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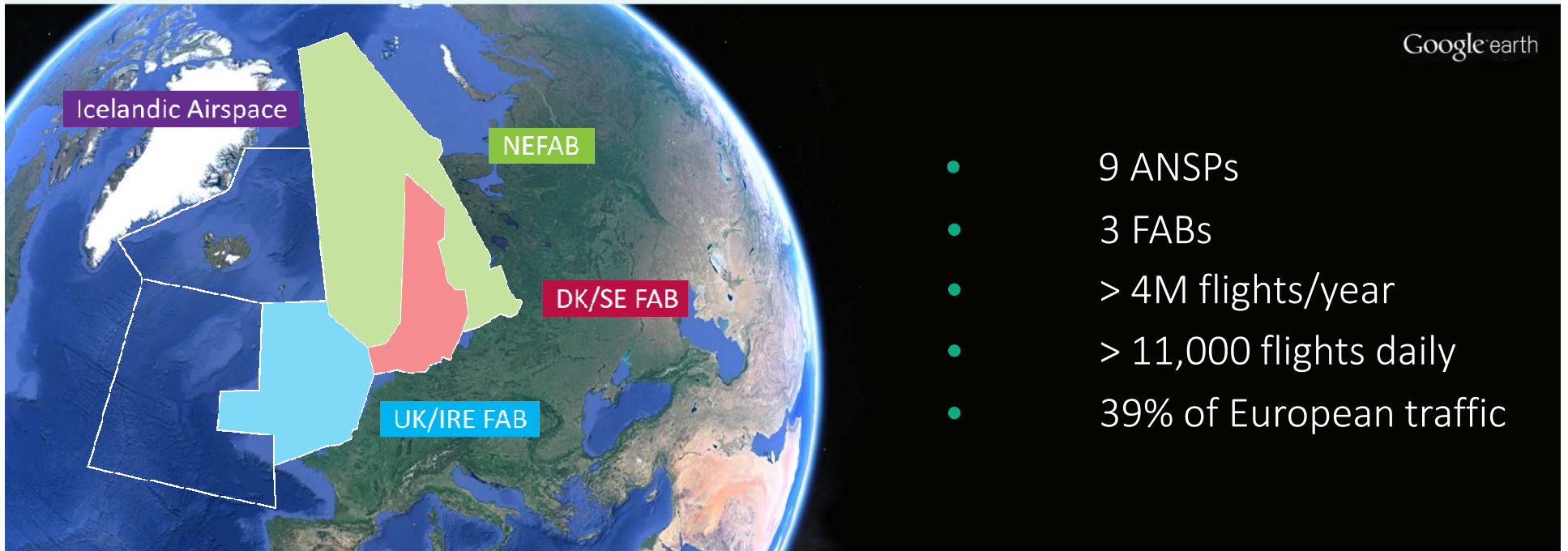
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Stand 849

Borealis Alliance



Borealis Alliance Free Route Airspace (FRA) Programme

Present status of Borealis FRA



Final vision of Borealis FRA – 2021



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DEPLOYMENT MANAGER



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2021



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Borealis FRA Implementation steps

ID	Step Lead	Step	Affected ANSPs	Deadline
S1	IAA	Extension of FRA in Shannon CTA down to FL75	None	Q3 2017
S2	Isavia	FRA for flights departing/arriving within Reykjavik FIR via Boudet or Norway FIRs	Avinor Implementation projects	Q4 2016
S3	Isavia	FRA for flights departing/arriving within Reykjavik FIR via Scottish FIR	NATS Implementation projects	Q3 2017
S4	NATS	Implementation of FRA in eight Scottish FIR sectors	Avinor/IAA/Naviair/Isavia Implementation projects	Q4 2020
S5	Isavia	Implementation of FRA for departures/arrivals at airports in BIRD FIR flight planned from/to/via Norway and Scottish FIRs	Avinor/NATS Implementation projects	Q1 2019
S6	NATS	Full implementation of FRA in Scottish FIR and in parts of London FIR	IAA/Naviair Implementation project	Q4 2021
S7	NATS	Full implementation of FRA in London FIR	IAA Implementation project	Q1 2022



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Borealis Alliance FRA estimated benefits (incl. NEFRA) 2022¹ (per annum)



Seamless airspace
7M Nm
>1M min



Cost savings²
€60M



Reduced fuel burn
46K t



Less emissions
146K t CO₂
641 t NO_x

1 Borealis FRA SAAM modelling results for the seven implementation steps

2 Fuel cost + Operating cost savings



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FINEST programme

- Efficient cross border service provision to meet the traffic demand in two FIRs
- Technical solutions
 - common FDP, sensor data sharing, COM/VCS etc)
- Dynamic (not static) airspace delegation
- One rostering and dynamic cross-border sectorization
- Service provision continuity

EANS webpage:

www.eans.ee

Q / A



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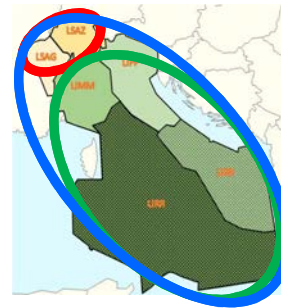
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Cross-border FRA high complexity environment exercise

Flight Optimisation following business needs

- Fuel efficiency
- Predictability



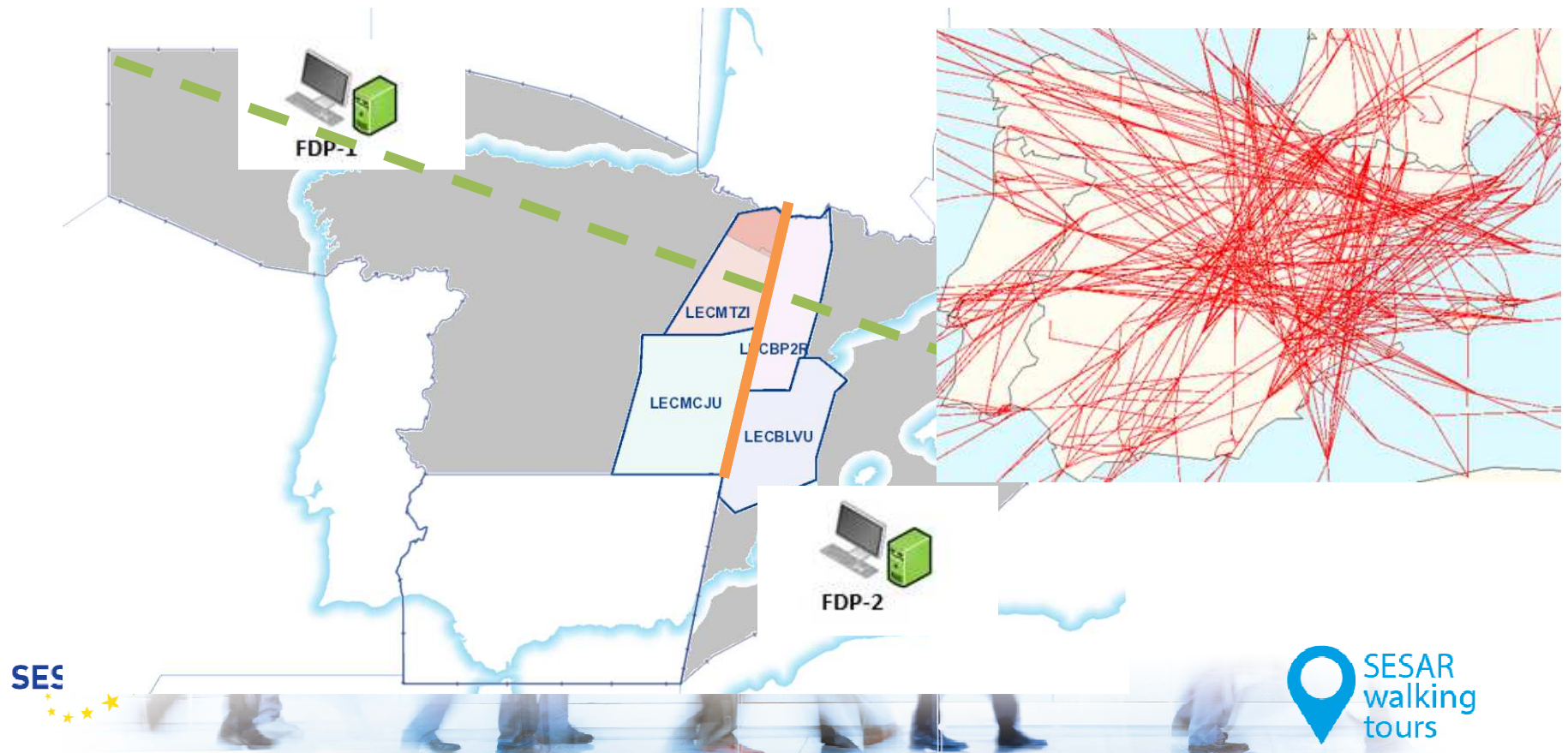
DSNA, Météo France, Naviair, ENAIRE, CRIDA, INECO, Nav Portugal, ENAV, BULATSA, TECHNO SKY, ECTL, INDRA, Leonardo, Selex ES GmbH, Skyguide, Skysoft ATM, Thales Air Sys, SMATSA, ACG, CCL, LFV



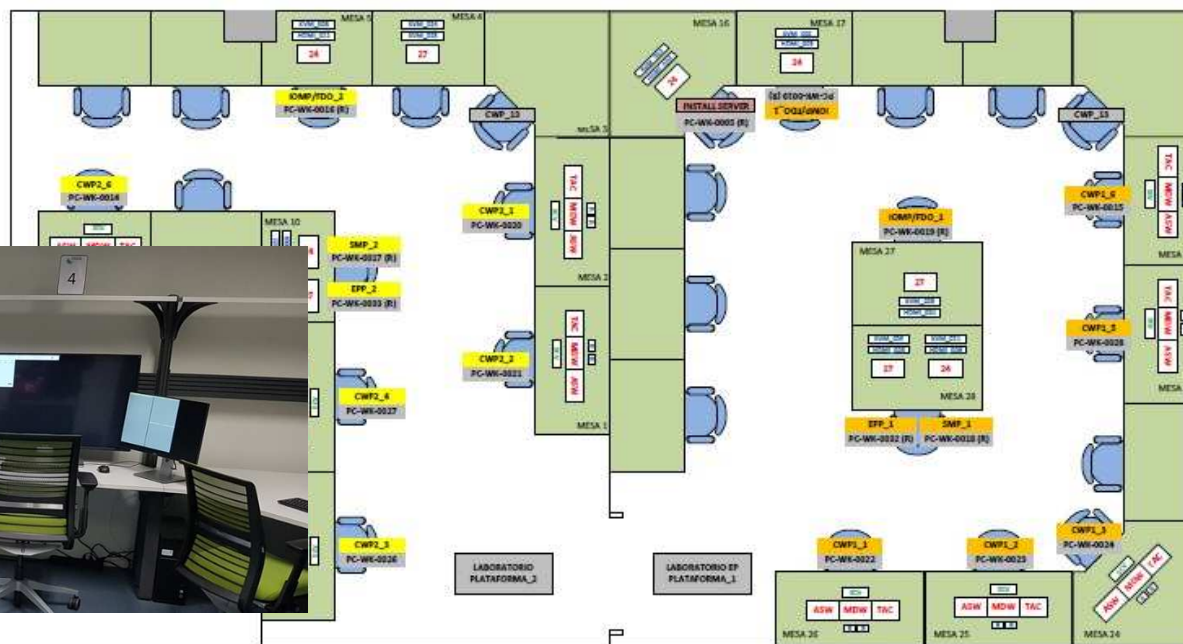
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Spanish Validation Scenario



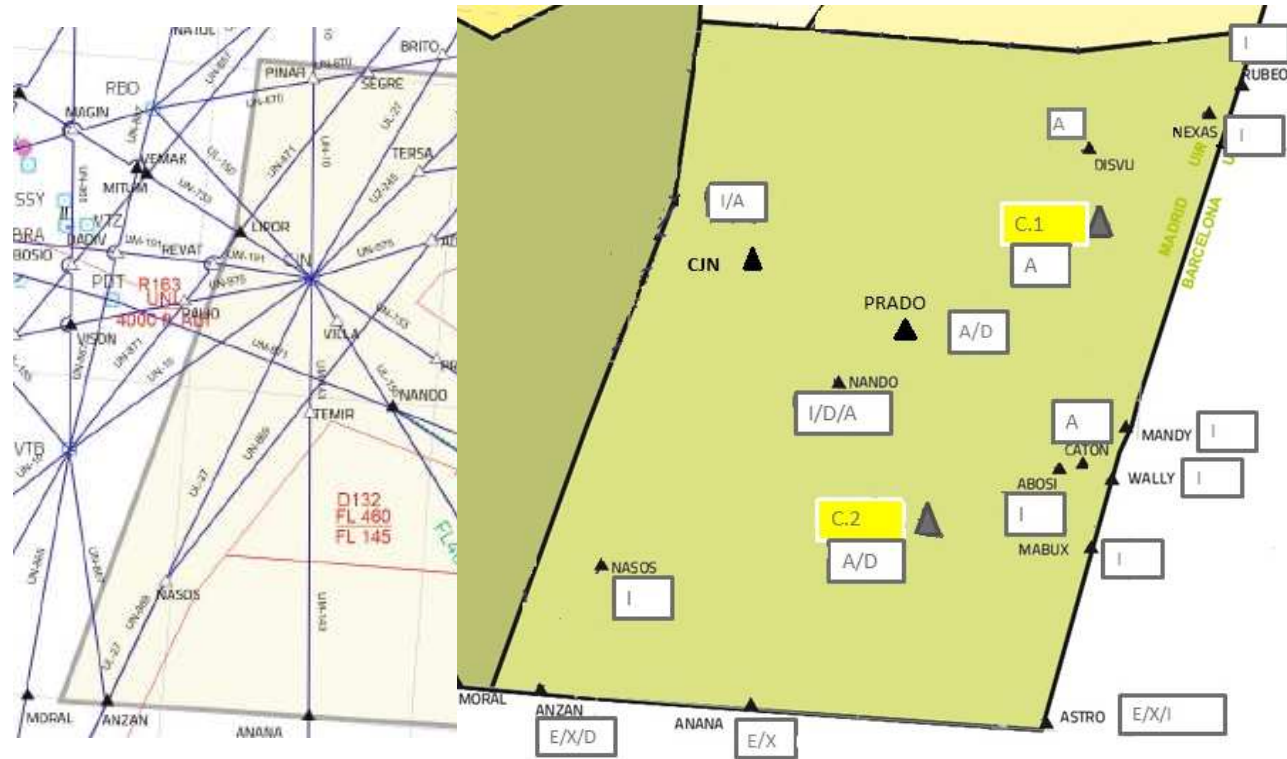
A graphic consisting of a hexagonal grid of five white hexagons with blue borders. The top-left hexagon is empty. The top-middle hexagon contains the ENAIRE logo. The top-right hexagon contains the CRIDA logo. The middle-left hexagon contains the Indra logo. The middle-right hexagon contains the ineco logo. The bottom hexagon contains the EUROCONTROL logo. The background of the slide shows a blurred image of an airport terminal with people walking.



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ARN vs FRA



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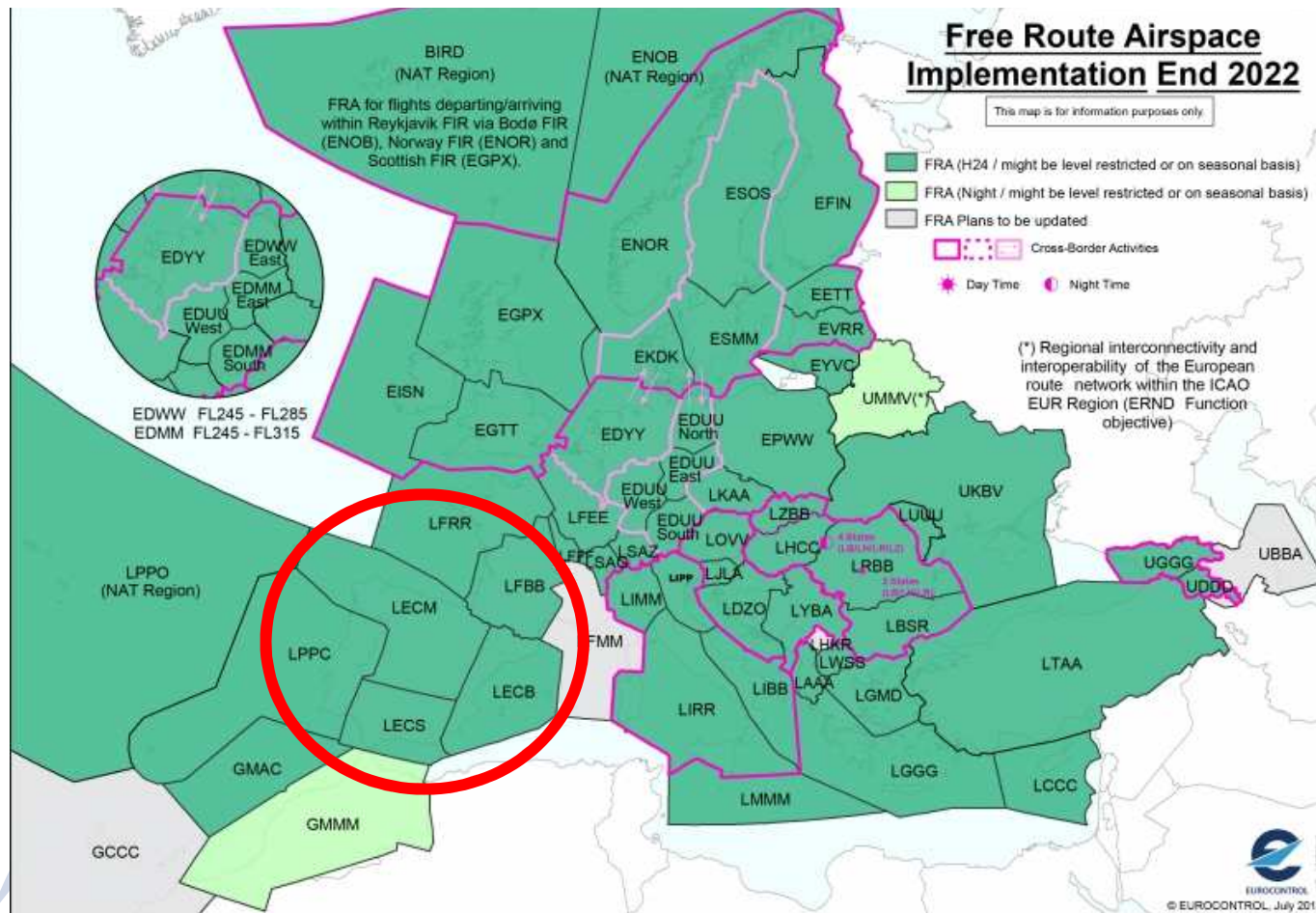


video



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



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4-Flight Deployment in Italy

- ❖ 4-Flight Overview
- ❖ Relevant elements
- ❖ 4-Flight and PCP
- ❖ Deployments (what and when)
- ❖ Conclusions



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4-Flight: Overview

The ENAV 4-FLIGHT System represents a real innovation in the framework of ATM automation:

- ❖ Fully aligned to the SESAR Master Plan with many implementations of PCP ATM functionalities stated in the SESAR Deployment Programme
- ❖ A 1st case of SESAR compliant ATM System based on Service Oriented Architecture (through standardization of interfaces)
- ❖ Implementation of new functions and technologies to support advanced ATM operations (4-D Trajectory, CDPT, CDTT, AMAN), in line with the recommendations from the recent Airspace Architecture Study.
- ❖ Safety Assessment in accordance with Eurocontrol Methodology (SAM)



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4-Flight: Relevant elements

WHAT'S

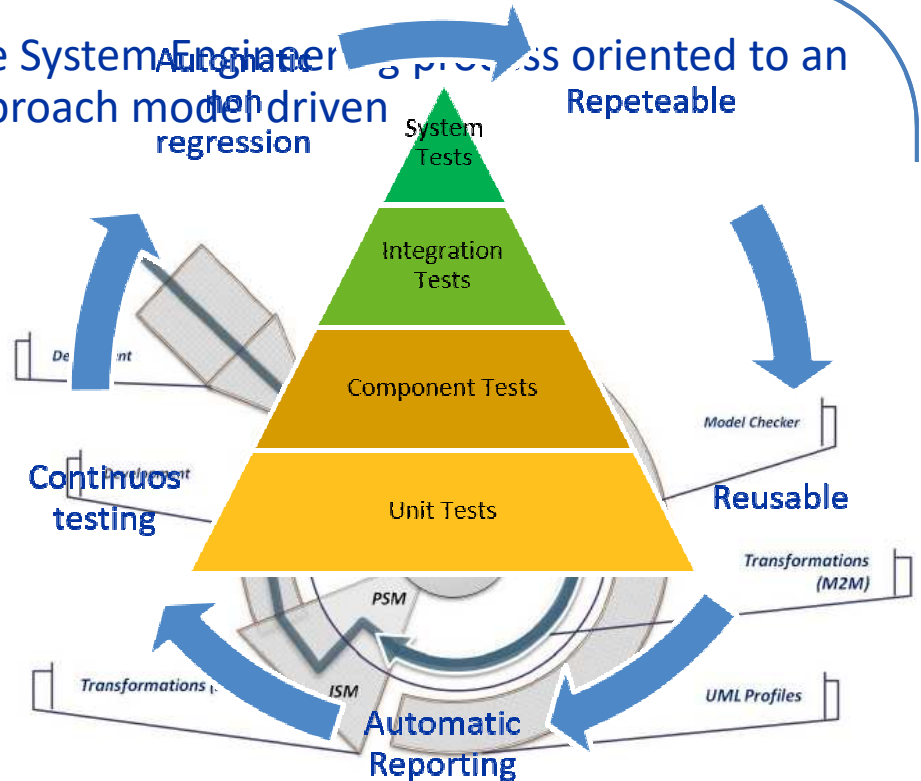
NEW

Model Driven Engineering (MDE) in the validation process system by means of the use of abstract models that are converted afterwards in concrete software implementations.

- produce automatically software test report (at CSU, component and system level)
- Describing the system in a language understandable by both customer and provider so to avoid possible misunderstandings
- execute easily non regression tests at each software delivery
- verifying the system behaviour at first steps of design so to avoid the propagation of mistakes
- To provide evidences in support of SWAL assessment



The System Engineering process oriented to an approach model driven regression



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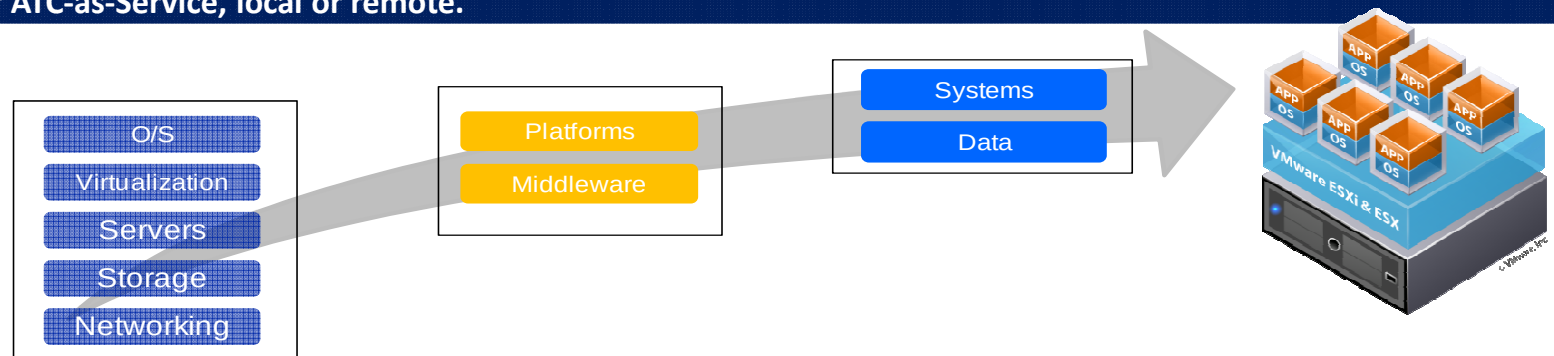
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Virtualization & Cloud

4-Flight system will be deployed on a virtualized hardware platform in line with SESAR 2020 concept of operation regarding provision of services irrespective of the location of physical infrastructure

ENAV ATM Platforms and Facilities

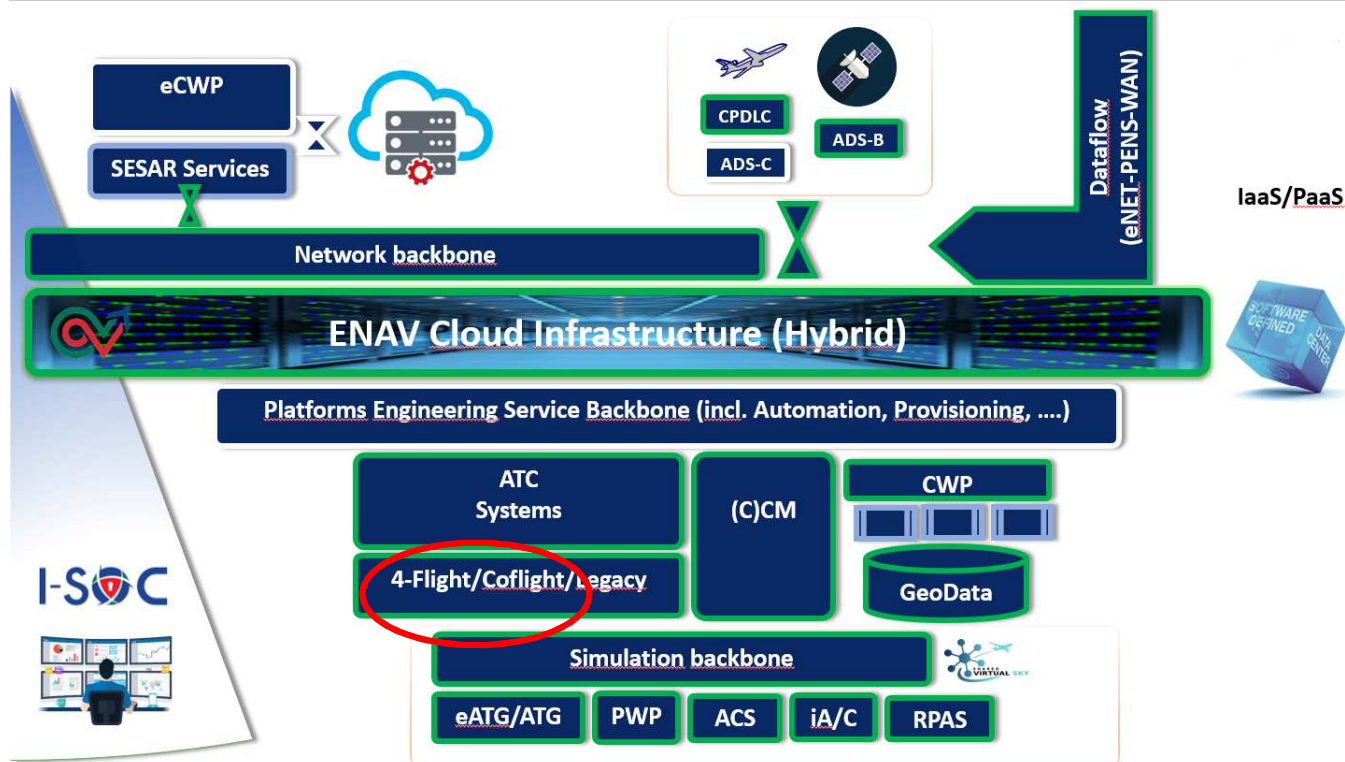
- (Virtualised) Hybrid Cloud Infrastructures, Service based – IaaS and PaaS.
- Heterogeneous Data Sources (Radar Sensors, Flight Plan, inc. Satellite data).
- Automated Systems Integration.
- Operational Testing and pre-operational Verification and Validation (Coflight/4-Flight, ERATO, Link-iT, ..) and SESAR simulations,
- Ready for ATC-as-Service, local or remote.



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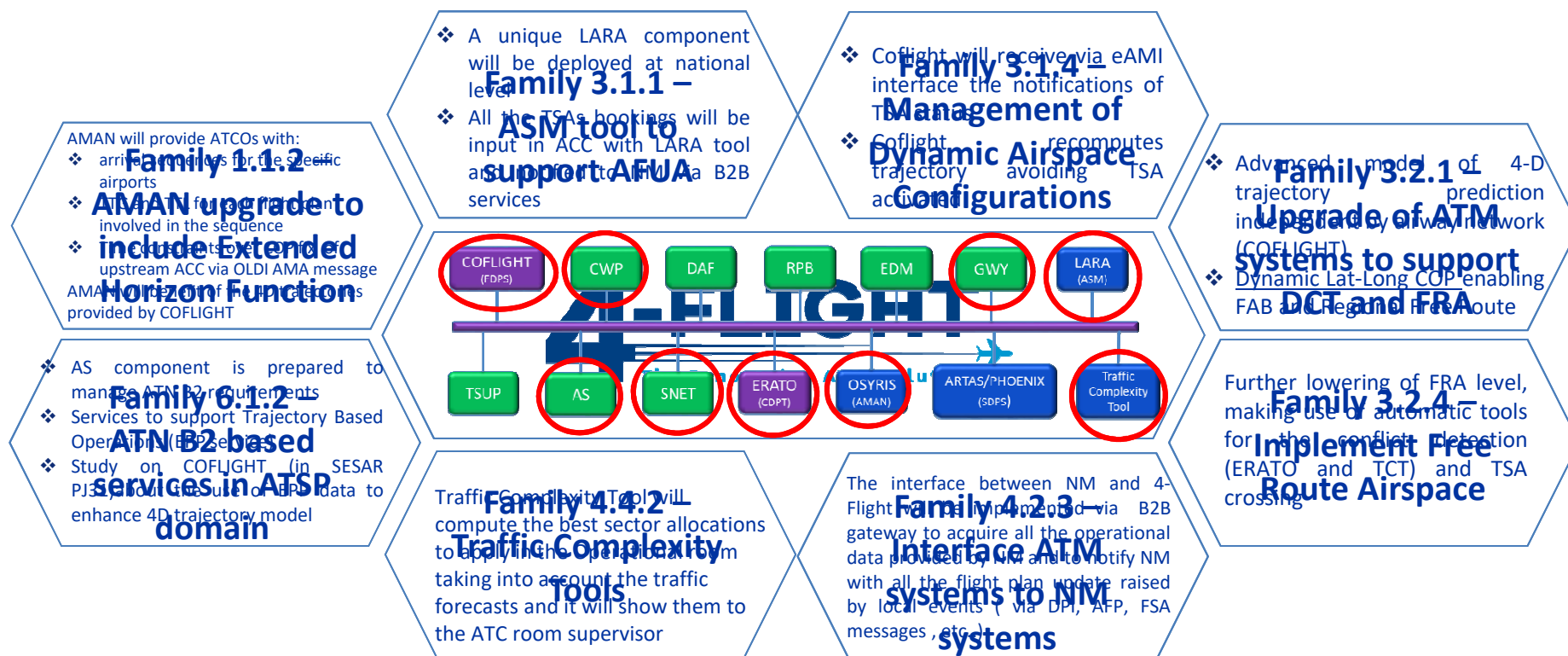
Enav Cloud Infrastructure



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4-Flight and PCP

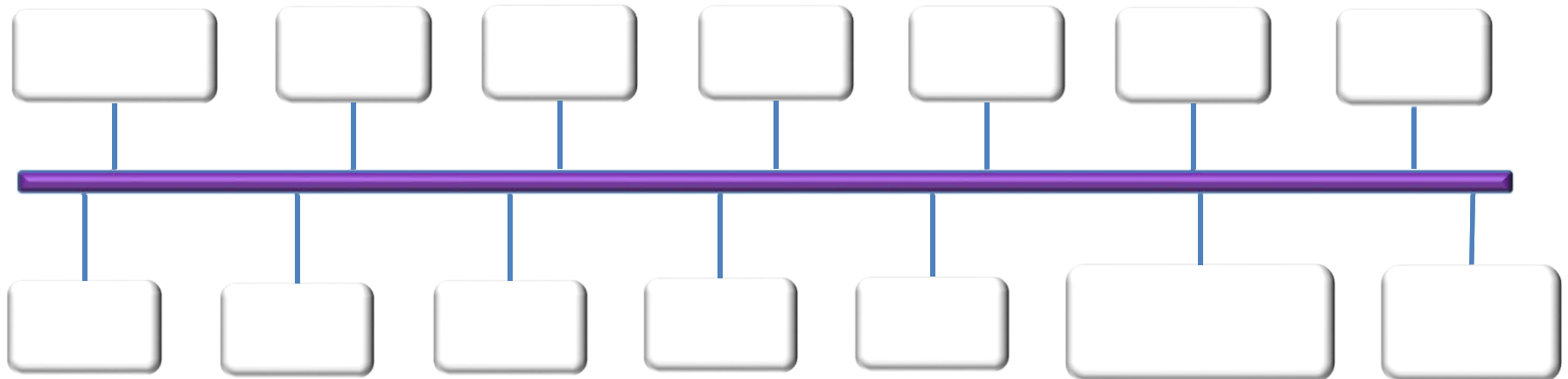


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4-Flight: Builds Content

Final Draft: EUI-2007-2011
Final Draft: EUI-2007-2011



LEGENDA



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Conclusions

- ❖ 4-Flight represents a very innovative program to deal with the future requests of traffic demand growing and safety increase.
- ❖ To win this challenge, 4-Flight is introducing new technologies and methodologies in the design, development and deployment of an ATM system.
- ❖ 4Flight will increase operational, technical and economic efficiency
 - Interoperability (Major awareness of the neighbouring traffic)
 - Lowering of Free Route Airspace (Minor elapsed times for the flights and better environmental impact)
 - Increased operational flexibility in the configuration of airspace volumes, more precise airspace configuration planning in order to accommodate traffic demand in an improved cost-effective environment
- ❖ 4-Flight represents a reference for all R&D activities, with further evolutionary process integrated in the SESAR chain



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Human Performance in PJ16-04

- Looking across all the technologies to assess the HP benefits and issues to allow progression to higher maturity.
- No point developing if the tools do not improve the basics

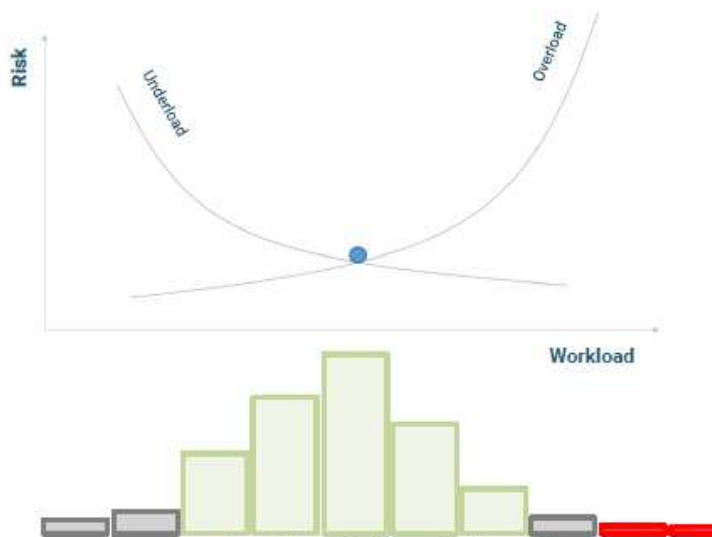
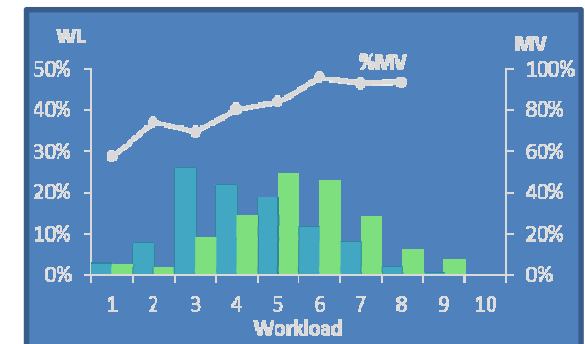


Figure 1 - Sector Profiling against WL and Risk

9) Please read the FOUR statements below and then circle the number that represents your agreement with that statement.

I am sure that this system enables my team to support me.											
Completely Disagree	1	2	3	4	5	6	7	8	9	10	Completely Agree
I feel adequately trained in the use of this system.											
Completely Disagree	1	2	3	4	5	6	7	8	9	10	Completely Agree
I believe that the tools, functions and information presented by the system are suitable for my job and tasks.											
Completely Disagree	1	2	3	4	5	6	7	8	9	10	Completely Agree
Please rate your overall confidence in the system as a whole.											
Not at all Confident	1	2	3	4	5	6	7	8	9	10	Totally Confident



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Finding new measures

```
<result>
  <interpretation confidence="87">
    <input mode="speech">airfrance three four one six climb to
    flight level two hundred</input>
    <instance>
      <CALLSIGN confidence="87">AFR3416</CALLSIGN>
      <INDEX1 confidence="87">1</INDEX1>
      <GROUP1 confidence="87">Level</GROUP1>
      <TYPE11 confidence="87">LEVEL</TYPE11>
      <VALUE11 confidence="87">FL200</VALUE11>
      <TYPE12 confidence="87"/>
      <VALUE12 confidence="87"/>
      <TYPE13 confidence="87"/>
      <VALUE13 confidence="87"/>
      <TEXT1 confidence="87">climb to FL200</TEXT1>
      <SWI_literal>airfrance three four one six climb to
      flight level two hundred</SWI_literal>
      <SWI_meaning>{CALLSIGN:AFR3416 GROUP1:Level INDEX1:1
      TEXT1: climb toFL200 TYPE11:LEVEL TYPE12: TYPE13:
      VALUE11:FL200 VALUE12: VALUE13:}</SWI_meaning>
    </instance>
  </interpretation>
</result>
```

Figure 5. Example of recognition result in XML output file.



Figure 6. Elements of an instruction of a clearance.

- What can a line of code tell us about human workload?
- How can we use this to improve our understanding of what people are doing?



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User Profile Management

in collaboration with LVS-Slovakia



Why UPMS?

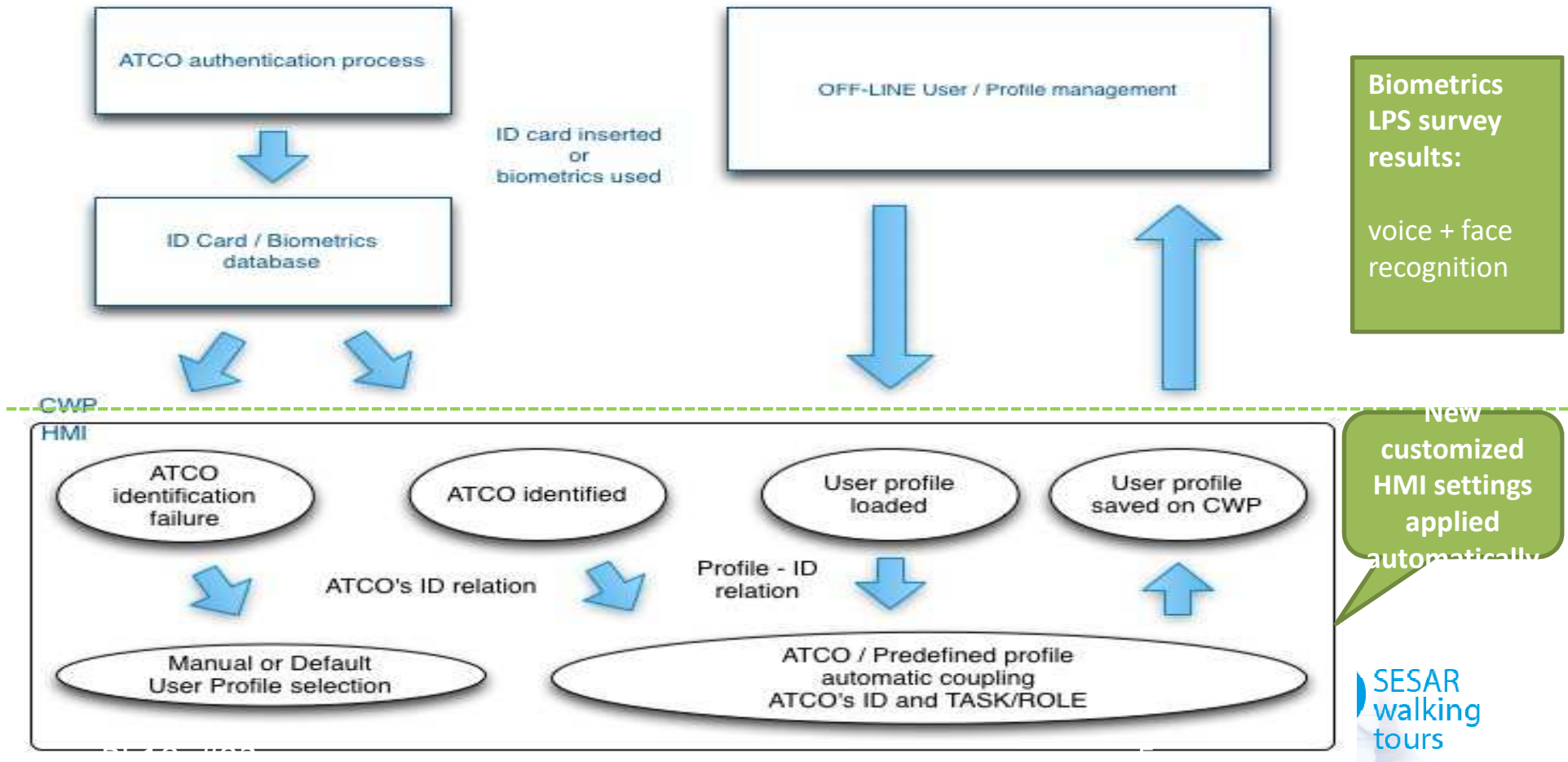
- complete and instant personalization of CWP/HMI settings according to the ATCO's individual operational needs, requirements and preferences.
- During a shift takeover
- When ATCO's task or role on the CWP changes – e.g. change of sectorisation



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UPMS processes



Machine Learning of Objective Data Inputs

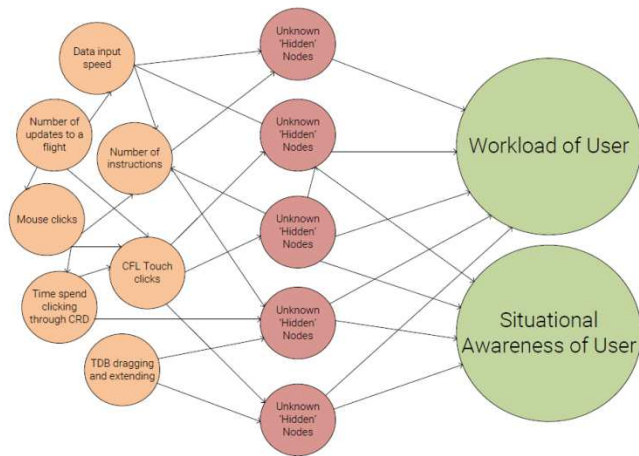
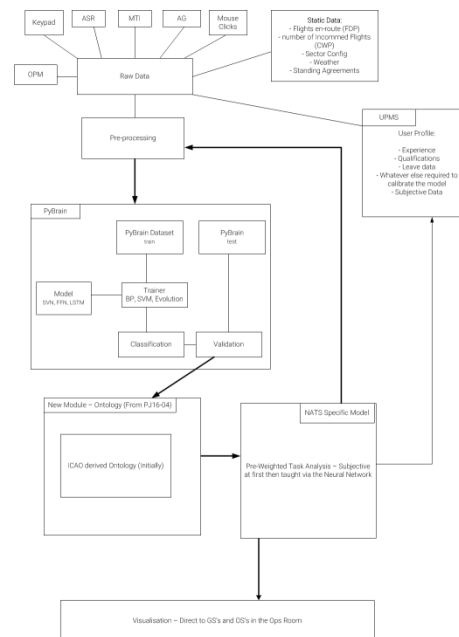


Figure 3 - Basic Neural Network of System data for HP Metrics

New approaches to designing future technologies with machine learning infrastructure built in... leading to smarter use of data for real time HP analysis



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FAB CE FRA Study

“Black forrest to the black sea”

Project Leader: Hungarocontrol

Project Partners: FAB CE ANSPs: ANS CR, Austrocontrol, BHANSA, Croatia Control, LPS, Slovenia Control and FABCE Ltd as an affiliated entity

Main AF: AF3 Flexible ASM and Free Route

Sept 2015 – Apr 2017

Project objective: Defining operational & technical pre-conditions for FAB CE FRA implementation



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FAB CE FRA Study

Main Project Deliverables

- CONOPS development
- Identification of technical requirements
- Validation (Fast Time & Real Time Simulations, Data analysis)
- Final report with recommendations



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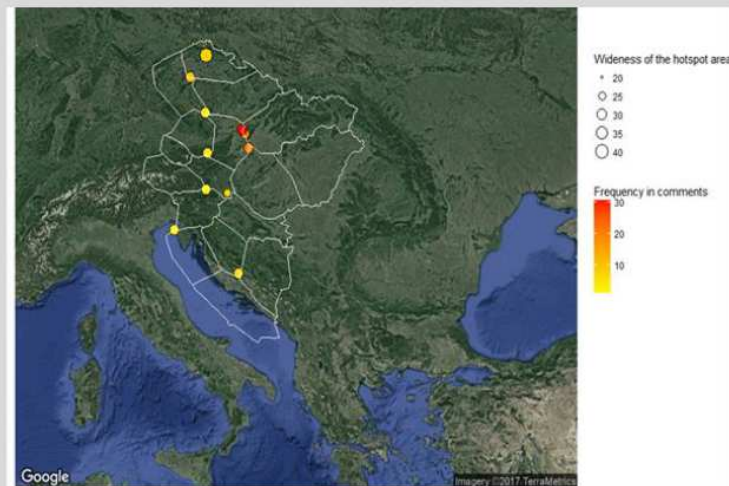
FAB CE FRA Study Results

CONOPS defined safety requirements, route network specifications (sectorization, airspace & network management), ATS procedures and contingency plan

Hot spots in FAB CE area were identified for future FAB CE FRA area and mitigation measures proposed

- ATM tools
- Restrictions and limitations on sector borders
- Alignment of airspace structure to new traffic flows

Guidance for necessary ATM system developments and upgrades



FAB CE FRA Study

Follow up

- Study results proved as important enablers for FRA implementation in FAB CE area
- Two initiatives successful in FAB CE
 - SECSI FRA
 - SEEN FRA
 - Both solutions already deployed even beyond FAB CE border
- Only one ANSP still to be integrated in FAB CE cross border FRA deployment



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FAB CE FRA Study

Completed

Date	FRA Implementation	Applicability	Vertical boundaries	Horizontal boundaries
Feb. 2015	HUFRA	H24/7	9500 MSL – FL660	HCL
Nov. 2016	SAXFRA	H24/7	GND – FL660	ACG, SCL
Dec. 2016	SEAFRA	H24/7	FL325 – FL660 -> FL205 – FL660	CCL, BHANSA, SMATSA
Mar. 2017	SEENFRA	23:00 - 05:00 (22:00 - 04:00)	Budapest CTA: 9500ft - FL660 Bucharest CTA: FL105 - FL660 Sofia CTA: FL245 - FL660	HCL, ROMATSA, BULATSA, LPS joined in DEC 2018
Feb. 2018	SECSI FRA	H24/7	GND/FL205 – Upper State Border/FL660	ACG, SCL, CCL, BHANSA, SMATSA



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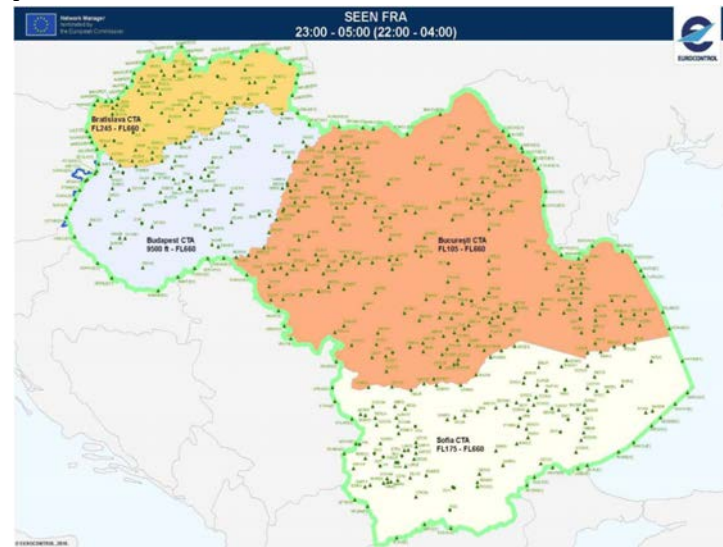
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FAB CE FRA Study

Completed



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