SESAR Showcase

A Conference & Exhibition of SESAR 1 Results

Amsterdam, 14-16 June 2016

SESAR JOINT UNDERTAKING

EU 2016

Demand capacity balancing in a dynamic fashion

Sonke Mahlich,
EUROCONTROL Experimental Centre

SESAR Showcase
Amsterdam, 14-16 June 2016

SESAR Industrial Research to overcome the shortcomings

Dynamic Demand Capacity Balancing (DCB)

- Short Term ATFCM Measures (STAM)
- AOP / NOP Integration
- Target Time Management

Project Partners:

EUROCONTROL — Experimental Centre - Network Manager - Maastricht UAC

ANSPs: DFS Deutsche Flugsicherung, dgac DSNA, ENAV, ENAIRE, NATS, skyguide

Ground Industry: indra, Selex ES A Finmeccanica Company

Operational shortcomings before SESAR

- Uncertainty in Traffic Prediction at time of slot allocation
- Lack of reactivity of the ATFM system in execution phase

  => may lead to over-delivery or over-regulation

- Local airspace solutions ignoring network effects

Solution: STAM - Short Term ATFCM Measures

Before SESAR

SESAR Operations

STAM can be applied for residual overloads when predicted traffic is **accurate enough.**

STAM impact a **limited numbers of flights**:
- minor ground delays
- flight-level capping
- minor re-routing

Decisions are taken **locally** by ANSPs and follow a **coordination process** with other actors

Validation exercises

Short-Term ATFCM Measures (STAM)

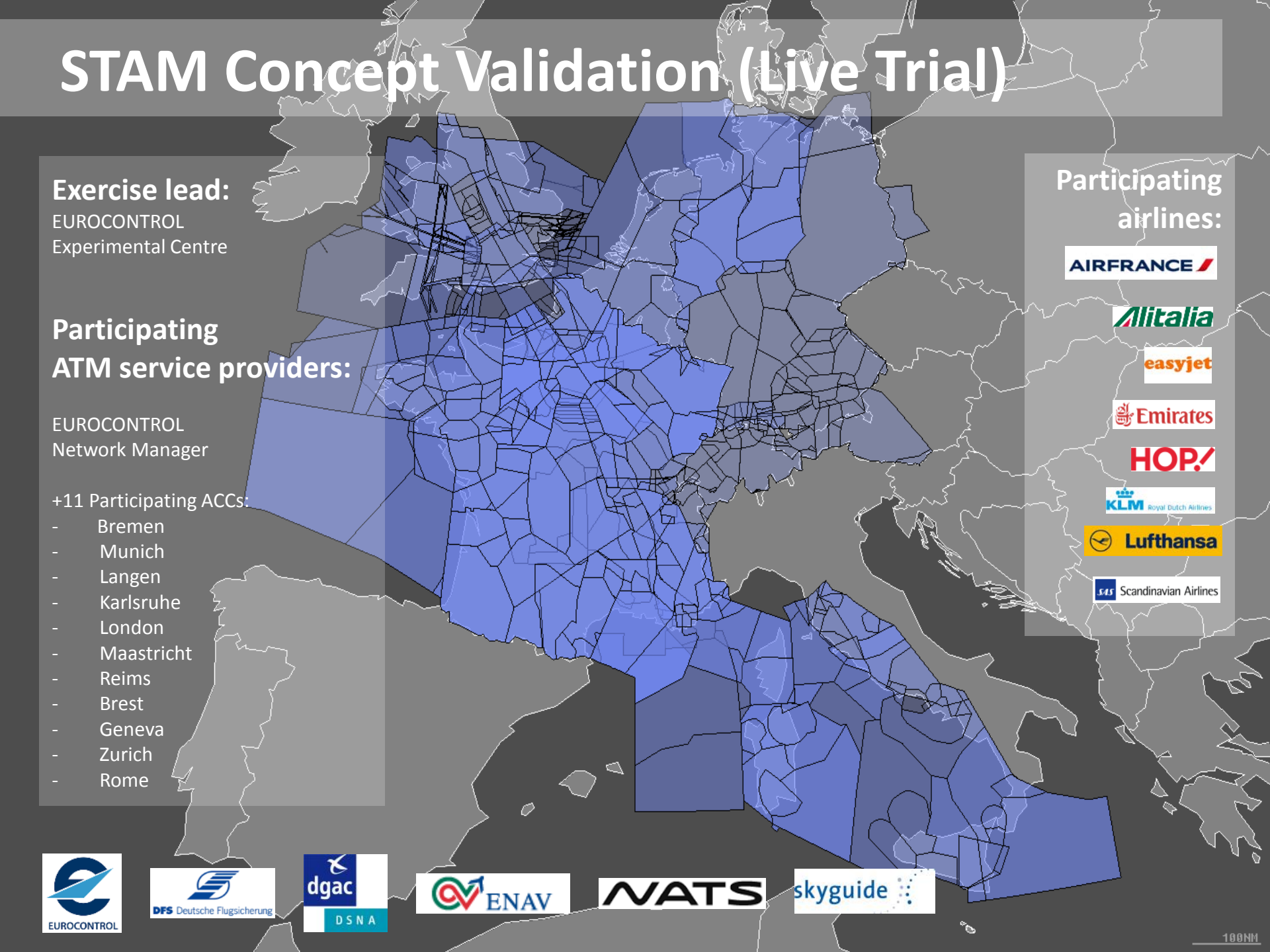
1. **STAM Pilot Trial** (London, MUAC, Reims)
   Small scale operational feasibility and benefit assessment

2. **STAM Concept Live Trial** VP522 (Core European Airspace)
   Prove of Concept, Large scale operational feasibility

3. **Multiple STAM** (Fast time Simulation, ECAC Airspace)
   Large Scale Benefit Assessment

4. **B2B Services and Local Tools** VP700 (Shadow Mode, 4 bilateral sessions)
   Integration of STAM into Local Tools, Operational Feasibility

STAM Concept Validation (Live Trial)



Exercise lead:
EUROCONTROL
Experimental Centre

Participating ATM service providers:

EUROCONTROL
Network Manager

+11 Participating ACCs:
- Bremen
- Munich
- Langen
- Karlsruhe
- London
- Maastricht
- Reims
- Brest
- Geneva
- Zurich
- Rome

Participating airlines:

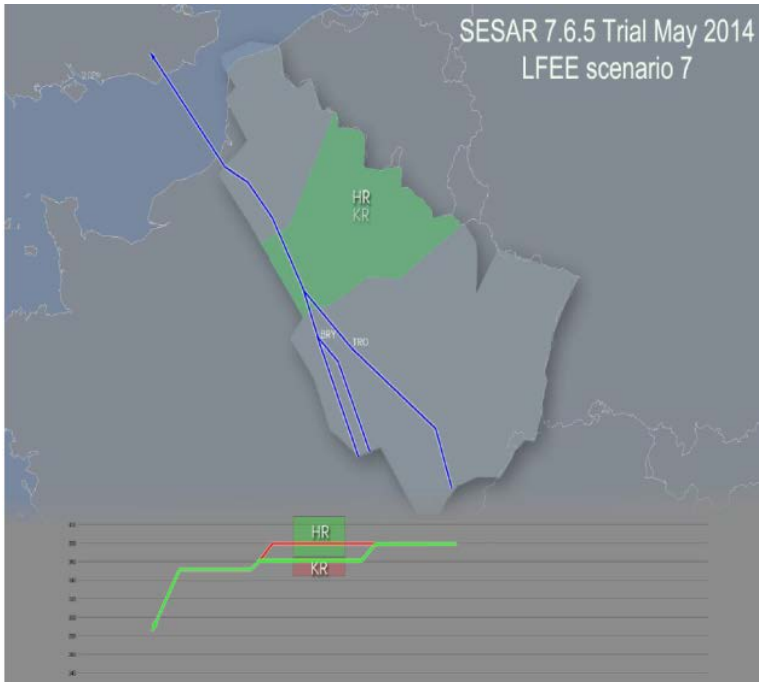
AIRFRANCE
Alitalia
easyjet
Emirates
HOP!
KLM Royal Dutch Airlines
Lufthansa
SAS Scandinavian Airlines

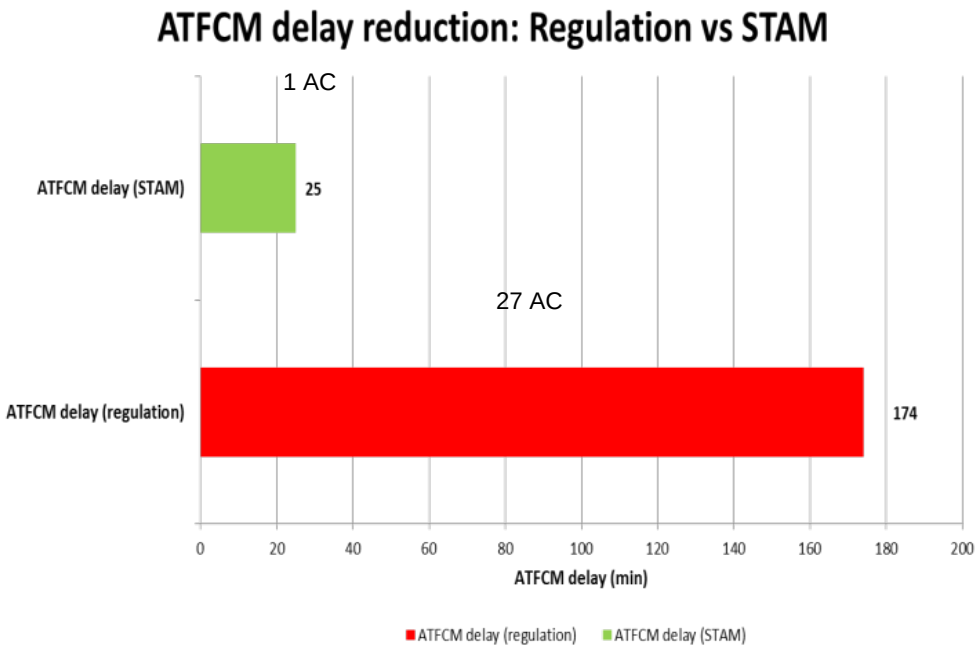
EUROCONTROL
DFS Deutsche Flugsicherung
dgac DSNA
ENAV
NATS
skyguide

100NM

STAM benefit mechanism

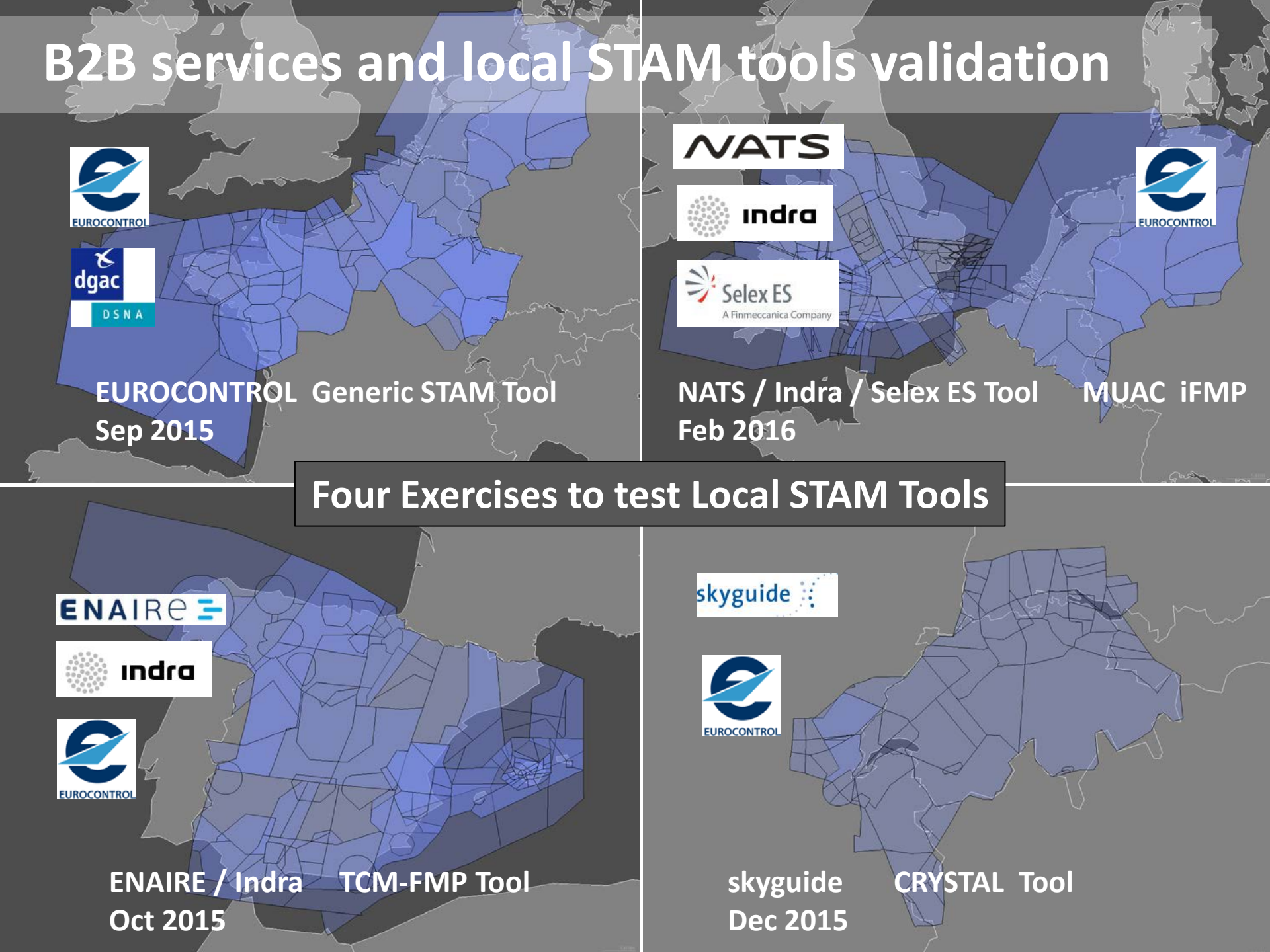
Example LFEE: In situations of minor overloads, ATFCM Regulation impacting 27 flights could be avoided if replaced by only 4 STAM Flight Level Caps





The Right Measure at the Right Time

B2B services and local STAM tools validation



EUROCONTROL Generic STAM Tool
Sep 2015

NATS / Indra / Selex ES Tool MUAC iFMP
Feb 2016

Four Exercises to test Local STAM Tools

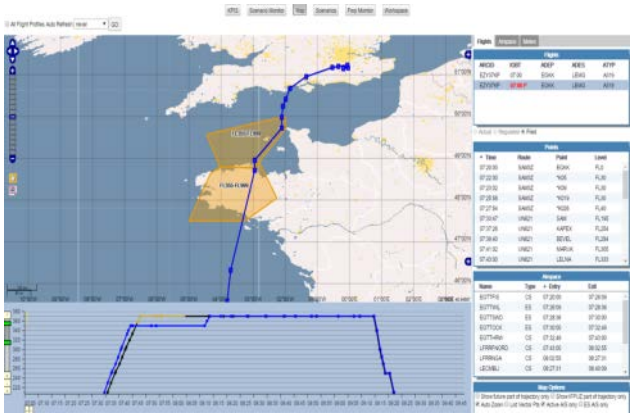
ENAIRE / Indra TCM-FMP Tool
Oct 2015

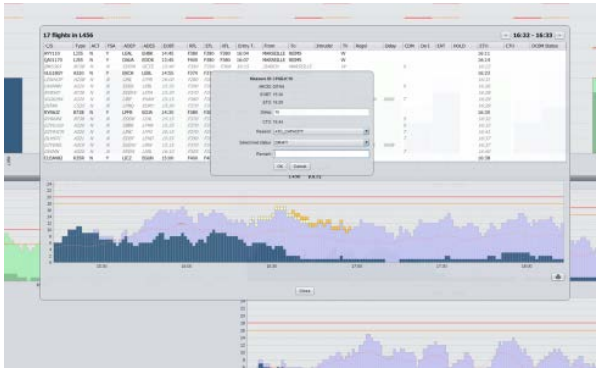
skyguide CRYSTAL Tool
Dec 2015

STAM local tools and B2B services

Local tool functionalities tested:

- Complexity/workload for hotspot detection and selection of flights
- Sectorisation optimisation
- Performance monitoring and analysis
- HMI (ergonomics, tailored to local needs)





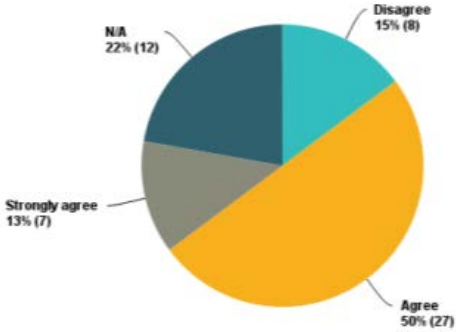
SWIM B2B services:

- DCB Federation Services

STAM validation results

STAM Concept Validation - conclusions:

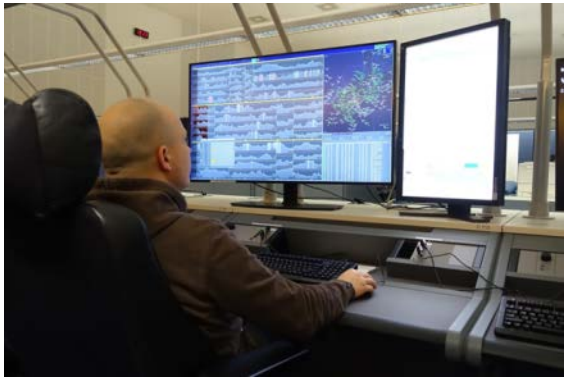
- Wide acceptance of the STAM concept
- STAM very efficient for minor overloads
- Central Slot Allocation remains indispensable
- What-If impact assessment improves decision making



Question 9:
I found STAM measures efficient in resolution of my hotspots.

STAM local tools validation - conclusions:

- Wide range of maturity between the 5 prototypes
- Gain of situation awareness across network
- Performance of STAM tasks greatly improved
- MCDM coordination workflows still too complex
- Problems with divergence between local FDPS data



STAM cost benefits

STAM Daily Extra Fuel Cost (k EUR)	TOP05	TOP10	TOP20	TOP30	ALL
Average Extra FUEL per Flight (kg)	132	154	164	187	191
Total Extra Fuel Burnt (kg/day)	71062	89508	106429	130818	154305
Extra FUEL Cost (k EUR)	**50**	**63**	**75**	**92**	**108**

Cost of fuel per kg: EUR 0.7
(Source: standard inputs for EUROCONTROL CBA – 2015)

STAM Daily Delay Cost Savings (k EUR)	TOP05	TOP10	TOP20	TOP30	ALL
Delay reduction per flight (minutes)	0.51	0.59	0.78	0.81	0.76
Daily Delay Cost Savings (k EUR)	**820**	**937**	**1249**	**1295**	**1203**

Cost of ground delay per minute: EUR 49.5
(Source: standard inputs for EUROCONTROL CBA – 2015)

1

15

Cost of STAM measures (extra fuel burn)

Benefit of STAM measures (reduction of delay costs)

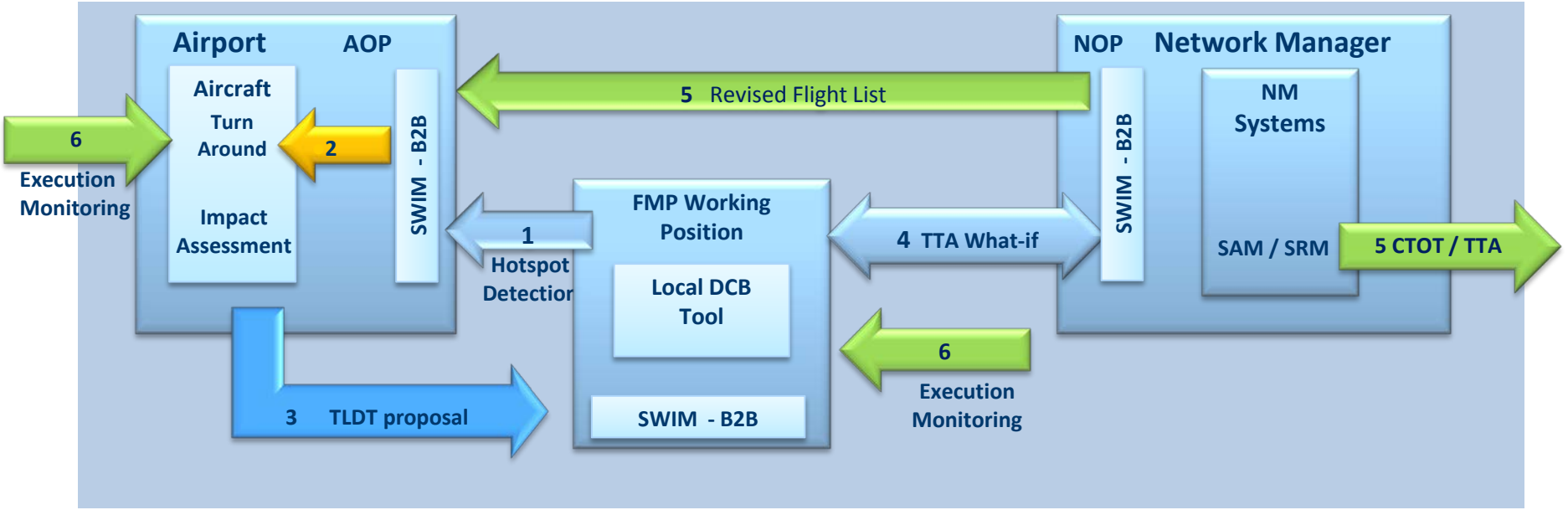
Operational shortcomings before SESAR

- Uncertainty of Arrival Times
- Network not aware of Airport Planning
- ATC not aware of Network Planning

Solution: AOP/NOP & Target Time Management

- Complementing departure regulations (CTOTs) with locally generated and consolidated target times;
- Reconciliation with Airport planning and Airspace User impact.

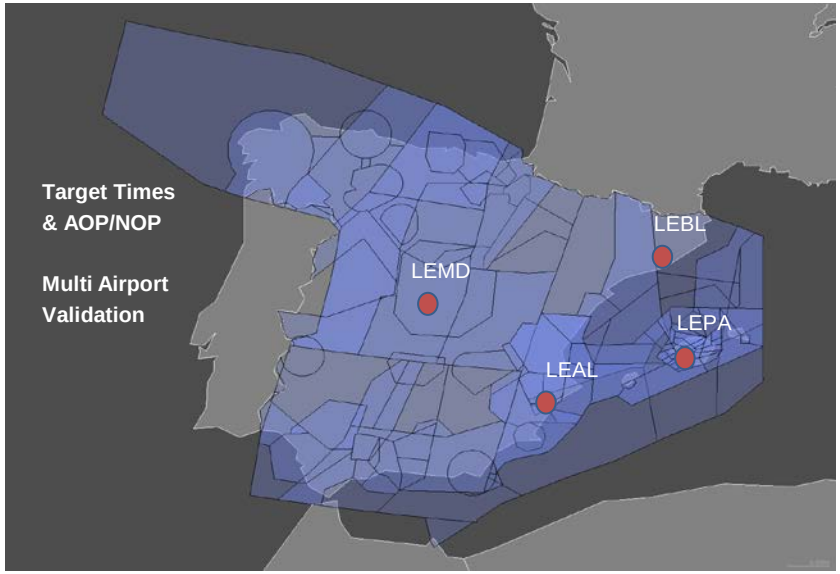
Target Time consolidation process:



Target Time concept validation

Validation exercises:

1. **Arrival Airport** (Live Trial, Palma) Inbound Target Times Operational Feasibility
2. **Large Scale** (Fast Time Simulation) Benefit Assessment
3. **Multi Airport** (Shadow Mode, Spanish Airspace) Multiple Turnarounds, Target Times and AOP/NOP Operational Feasibility



ENAIRE

EUROCONTROL aena indra

airberlin easyjet AirEuropa

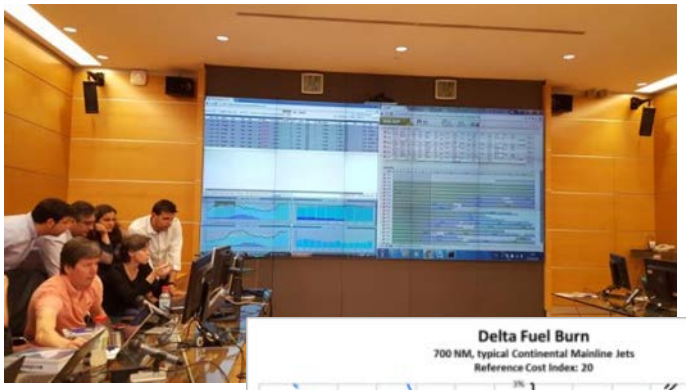
Target Times validation results

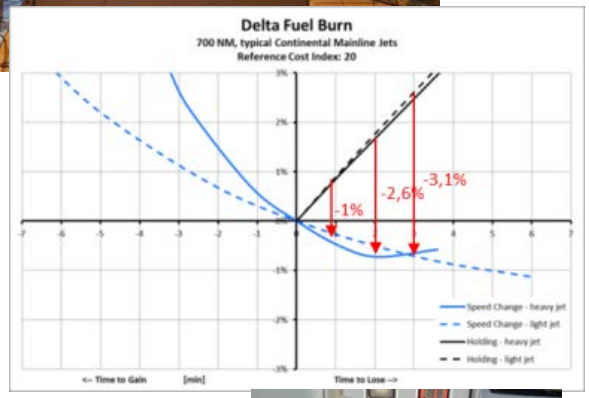
Concept validation

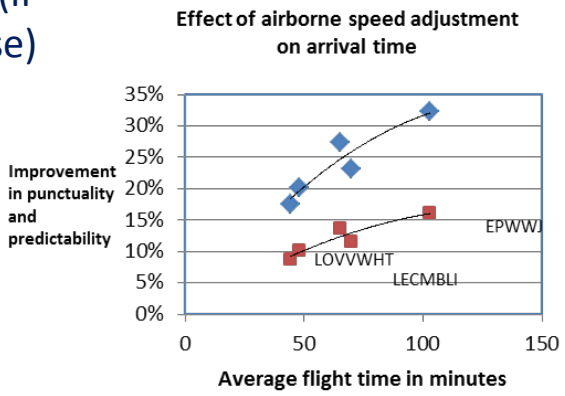
- TTA Consolidation process proven to work (minor increase of workload at FMP)
- AU Impact and Turnaround Constraints important input to network planning (AU involvement possible)
- No extra aircraft equipment required

Cost benefit assessment

- In-Block punctuality and Departure predictability improved (10-30% reduction of uncertainties)
- Up to 2,7-5,3% capacity increase possible (if not jeopardized by ATCO workload increase)
- TTA Mgt can be overall fuel-neutral (up to 3% fuel saving with “time to lose” scenario, depending on a/c type and CI)
- Significant reduction of reactionary delays







Recommendations and next steps

STAM - Short Term ATFCM Measures

- Ready for VLD and V4 with recommendations for improvements * (see below)
- Positive Business case for STAM deployment at top 20 delay producing ACCs
- Deployment Strategy: STAM deployment in evolution packages

*** Key points for improvement:**

- STAM Workflow to differentiate between ATC short notice STAM and ATFM tactical STAM
- Simplify and semi-automate STAM coordination procedure
- SWIM B2B services to allow workflow tailored at ANSP/tool level
- Harmonisation of flight plan data base (through FOS?)

Target Time Management

Recommendations and next steps

Consolidation of TTA in planning phase: **validated**

Clear benefits as a standalone.
TTA dissemination in Slot Allocation Messages (SAM) already deployed (April 2016)

Consolidation of TTA with AMAN: **further validation needed**

To be addressed in SESAR 2020 PJ09

TTA Management by the Flight Deck: **further validation needed**

Remaining validation objectives:
- TTA transmission time to cockpit
- Update of TTA after departure
- TTA adherence strategies and revision

ATC Facilitation of Target Times: **further validation needed**

- In the context of RBT management
- To be harmonised with ATC support to XMAN

Thank you for your attention

More information:

Sonke.mahlich@eurocontrol.int

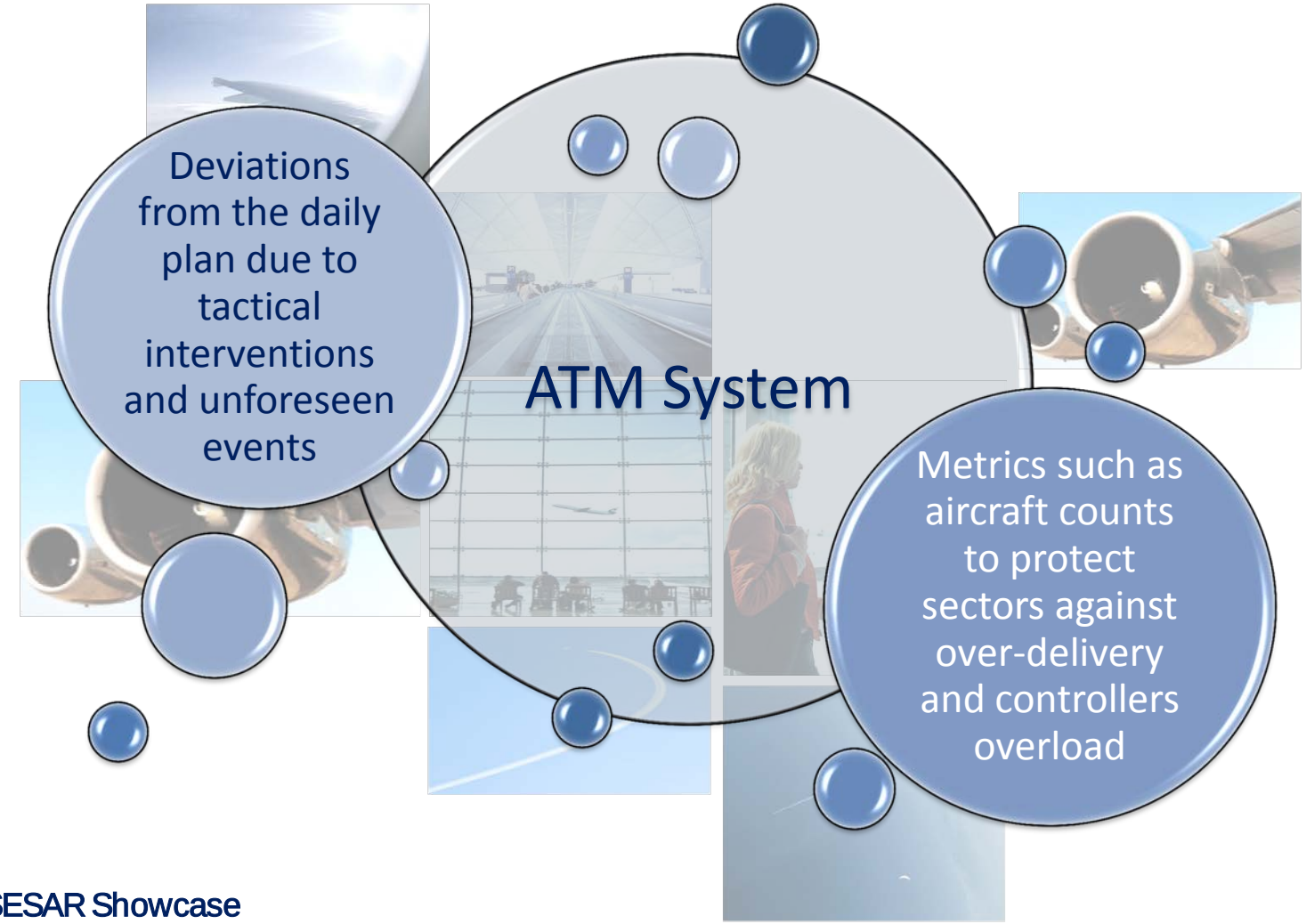
Complexity Management in En Route

Pablo Sánchez-Escalonilla

CRIDA

SESAR Showcase
Amsterdam, 14-16 June 2016

What was the challenge before SESAR?



What is the SESAR solution?

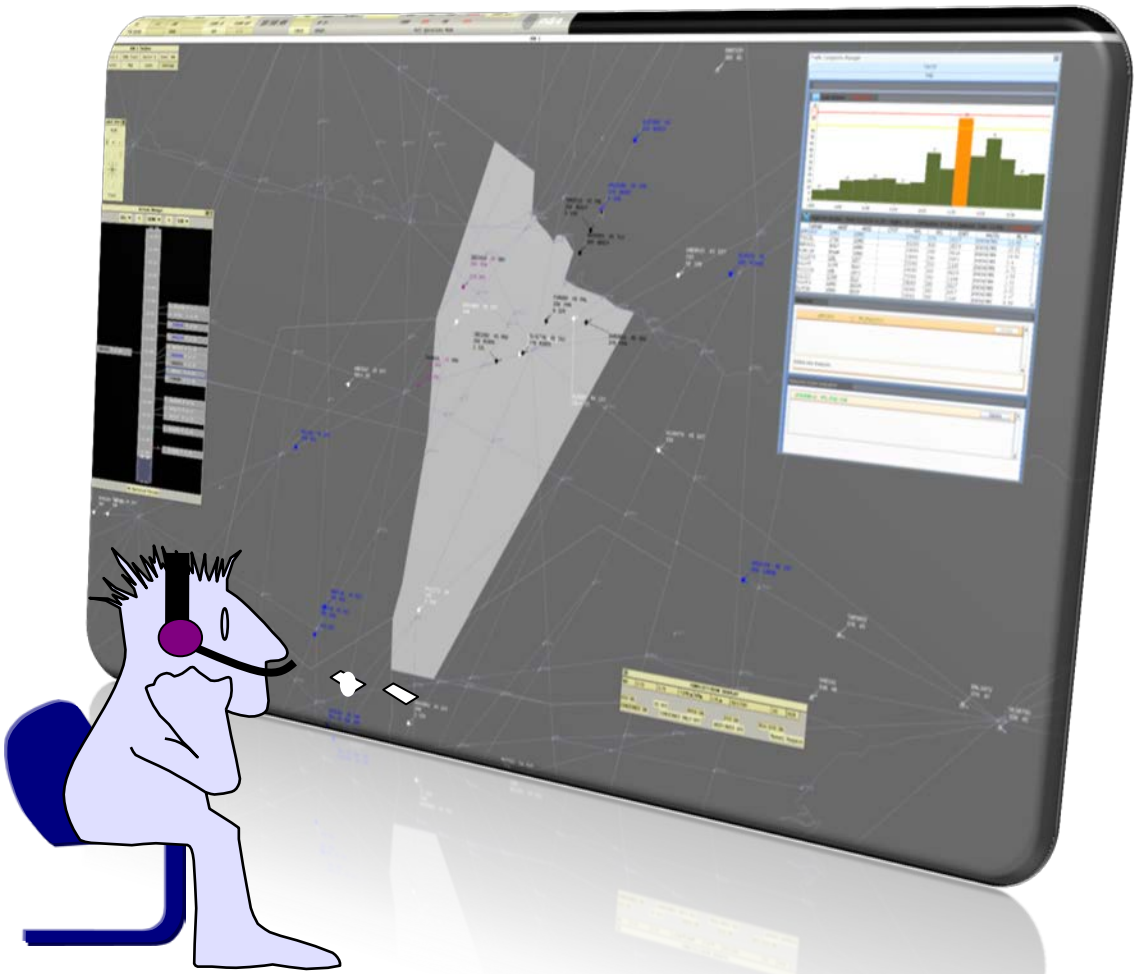
The **Complexity Assessment and Resolution (CAR)** concept allows managing the complexity of the traffic to avoid sectors becoming overloaded

An example

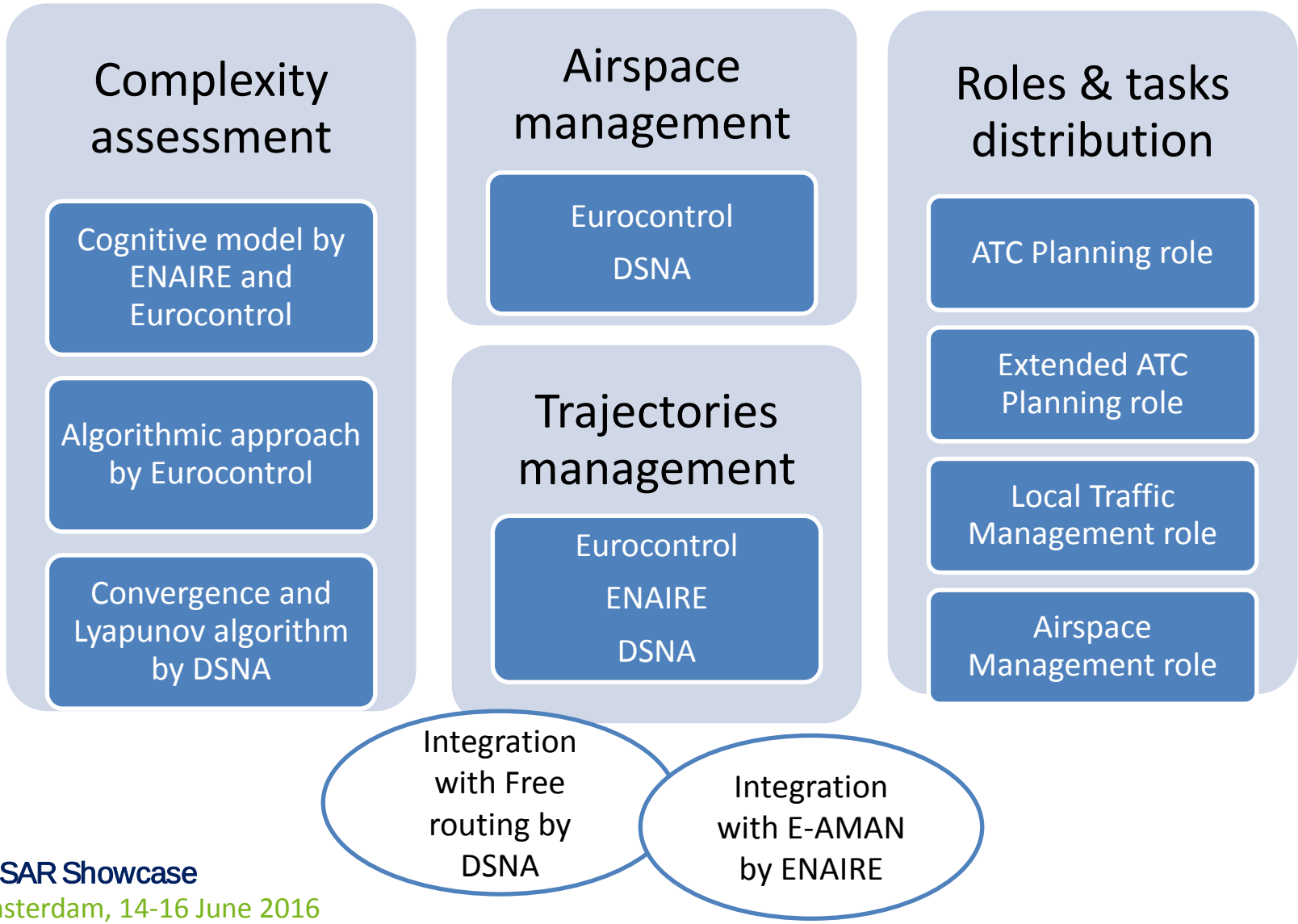
Planning controller monitoring complexity up to 40 minutes before sector entry

Cognitive model of the controller's behaviour to calculate controller's workload

What-if functionalities and pre-defined solutions based on trajectories' modifications



How partners worked together?

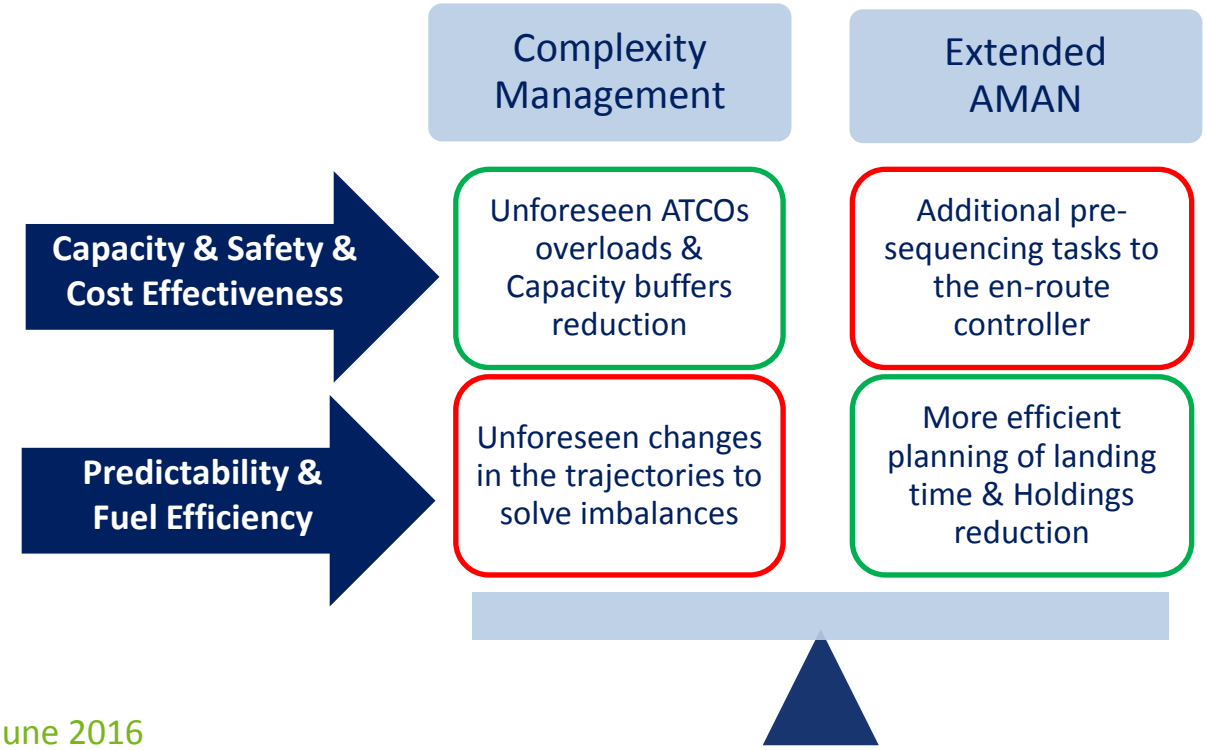


What are the concept results? (1/2)

- The concept has proven to be a bridge to address the gap between the local ATFCM and ATC processes.
  - Complexity predictions as a proper representation of the expected workload on which decisions can be based.
  - Standardization of mechanism to react to unsafe situations.
  - Reduction of capacity buffers / over-estimation of resources.
- Complexity must be adapted to the local airspace characteristics and ATC working methods.
  - Integration with Flow Management Position functionalities and local supporting tools.

What are the concept results? (2/2)

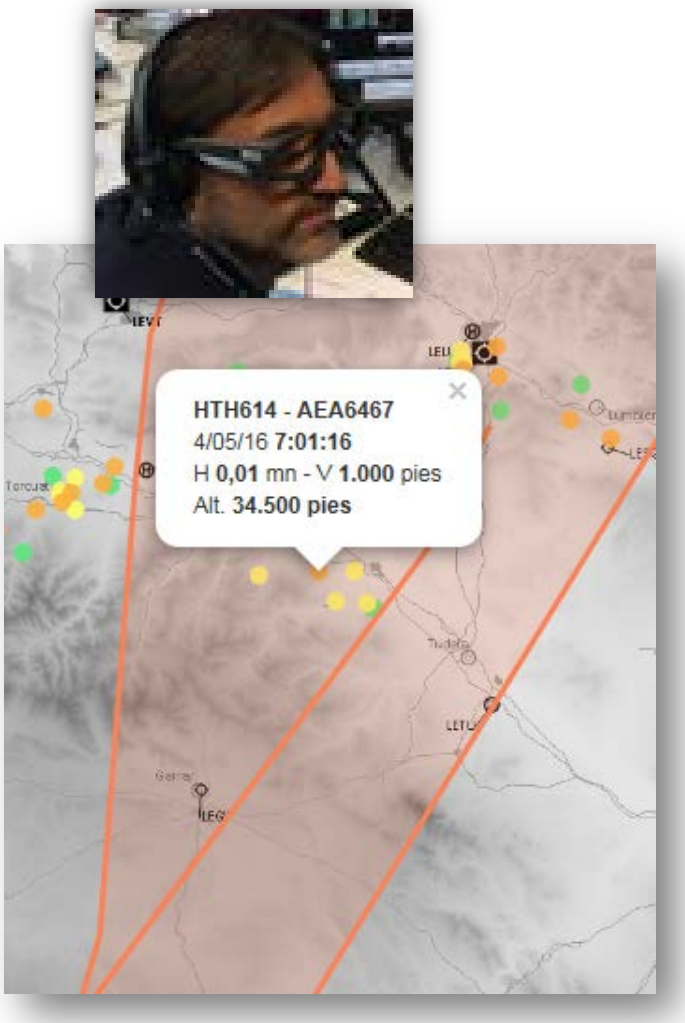
- Clarification of the most suitable actors to perform the tasks associated to the new roles.
  - Time horizon as cornerstone.
- Need to consider the interdependencies with other concepts.



What are the findings in validation?

- New data collection methods from other fields.
  - E.g. Eye Tracking Glasses to monitor the controllers' cognitive activity.

- Added value for the quantification of performances of methods and metrics in non-simulated ATC environment.
  - E.g. automatic safety monitoring tool to quantify separation infringements metrics consistent with the European Commission Performance scheme.



What does this research mean for industry?

- Awareness of different technical and operational requirements due to the collaboration with multiple Service Providers:
  - Evolution of the architecture of the prototype to integrate external Workload calculation engines.
- Next generation of products visible to potential customers:
  - Generation of a baseline for the Airspace Capacity Manager Product (iACM) in iTEC.
- Operational deployment as a “best practice”.

Next steps

Eurocontrol already uses Complexity as a part of their supporting tools for the application of STAM

DSNA is assessing the implementation of local trajectory management measures by a new role

ENAIRE is assessing applications of the cognitive model in the current ATC system

Integration with the local ATC system, e.g. ATC shift planning tools, and synchronization with network measures

Non-nominal cases:

E.g. METEO changes

Thank you for your attention

More information:

mtcano@e-crida.enaire.es (P04.07.01)
nstelzlaff@e-crida.enaire.es (OFA05.03.04)
psescalonilla@e-crida.enaire.es (P05.03)