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Stand 849

Agenda of the Tour

TOUR 5: optimising the performance of air traffic

The Single European Sky and SESAR aim to optimise the performance of air traffic management in Europe, in terms of safety, capacity, cost and operational efficiency, and the environment. The tour will present a number of solutions in the pipeline aimed at optimising airspace and airport capacity, such as tools for improving flight planning and trajectory information sharing, demand and capacity balancing techniques, enhanced approach procedures using satellite-based technologies, and a prototype for airport post-operations analysis. The tour will also take a look at the implementation in Bulgaria of a traffic complexity assessment tool.



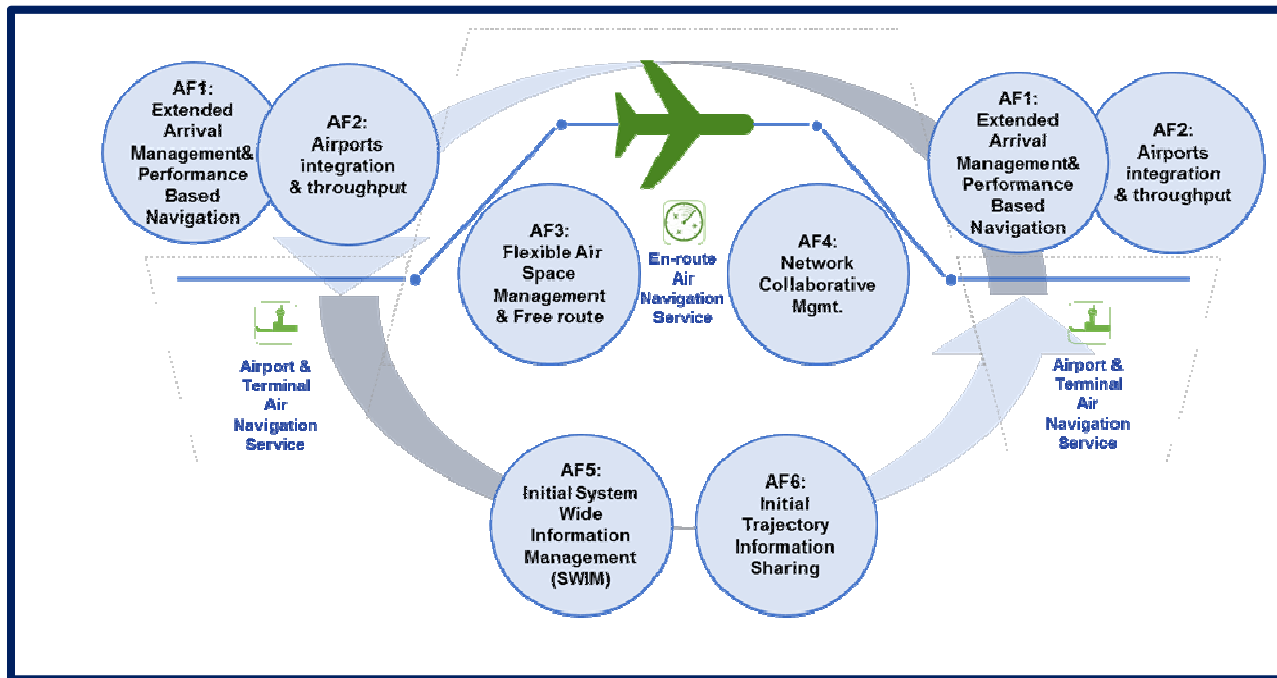
TOUR GUIDE: Ralph Schwarzendahl, SESAR DM

TRAVEL TIME	TIME	TOUR STOPS	PRESENTATION TITLE	SPEAKER
	15:15	Europe For Aviation (849)	CHECKIN	
	15:30	Europe For Aviation (849) (SESAR JU pod)	Introduction	Ralph Schwarzendahl, SESAR DM
	15:45	Air Navigation Services of the Czech republic (885)	Traffic complexity tools	Pavel Mrna, ANS CR
	16:00	Europe For Aviation (849) (EUROCONTROL)	Improved parallel approaches with PBN	Karim Zeghal, EUROCONTROL
	16:15	BULATSA/DANUBE FAB (270)	TCAT implementation in Sofia ACC	Ivan Hassamski, BULATSA
	16:30	ENAIRe-CRIDA (844)	Demand-capacity balancing	Patricia López de Frutos, ENAIRe
	16:45	ENAIRe-CRIDA (844)	Airport post operations analysis prototype	Alan Groskreutz, ENAIRe
	17:00	ENAV (927)	First European Implementation of PINS Procedures to Support Medical Emergency Operations	Gennaro Graziano, ENAV
	17:15	END OF TOUR		



Zoom on Performance

ATM Functionalities and their impact



This overview shows the **different ATM functionalities (AF)** and where the **impact shall be expected**. AF5 and AF6 are mainly supporting the other ATM functionalities.

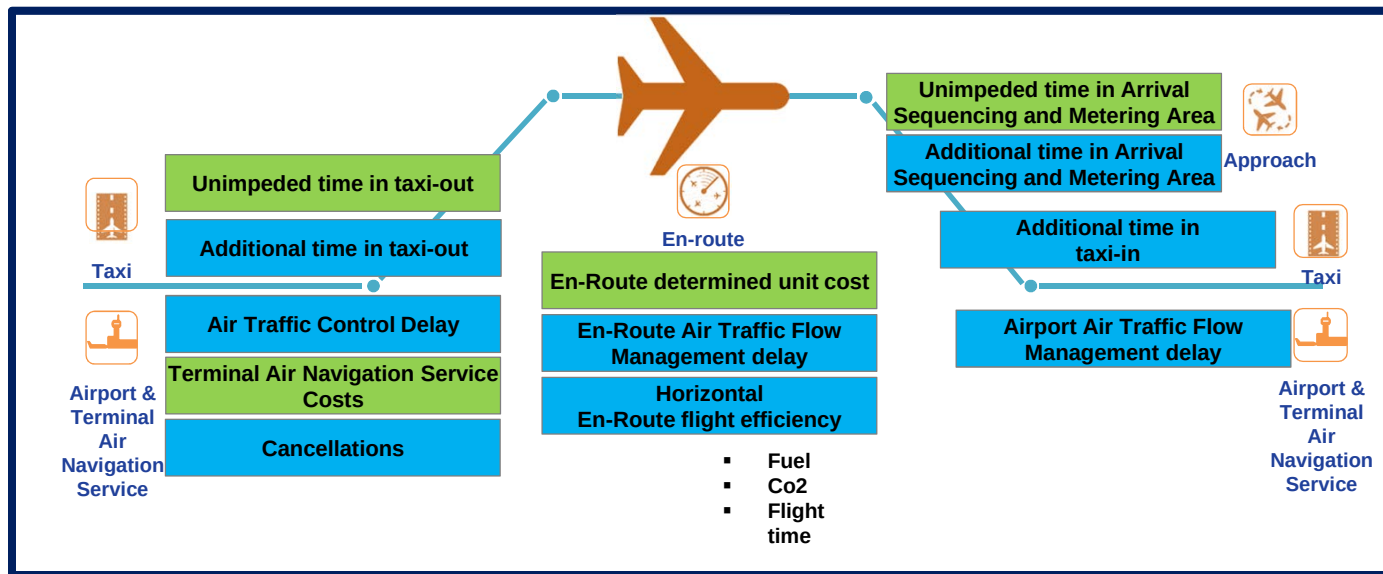


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Zoom on Performance

Key Performance Indicators



This figure shows the **Key Performance Indicators** that are used in the Performance assessment. Units can be minutes, tons of fuel/CO₂, or Euros

In green, KPIs referring to **strategic** inefficiencies (planned)

In blue, KPIs referring to **tactical** inefficiencies (unplanned)



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Zoom on Performance

Key Performance Areas

KPAs (Key Performance Areas)	KPIs (Key Performance Indicators)
Cost Efficiency	Gate to Gate ANS cost (in €)
Capacity	Departure Delay (in minutes): • Airport ATFM Delay • En-Route ATFM Delay • ATC Delay Cancellations (in number of events)
Operational Efficiency	Flight Time (in minute): • Unimpeded ASMA Time • Additional ASMA Time • Unimpeded Taxi-in Time • Additional Taxi-in Time • Unimpeded Taxi-out Time • Additional Taxi-out Time • Horizontal Flight Time Fuel consumption (in tons of fuel)
Environment	CO2 emissions (in tons of CO2)

This table shows the *classification of Key Performance Indicators (KPI) into the 4 main Key Performance Areas (KPA)*

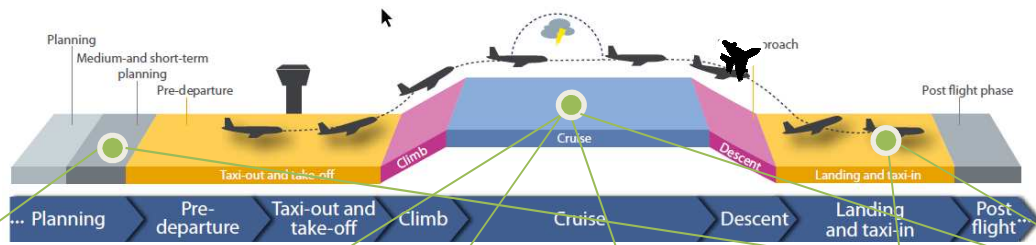


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Zoom on Performance

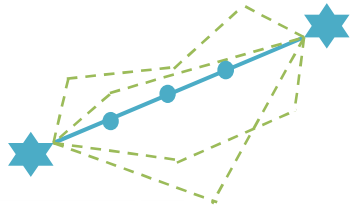
Gate2Gate



Extended Flight Plan



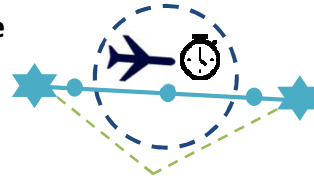
Free Route



Network Collaborative Management



Rolling Airspace Capacity Management



Extended Arrival Management



STAM Phase 2 in Combination with Target Times



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Zoom on Performance

Master Plan ambitions for 2035

Figure 5 SESAR performance ambitions for 2035 (categorised by KPA)

Key performance area	SES High-Level Goals vs. 2005	Key performance indicator	SESAR ambition vs. baseline 2012	
			Absolute saving	Relative saving
 Cost efficiency: ANS productivity	Reduce ATM services unit cost by 50% or more	- Gate-to-gate direct ANS cost per flight - Determined unit cost for en-route ANS* - Determined unit cost for terminal ANS*	EUR 290-380	30-40%
 Operational efficiency		- Fuel burn per flight (tonne/flight) - Flight time per flight (min/flight)	4-8 min 0.25-0.5 tonne	3-6 % 5-10 %
 Capacity	Enable 3-fold increase in ATM capacity	- Departure delay (min/dep) - En-route air traffic flow management delay* - Primary and reactionary delays all causes - Additional flights at congested airports (million) - Networkthroughput additional flights (million)	1-3 min 0.2-0.4 (million) 7.6-9.5 (million) Additional flights, not saving	10-30 % 5-10 % ¹ 80-100 % ²
 Environment	Enable 10 % reduction in the effects flights have on the environment	- CO₂ emissions (tonne/flight) - Horizontal flight efficiency (actual trajectory)* - Vertical efficiency - Taxi-out phase	0.79-1.6 tonne	5-10 %
 Safety	Improve safety by factor 1.0	Accidents with ATM contribution	No increase in accidents	Improvement by a factor 3-4
 Security		ATM related security incidents resulting in traffic disruptions	No increase in incidents	

* Targeted by the Performance Scheme

This figure shows, for each KPI, the Master Plan targets (or “ambitions”) defined for 2035 (note that a Master Plan update is ongoing)

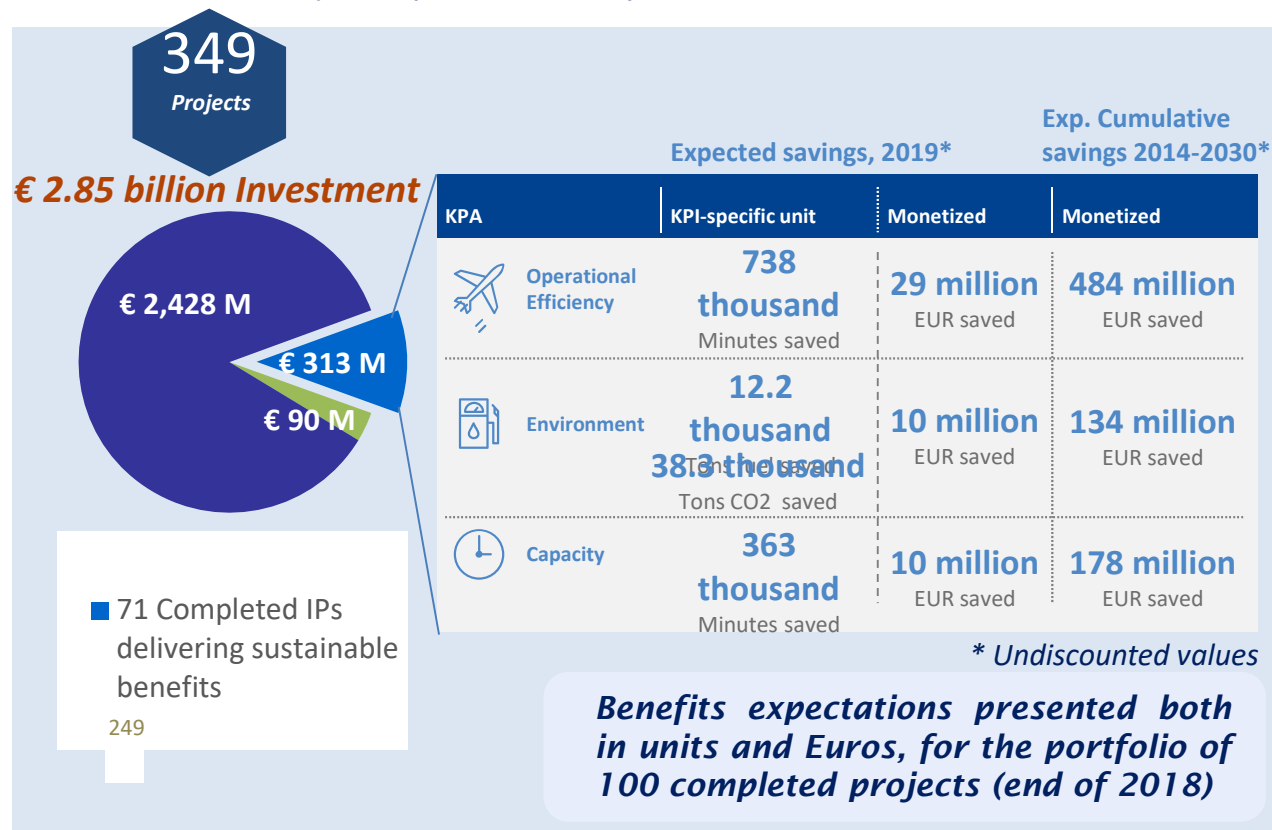


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Zoom on Performance

Portfolio of completed projects (end of 2018)



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Thank you

**Ralph Schwarzendahl,
Senior Expert Cost Benefit
SESAR Deployment Manager**



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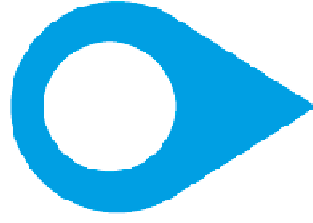


Air Navigation Services
of the Czech Republic



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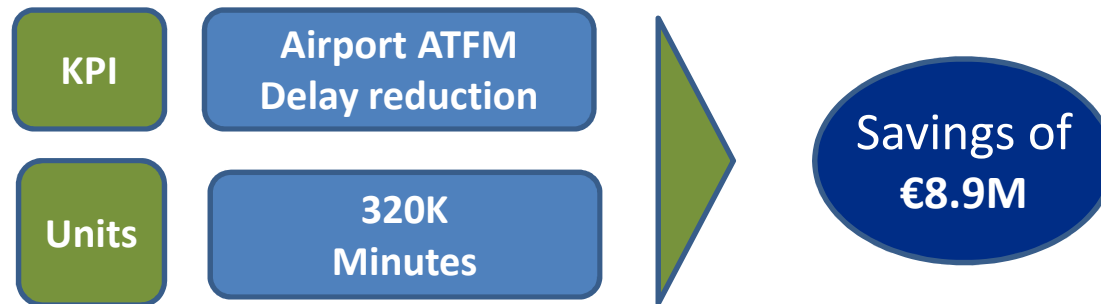
Traffic Complexity Tools



Co-financed by the Connecting Europe
Facility of the European Union

- Implementation period: 02/2016 – 11/2018
- Costs: €1.45M
- Co-funded by EU under SESAR Deployment Programme

Identified benefits cumulated until 2030



Traffic Complexity Tools



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Facility of the European Union

How does it work?



Traffic Complexity Tools



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Facility of the European Union

TCM main functions:

- Presentation of the occupancy counts of the selected sectors
- Support of handling sector overload (What-if Analysis)
- Presentation of load of adjacent FIRs (Sectors adjacent to LKAA)

In the FMP position, it is possible to visually compare the occupancy prediction of the traffic load with the occupancy on the simulated sectors.

When OC exceeds maximum OC defined for the sector, TCM helps to spread the traffic into the Lower sectors. TCM shows all A/C in this period and highlighted the candidates for descent.

Note: Traffic which will descent anyway due to LoA with adjacent sectors.

Traffic Complexity Tools



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1st Step:

Traffic Analysis



Traffic Complexity Tools

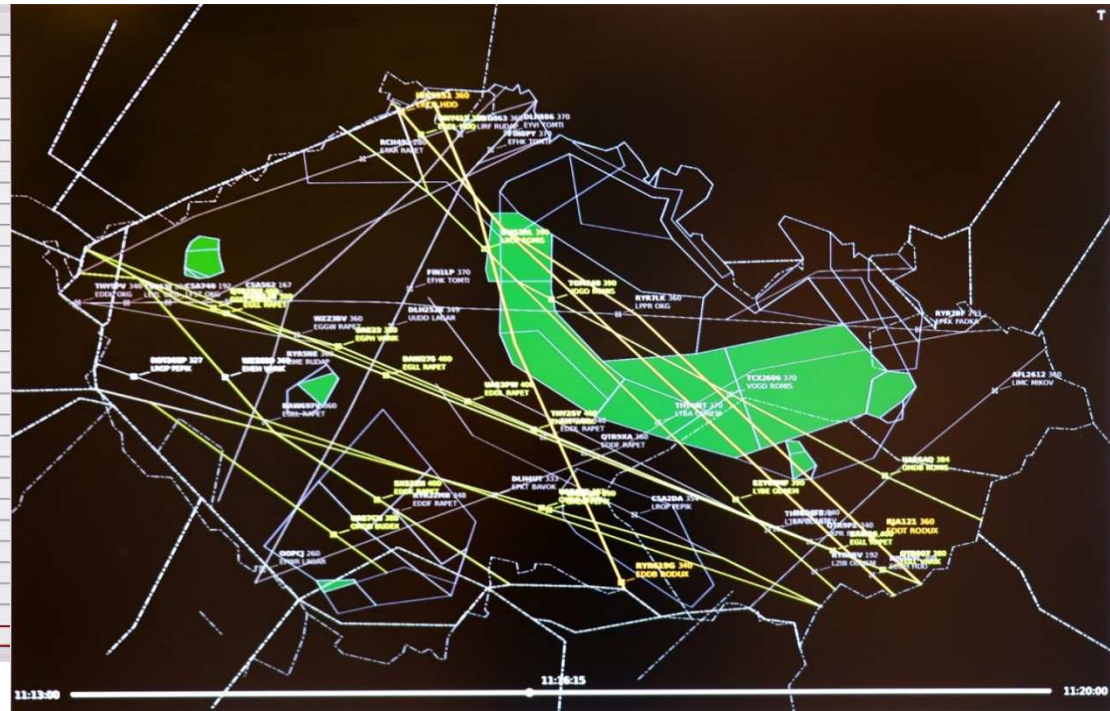


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2nd Step:

Implementation of Changes

ADEP	ADES
EDDF	LROP
EDDF	UTTT
VOHS	EGLL
VOMM	EGLL
OMAA	LFPG
OTHH	EGLL
LTAI	EDDK
LTBA	EHAM
OMDB	EDDL
EGGP	LROP
EKCH	LDZA
EDDT	LYBE
EGBB	VOGO
EGKK	OMDB
KJFK	OMDB
EGLL	OMDB
VOBL	EGLL
LIPZ	EDDT
LHBP	EKCH
OTHH	EGLL
OJAI	EDDT
EDDB	LIPE
LGAV	EDDB
OMDB	EBBR
OMDB	EGPH
LOWW	EHEH
EGCC	VOGO
EGCC	OMDB
LTBA	EDDL



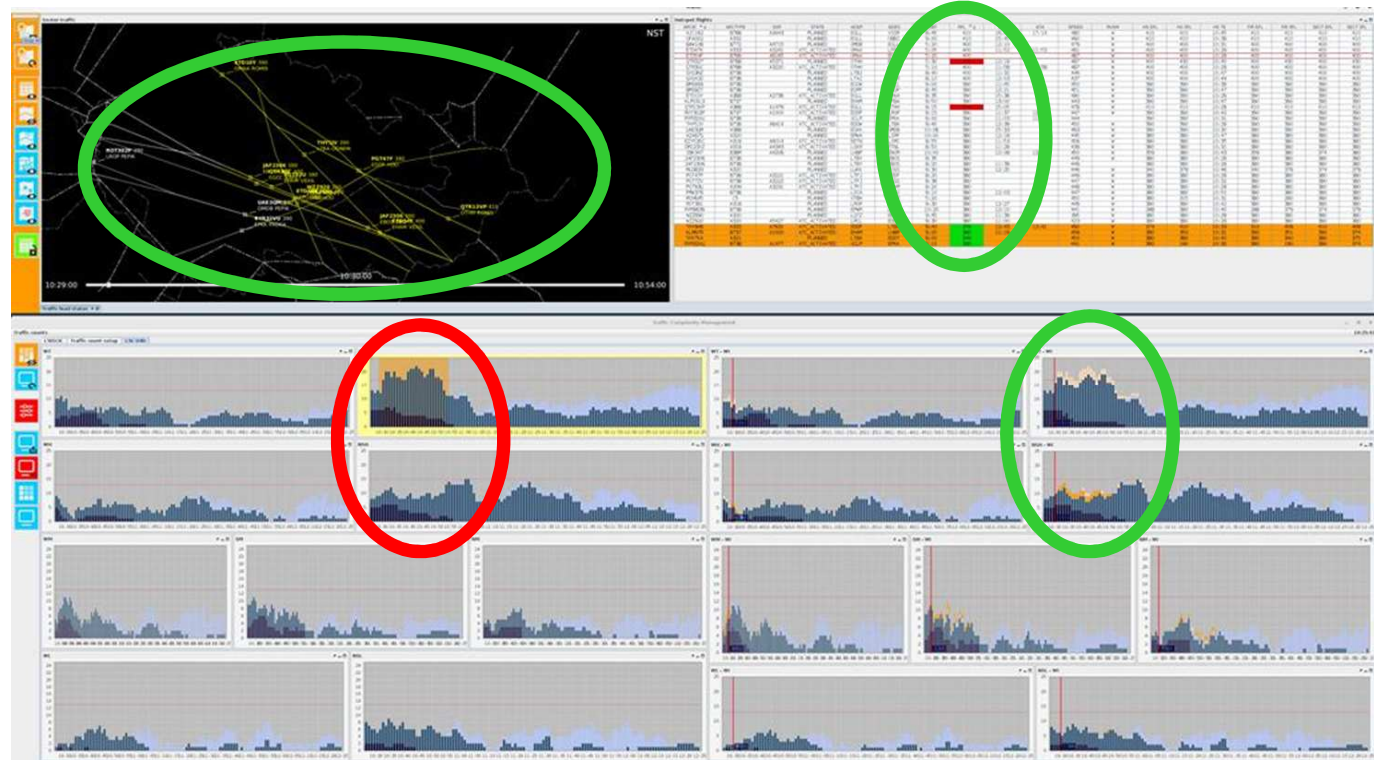
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3rd Step:

What-if
Analysis



Traffic Complexity Tools



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4th Step:

Implementation
of Changes

If you are satisfied with the result,
you should call the FMP of the
neighboring sector(s) and ask them
to apply these changes.

Traffic Complexity Tools



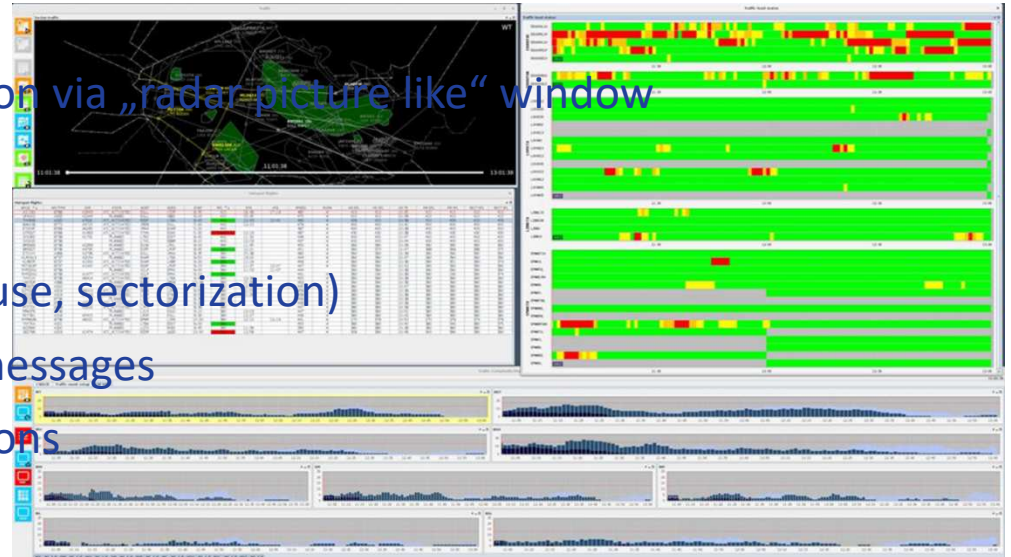
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TCM other functions:

- Highlighting of the prohibited areas, which appears during the activation time according AUP/UUP
- Presentation of future traffic situation via „radar picture like“ window

Future development

- Provide updates to NMOC (RWY in use, sectorization)
- Replace AFTN by B2B for DPI, AFP messages
- Further development of FMP functions



Traffic Complexity Tools



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Thanks for your attention!

Pavel Mrňa
mrna@ans.cz



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TRAFFIC COMPLEXITY ASSESSMENT TOOL

(tCAT)

GENERAL

MANAGE THE COMPLEXITY
IN AN EFFICIENT AND
COST-EFFECTIVE MANNER

ANALYSIS OF THE
COMPLEXITY OF THE ATC
OPERATIONS

COMBINATION OF THE
PREDICTED TRAFFIC
AND A SET OF
OPERATIONAL MODELS



ACCURATE PLANNING OF
ANSP RESOURCES

COGNITIVE WORKLOAD
ASSESSMENT

01**Traffic counts**

used for decision making and airspace configuration management.

04**Weather model integration**

allows the integration of a weather model, predicting the effects of adverse meteorological conditions on air traffic management operations.

02**Workload assessment**

uses a ATCO workload model which dynamically calculates complexity within a look-ahead time window

05**Targeted ATFCM measures**

allows the advance assessment and application of short term precisely targeted measures that allow micromanagement of ATCO workload.

03**Dynamic airspace optimiser**

optimizes use of airspace by dynamically assessing and proposing a sector opening scheme plan.

06**Forecast radar views**

allows flow and capacity managers to “fast-forward” current situation and directly observe a predicted radar picture, providing them with an indispensable visual-aid tool to assess the future air situation.

07

What-if scenarios

allows early assessment of the effects of a range of potential measures applied to the predicted air situation.

09

Archive and replay

The system provides advanced archive and replay functions, that not only allow the reproduction of any past situation, but also to assess possible application of different approaches to past situations (what if scenarios applied to archive data).

08

Rostering optimisation support

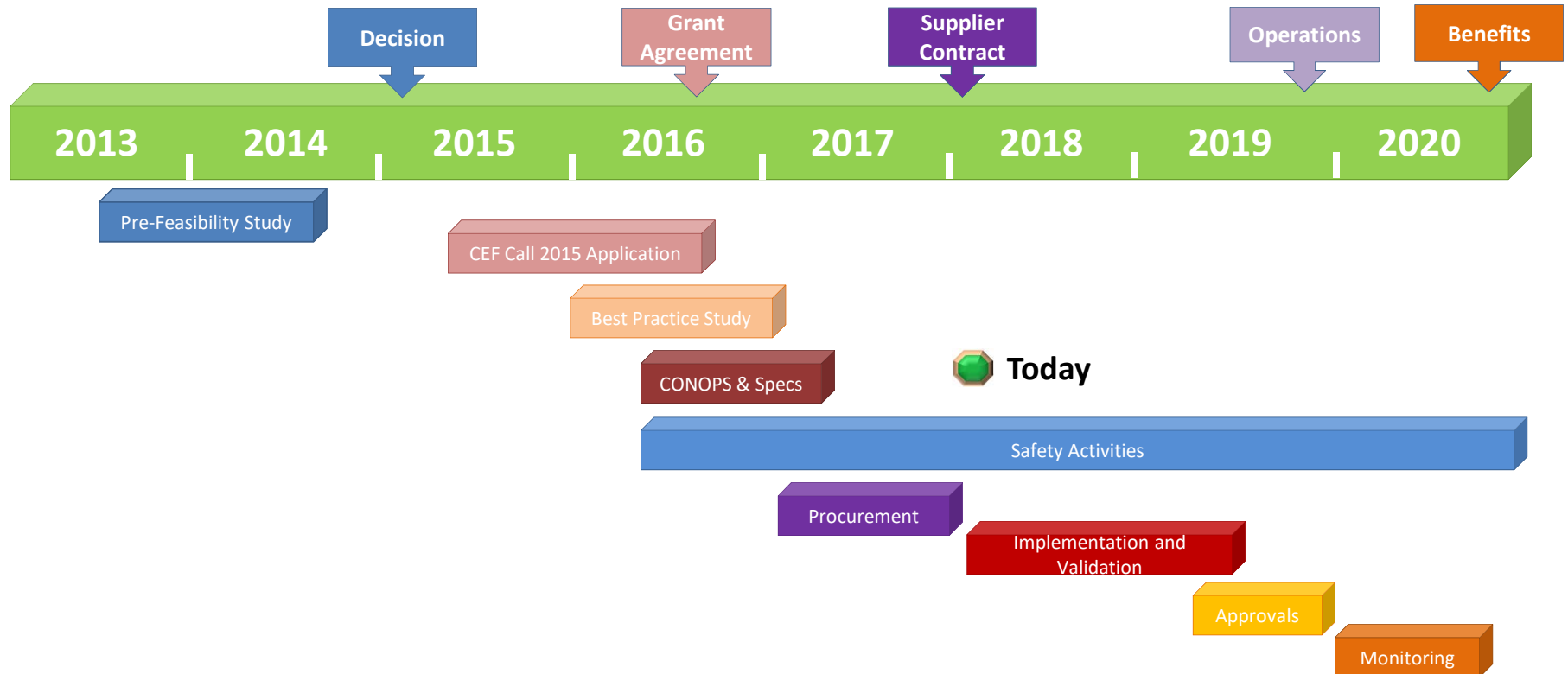
TCAT system is directly connected with the ATCO rostering system, allowing for an optimized use of available human resources.

10

Air situation detailed analysis

provides a number of views that allow to assess past, current and future air situation from different angles an in a depth which is not provided for by current tools.

THE PROJECT



THANK YOU



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SESAR 2020 PJ 07-OAUO

Optimised Airspace Users Operations

DELCOURTE, Kris
Project Manager PJ07
EUROCONTROL



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What is OAUO?

- Industrial Research (IR) Project of SESAR 2020 Programme
- Situated in the domain of the Network Management
- Central focus on the Airspace Users
- Optimising Airspace Users tools and processes in their interaction with the Network Management processes and tools
- Organised in 3 Solutions



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Solution 1 AU Processes for Trajectory Definition

- (Civil) Planning Service in the preliminary Flight Planning phase
- Better integration of Flight Planning and DCB processes and more automation
- enriched Demand and Capacity Balancing (DCB) information to AUs (hotspots, congestion indicators)
- AU preferences as input to DCB
- Part of the FF-ICE Concept (ICAO)



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Solution 2 AU's Fleet Prioritisation with UDPP, the User-Driven Prioritisation Process

- Provides AU flexibility to reduce impact of delay on their operations
- Allows AUs to prioritise on flights in case of delay in Pre-Flight phase
- Via collaborative processes at airports and in network DCB processes
- In collaboration with Airport Operation Centre (APOC), validation of UDPP in Arrival Constraint
- Exploratory Research on:
 - Low Volume Users
 - Absolute Priorities for Selecting Flights in DCB measures



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Solution 3: Mission Trajectory Driven Processes

- Wing Operation Centers (WOC) and their interactions with other ATM stakeholders (e.g. ATC), especially with the Network Manager
- Refine the Mission trajectory concept
- Focus on harmonisation of improved OAT flight plans
- Integration of the improved OAT flight plans in the ATM Network:
 - preparation and submission of the iOAT flight plans by WOC
 - processing and distribution of iOAT by NM function
 - ASM interaction with WOC and NM
 - WOC and ATC interaction
- In Planning and Execution phase



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PJ07 Benefits

PJ07 Will bring tangible Benefits for the AUs taking into account the overall Network impact

Total cost of Delay in 2018: 17.6 billion €

- Solution 1 Business Trajectory
 - Better planning and stability of the traffic due to taking Network constraints into account in preliminary Planning phase
 - Improved Predictability and Fuel Efficiency
 - Better use of spare capacity
- Solution 2 UDPP
 - Potential cost savings for the AUs: 4900€ per slot swap
 - In a hotspot: 5 to 15% of cost reduction
 - Selective Flight Protection will improve punctuality
 - Potential of saving 100 millions of Euros over 20 years
- Solution 3 Mission Trajectory
 - Better Network View of ALL traffic allowing better predictability of the network (leading to improved capacity planning)



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Thank you very much for your
attention!



EUROCONTROL

Kris.delcourte@eurocontrol.int



This project has received funding from the
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Union's Horizon 2020 research and innovation
programme under grant agreement No 699238



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Airport Post Operations Analysis



- Allows an airport to:
 - Compare daily operations against benchmarks
 - Set realist targets
 - Find correlations
 - Make predictions
 - Improve A-CDM



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Interactive Reports



- Reports no longer static; drill down and filtering enabled
- Can be tailored to each stakeholder through user security roles
- Viewing provided through web service



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Post Ops Analysis Benefits



- More efficient analysis
- KPI variation influencers are easily found
- Replay option can help in incident analysis



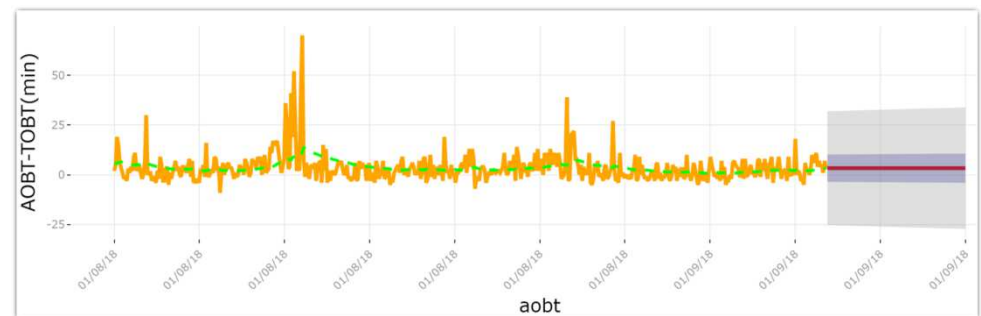
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Feedback to Operations



- Current work
 - Probabilities to feed into Execution phase
- Example
 - On-time departure probability for flight ABC1234 given an (x)min. arrival delay
 - Confidence interval for that prediction



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Thanks for your time

More information: SESAR JU PJ04

<https://www.sesarju.eu/projects/TAM>



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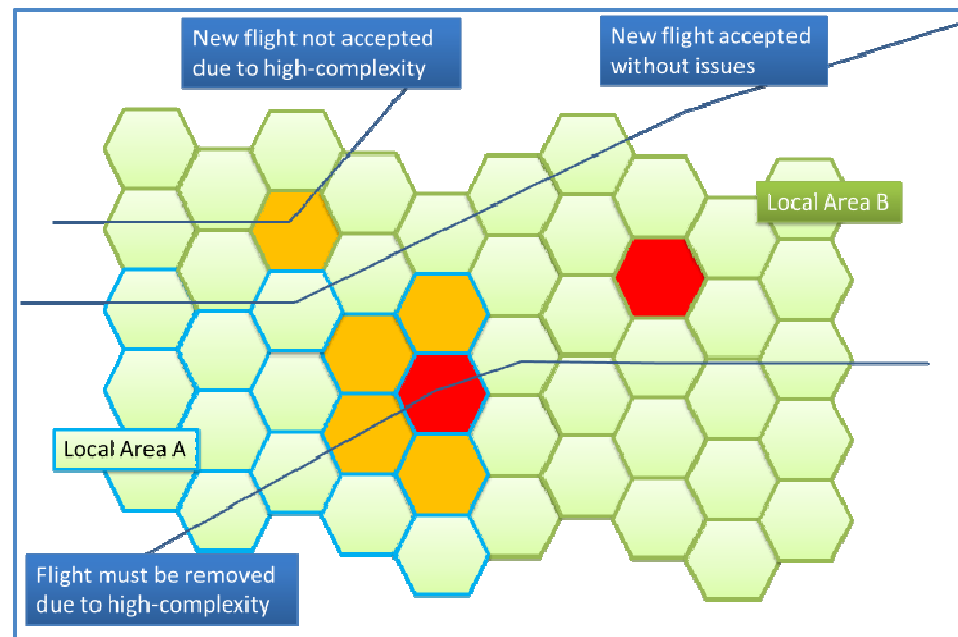
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What is eCOMMET?

enhanced COMplexity ManagEment Tool

eCOMMET is a supporting tool based on Complexity to balance demand and capacity



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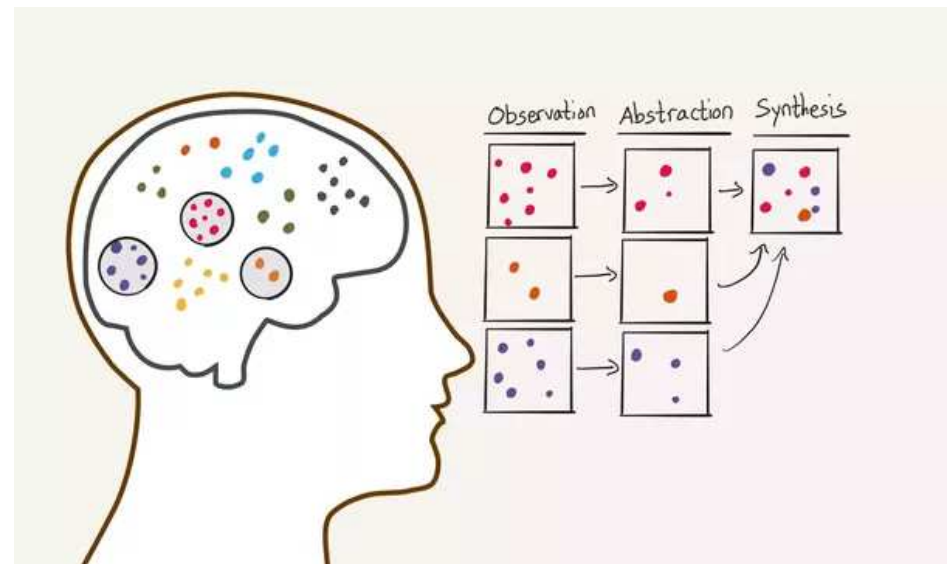
eCOMMET Foundations

- Research Goal: Achieve a set of metrics to assess complexity considering:
 - Traffic Controller cognitive limitations
 - Prediction in short-term
 - Meaningful information for demand and capacity decisions
- Multidisciplinary group composed by Engineers, Cognitive Psychologists and ATC operational staff.



Cognitive Complexity*

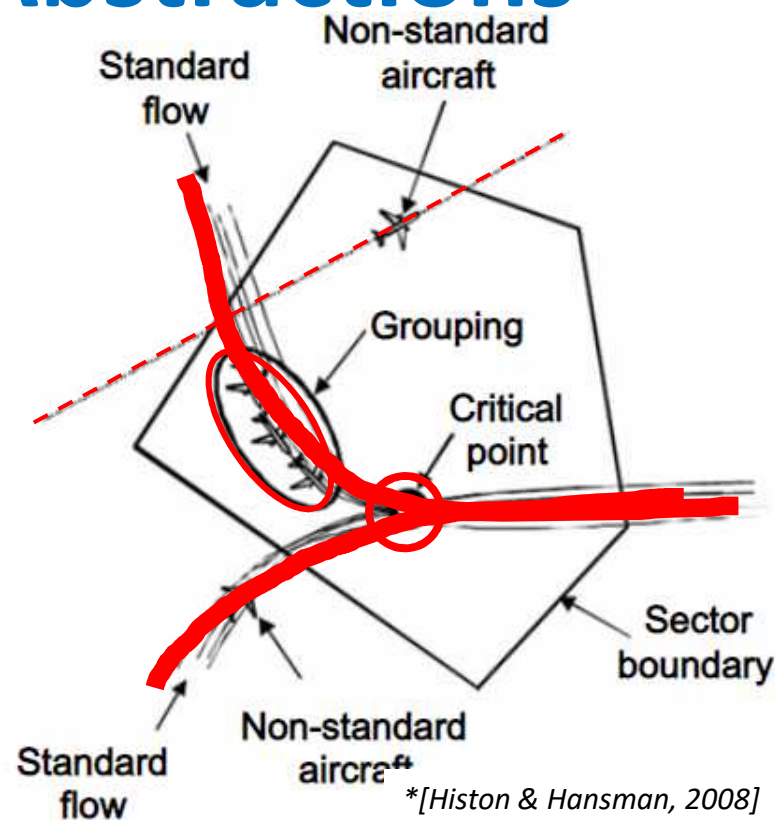
- **Cognitive Complexity** represents the cognitive difficulty of controlling an air traffic situation.
 - Cognitive challenge of ATC is one of the fundamental limits of airspace capacity
- ATM inherent structure is an important factor in cognitive complexity
 - Not considered on most complexity metrics (acft densities, occupancy, potential conflicts)
- Structured-Based Abstractions are mechanisms of cognitive simplification to reduce complexity



**[Histon & Hansman, 2008]*

Structured-Based Abstractions

- **Standard Flows**
 - Aircraft classified into standard and non-standard classes
 - Simplify dynamics calculations
- **Groupings**
 - Common properties (FLs, performances, origin, destination) define non-interacting groups of aircraft
 - Simplify projections and pair-wise comparisons
- **Critical Points**
 - High Priority regions where ATCO expect recurring problems (conflicts)
 - Simplify the problem from 4D to 1D “time-of-arrival”



**[Histon & Hansman, 2008]*

Complexity Metrics



COGNITIVE
COMPLEXITY



COGNITIVE
COMPLEXITY

Standard Flows

Flights out of standard flows

Standard Flows Interactions

Groupings

Aircraft with non common
performance within a flow

Critical Points

Flights in Evolution vs. Established
Flights

Potential Conflicts not belonging to
Critical Points

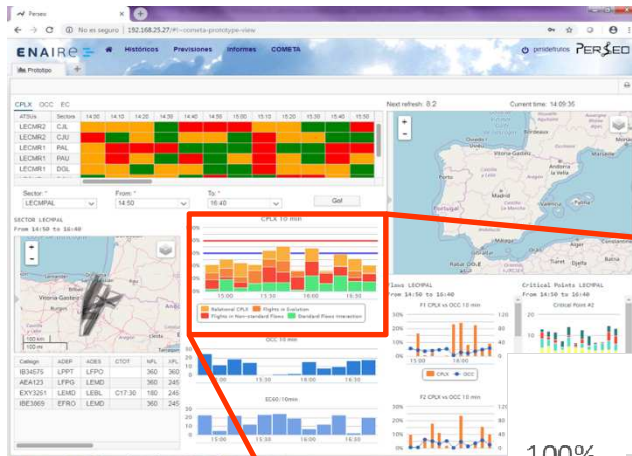


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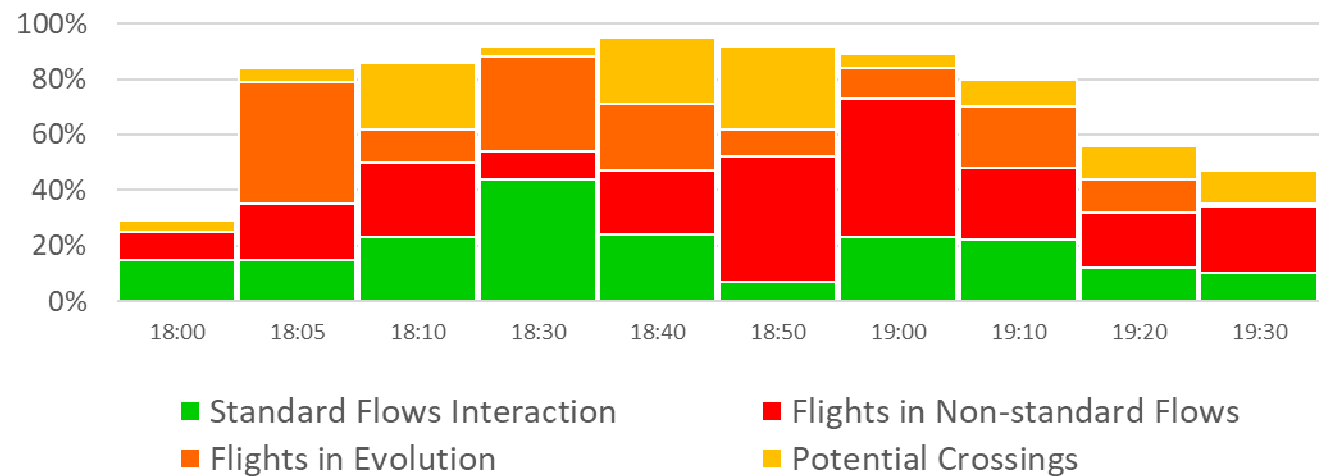


The Tool

Prototype used in
SESAR JU PJ09
validation activities



Complexity 10 min



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Thanks for your time!

More information: SESAR JU PJ09

<https://www.sesarju.eu/projects/dcb>



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First European Implementation of PInS Procedures to Support Medical Emergency Operations (G. Graziano)



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HEMS Operations, constraints and expectations

Helicopter Emergency Medical Services, especially in complex environment or when a prompt intervention is crucial, represent the **best mean** to treat patients in a reasonable time frame and improve survival probability

On the other hand **HEMS operations** represent one of the most **expensive** prehospital systems thus Health Service Managers expect to maximise the use of such “infrastructure”

Majority of HEMS interventions are conducted between secondary landing locations (e.g. helipad at hospitals) thus very often not supported by radionavigation aids and subject to VFR. In several places especially **the lack of VMC represents a strong limiting factor for operations.**



GNSS (EGNOS) Point In Space (PInS) procedures provide flexible solutions specific for helicopters and can be successfully used to improve operations of HEMS



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The «Trento → Cles Project»



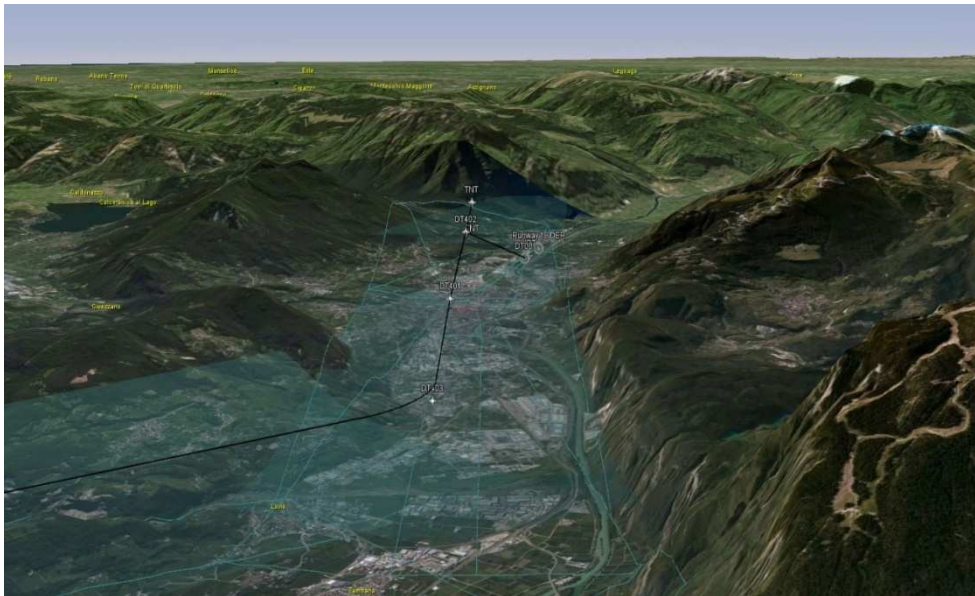
- Northern part of Italy represents one of most complex area of operations with high demand of HEMS service
- A specific project, to be used as pilot project for the national aeronautical community, was set up in order to test the “PInS Approach”
- **The challenge was to pass *from R&D to Operations*, also because this was the first European attempt to put in operations PInS procedures for HEMS (no other example to follow)**



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The «Trento → Cles Project»



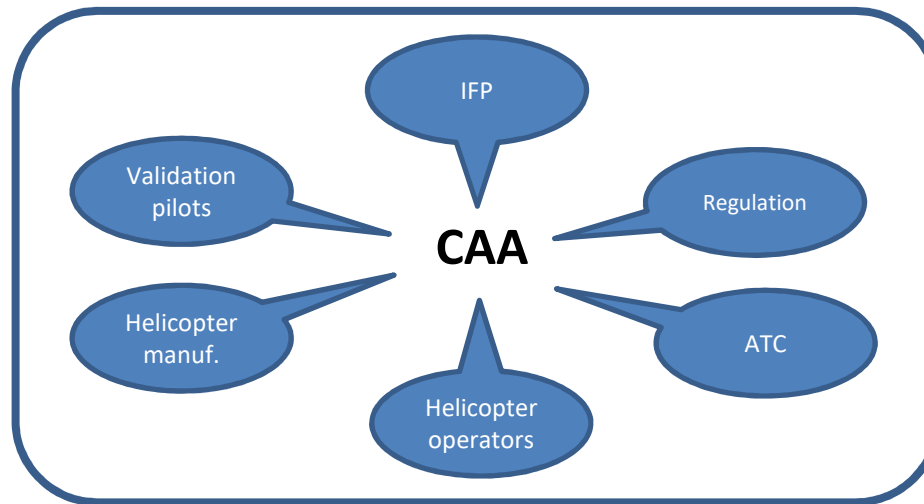
Main elements of complexity are:

- Orography
- PInS developed in Class G Airspace
- poor radio coverage In some valleys
- Interaction of PInS with existing IFPs of Bolzano and Trento Airport
- Possible lack of EGNOS coverage

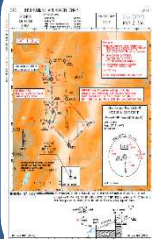


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Design



- 2 PInS (LPV) app LIDT
- 2 PInS (LPV) app Cles
- 1 PInS dep LIDT
- 1 PInS dep Cles

Flight Validation



- AW139 of Nucleo Elicotteri
- 2 specialised VAL pilots
- 1 specific recording tool designed by Leonardo

Safety Assessment

A robust safety assessment identified a set of «safety nets» to be implemented in order to operate the PInS



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- Mid 2018 the Italian CAA approved all the elements of the project (design, validation, safety) giving the green light to publication (AIP)
- The only prescription is related to an “experimental period” of six months to collect operational feedbacks and technical data. In this period the procedure can be flown only under VMC conditions
- The procedures have been published in AIP SUP S15/2018 (effective date 31/01/2019) ... they are alive and kicking!!



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Credits



European
Global Navigation
Satellite Systems
Agency



PROVINCIA AUTONOMA DI TRENTO



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Enhanced parallel operations

Applicability assessment @ Paris-CDG



Introduction



Context: study conducted as part of SESAR2020 project 1, solution 3A, with Paris-CDG

Focus: independent parallel approach operations

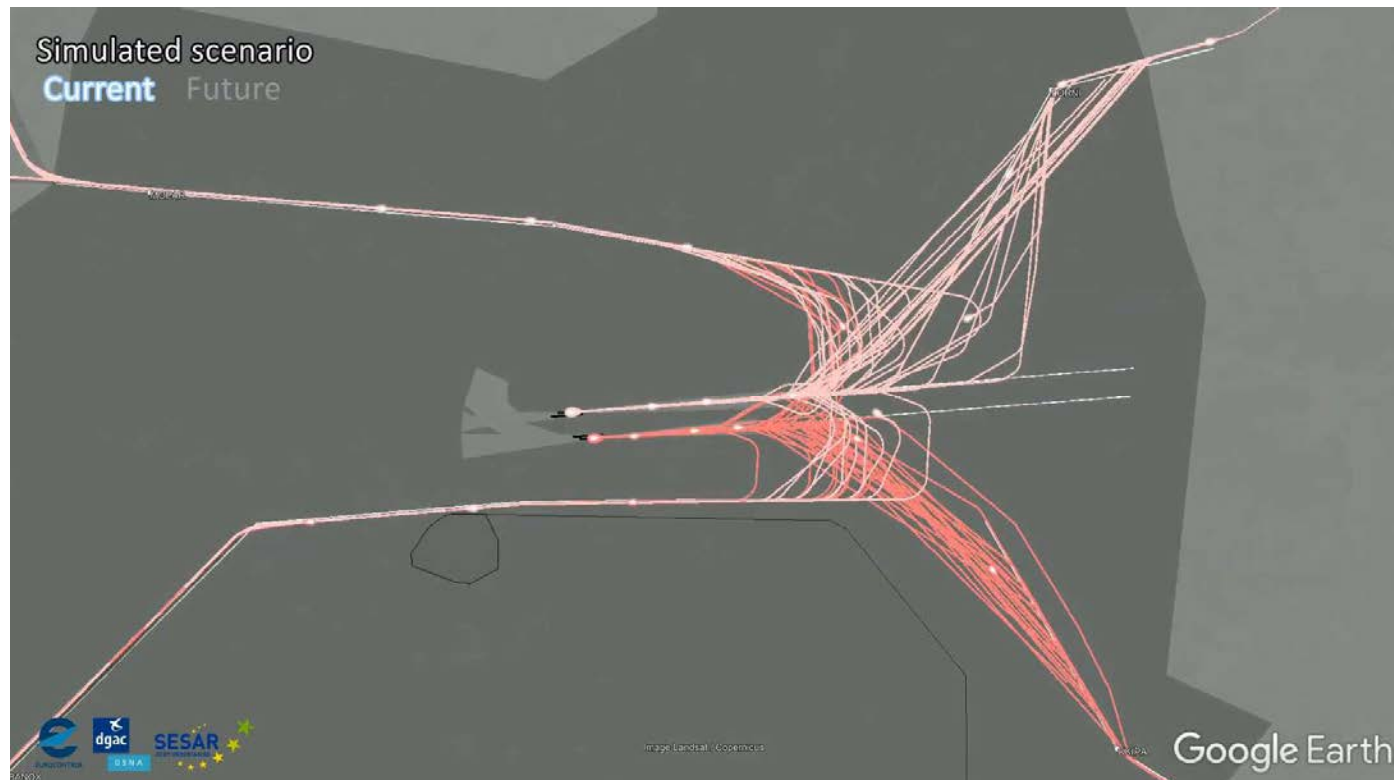
Motivations: reinforce safety at ILS intercept, reduce environmental impact (noise)

Solution: use of performance based navigation (PBN) connecting to final approach (ILS) with dedicated ATC procedures

Baseline: vectoring to ILS



Consequences: trajectory dispersion at low altitude, high controller workload, limited pilot situational awareness, no standardised intercept, runway crossing near final



Solution: PBN to ILS

Principles: segregation of arrival flows, standardised operating method

Elements:

- initial PBN segments to facilitate sequencing (direct to merge point)
- final PBN to ILS segments to guarantee standard intercept
- crossing downwing segments to reduce need for crossing near final



Outcomes



- **Operability:** feasible and usable in a typical dense and complex environment
- **Systematisation:** limited radar vectoring and systematic use of direct-to instructions
- **Safety:** effective segregation of arrival flows with regular traffic patterns
- **Environment:** slightly higher vertical profiles and limited dispersion at low altitude