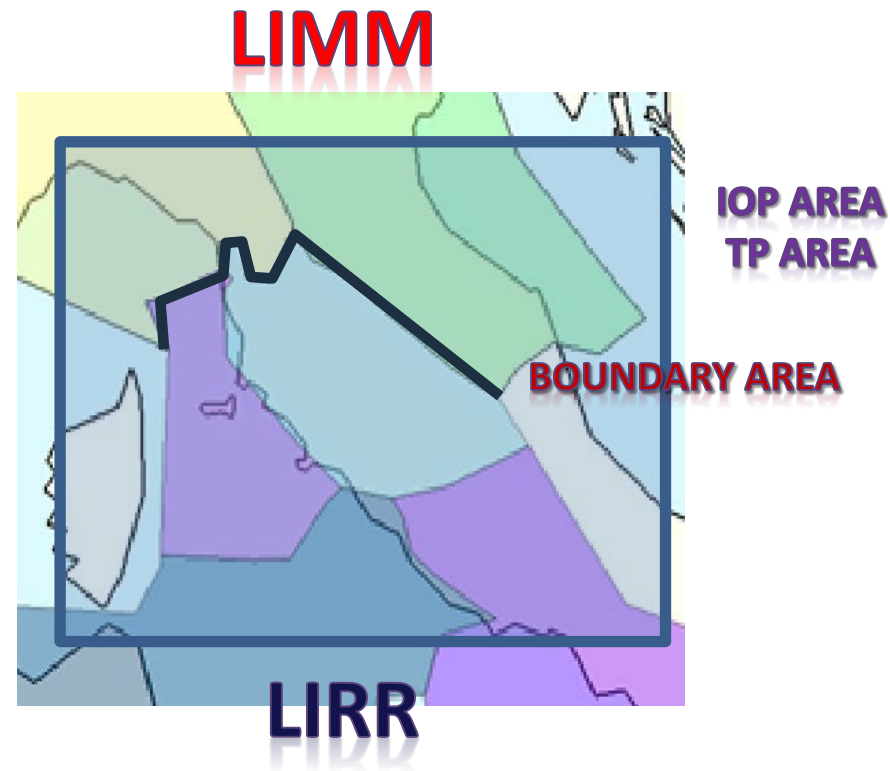
Main findings – Electronic Coordination

Electronic coordination is an important enabler for Direct routing and Free Routing operations

Highlighted the **IOP/FO** supports Direct routing and Free routing operations.

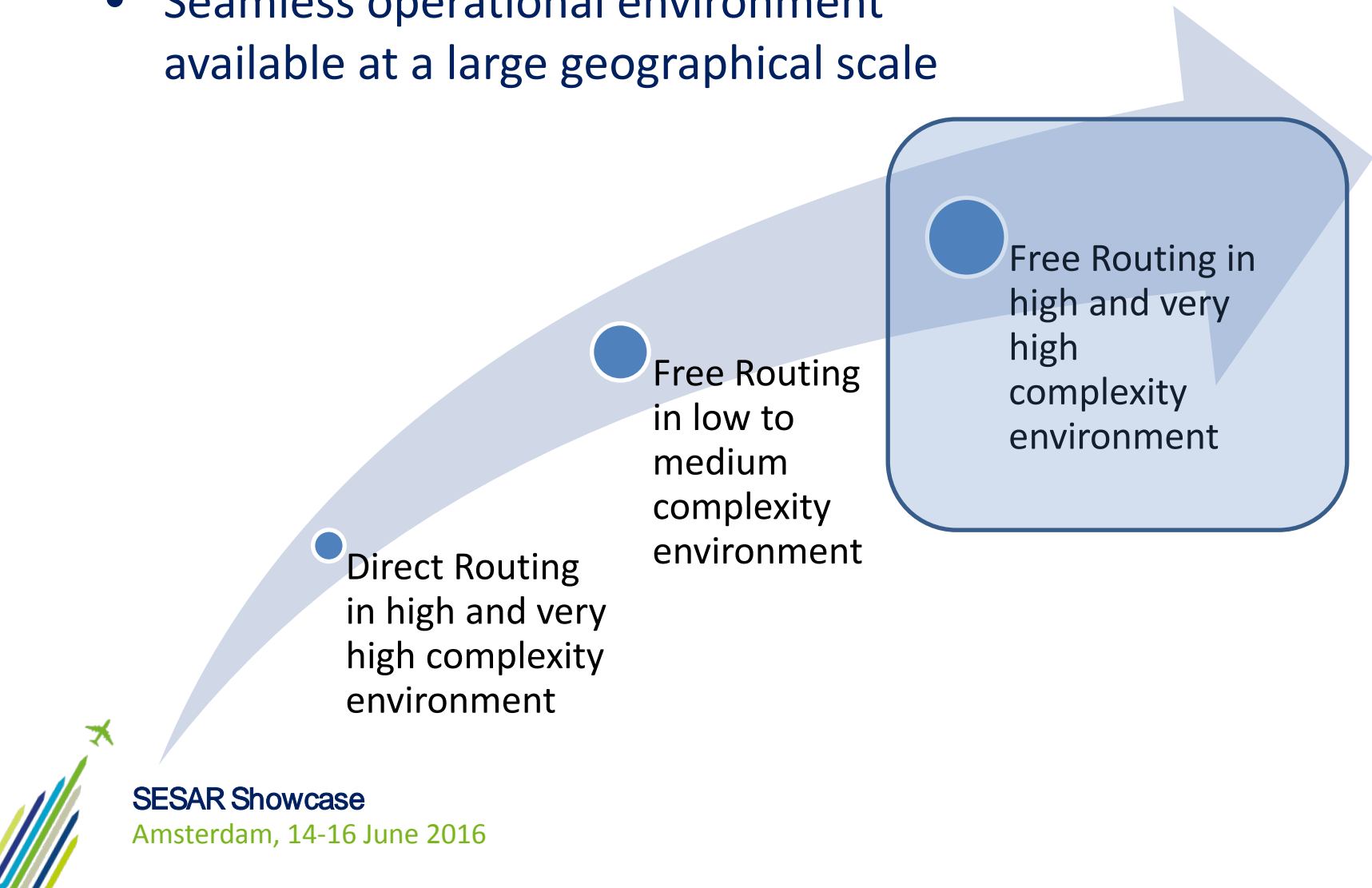
Compared with **current** Flight plan and **OLDI** (today implementations) coordination process

- Easier and more efficient phone coordination in IOP-G environment
- Seamless cross border operation as inside same ATSU
- Less dependent to Coordination points which varies “dynamically” especially in FREE Routing operations



SESAR R&D scope

- Seamless operational environment available at a large geographical scale



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Thank you for your attention

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