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Challenges of Future ATM Systems from a Regulators perspective

High Integrity Systems Symposium

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- Description of EU ATM environment today
- US vs. Europe comparison
- Role of various organizations in Europe
- SESAR projects planned
- Challenges of implementing future systems

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The US vs. Europe

- Joint study between EUROCONTROL Performance Review Commission (PRC) and the US Air Traffic Organization (operations arm of FAA)

- Studies are based on a set of comparable key performance indicators (KPI)
- Developed jointly and reviewed annually, creating a sound basis for factual comparisons between countries and world regions

- KPI's are used to compare, understand, and improve air traffic management performance.
- KPI data collected in all member states annually
- Planning for future KPI comparison with China in works

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The US vs. Europe

Calendar Year 2013	Europe[15]	USA[16]	US vs. Europe
Geographic Area (million km^2)	11.5	10.4	≈ -10%
Nr. of civil en route Air Navigation Service Providers	37	1	
Number of Air Traffic Controllers (ATCOs in Ops.)	17 200	13 400[17]	≈ -22%
Number of OJT/developmental ATCOs	1 000	1 740	≈ +74%
Total ATCOs in OPS plus OJT/developmental	18 200	15 140	≈ -17%
Total staff	58 000	35 500	≈ -39%
Controlled flights (IFR) (million)	9.6	15.1	≈ +57%
Flight hours controlled (million)	14.3	22.4	≈ +57%
Relative density (flight hours per km^2)	1.2	2.2	≈ x1.7
Share of flights to or from top 34 airports	67%	66%	
Share of General Aviation	3.9%	21%	
Average length of flight (within respective airspace)	551 NM	515 NM	≈ -7%
Number of en route centres	63	20	-43
Number of APP units (Europe) and terminal facilities (US)	260	163	-97
Number of airports with ATC services	425	516[18]	+91
Of which are slot controlled	> 90	4 [19]	
Source	EUROCONTROL	FAA/ATO	

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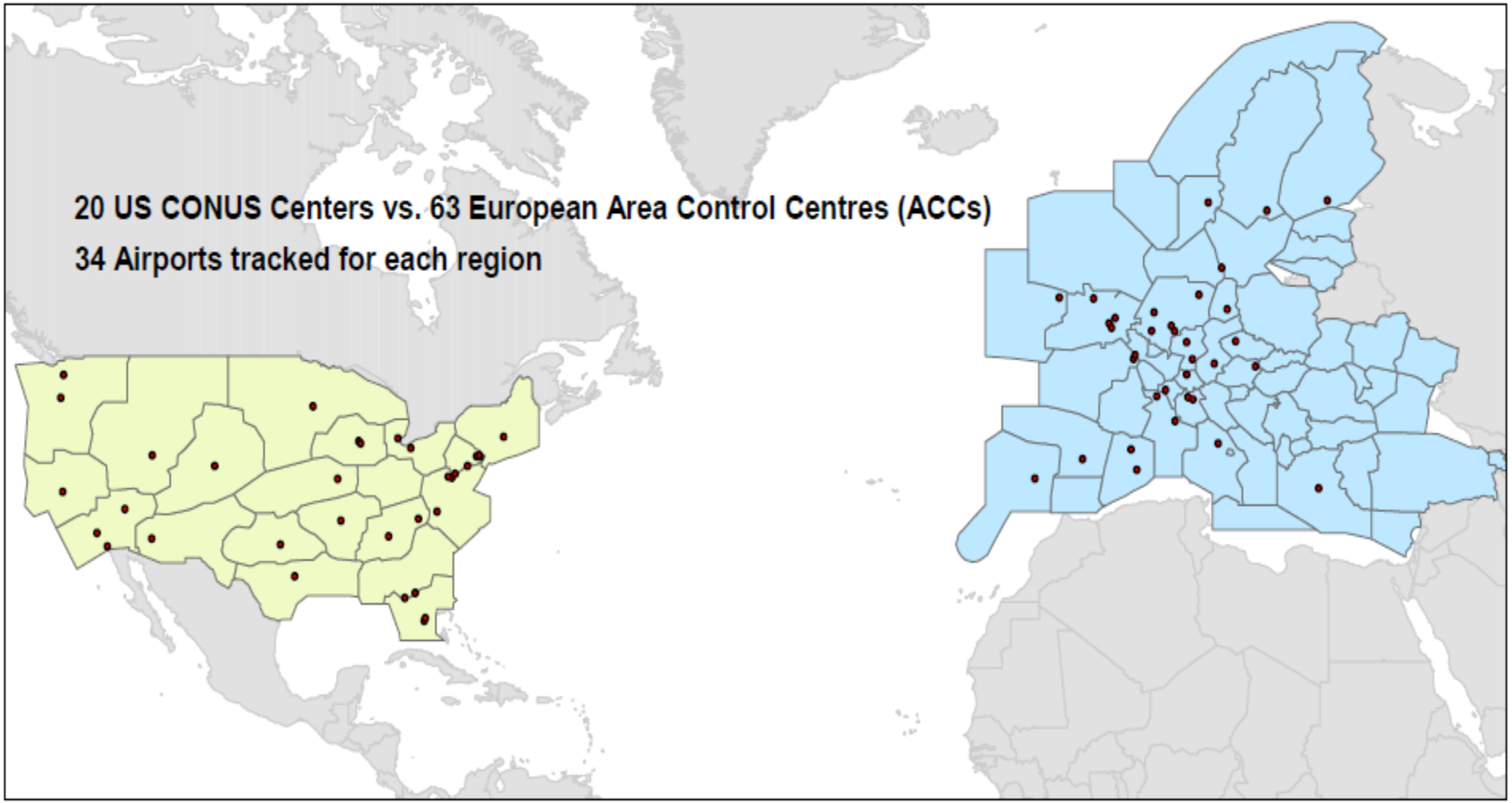
The US vs. Europe



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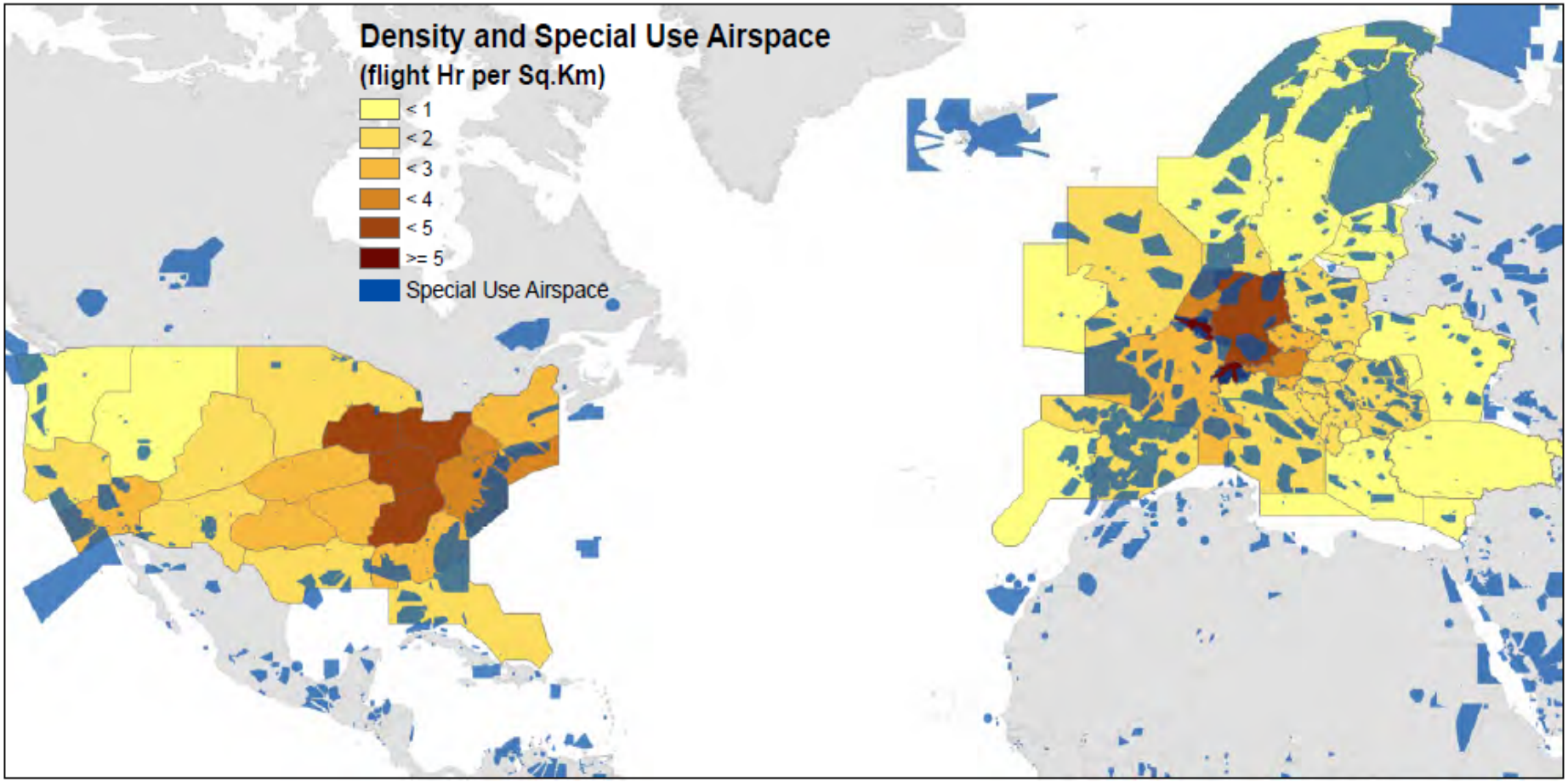

Figure 2.2: Comparison of Special Use Airspace (SUA)

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The need for change in Europe

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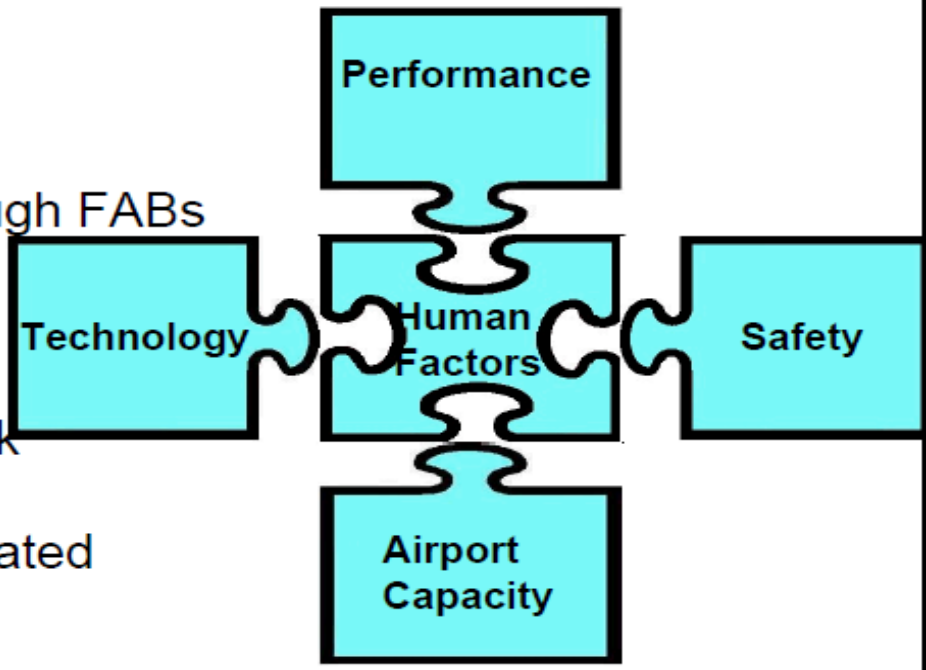
5 Pillars of SES

- Performance
  - Performance scheme
  - Network management function
  - Service provision integration through FABs
- Safety
  - EASA as centrepiece of the EU aviation safety system
  - Single safety regulatory framework
- Technology
  - Timely, synchronised and coordinated SESAR deployment
- Airport capacity
  - Airports seen as bottleneck
  - Better use of existing infrastructures
- Human Factors
  - Acknowledged as the overriding enabler of change



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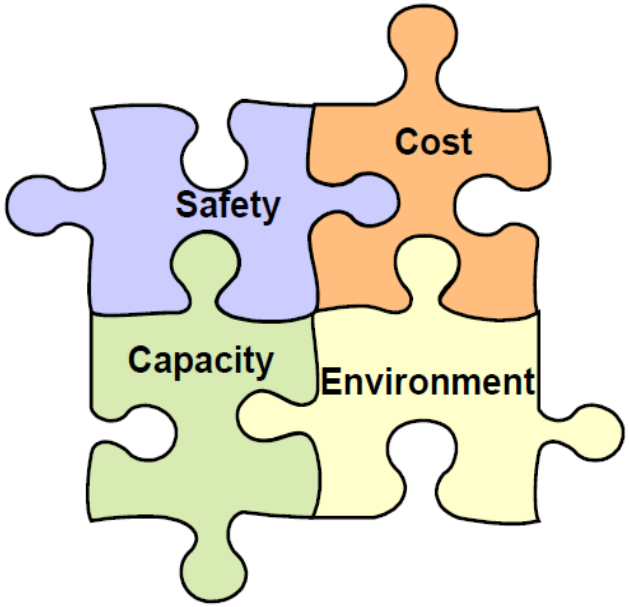
Performance

EUROCONTROL

Goals of SES



- Increase safety by factor 10
- Double capacity
- Reduce costs by 50%
- Reduce CO2 emissions by 10%
- By 2030

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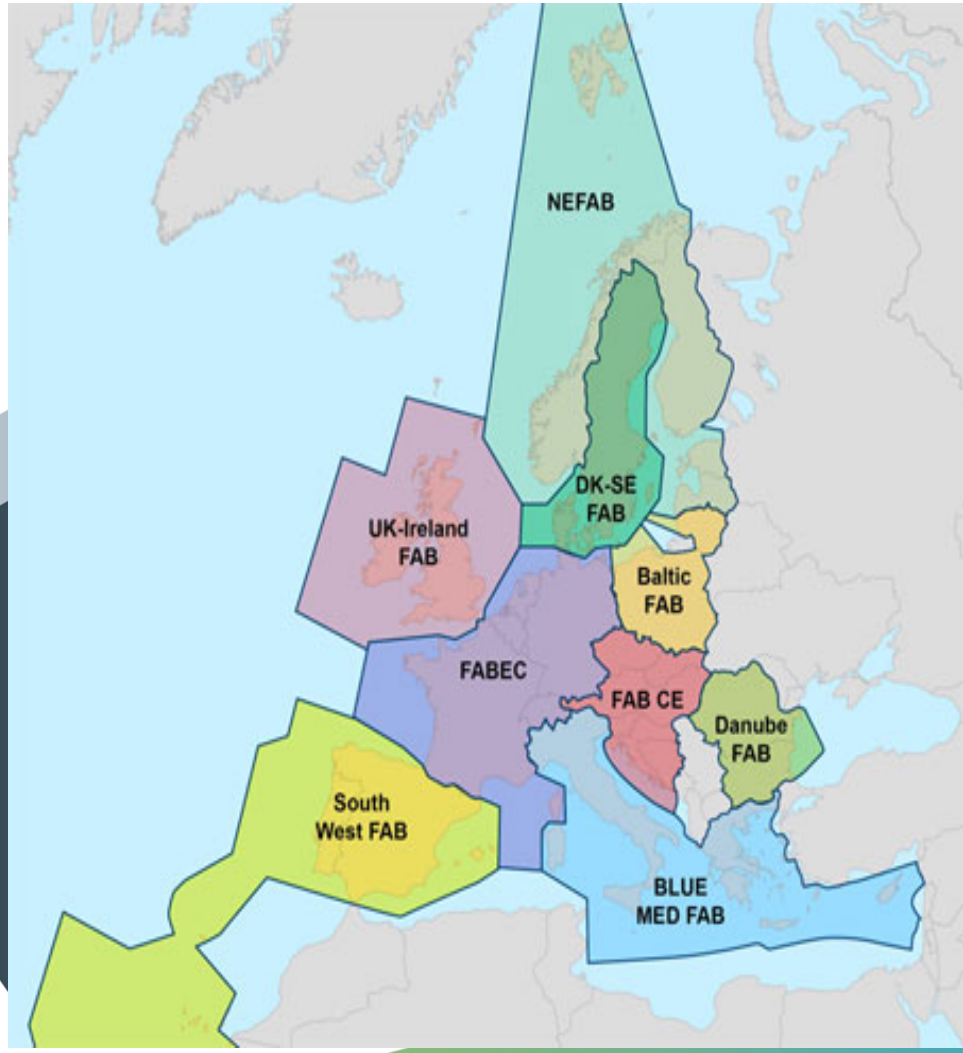
Functional Airspace Blocks

- Before -67 airspace blocks in Europe based on national boundaries
- 9 functional airspace blocks where the provision of air navigation services and related functions is performance-driven and optimized through enhanced cooperation among air navigation service providers
- Provision still mainly based on national boundaries



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Roles and Responsibilities

- **EC**-Legislative body governing/monitoring/enforcing SES
- **EASA**-Regulations/AMC/GM/Type Certification and Pan-European ANS Certification
- **EUROCONTROL**-Network Manager function
- **SESAR Joint Undertaking**-Development/testing/validation of new technology
- **Deployment Manager**-ensuring synchronized, timely deployment
- **Airspace users /Airports/ ANSPs**-invest and implement
- **Military-**Defense and airspace use/invest and implement

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CAA-Norway

- Norwegian NSA is the Flysikringseksjon (Air Navigation Services Department) in CAA-Norway

- **NSA**-approval of safety related changes, safety oversight, regulatory audits, interoperability, safety/security in ATM

- NSA Coordination Platform (NCP) SESAR Deployment WG-share and exchange best practices, discuss safety/security risks, direct link to the DM, EC, EASA and 14 NSA's (Co-Chaired by CAA-UK and DGAC)
- Local regulatory needs (EØS/EEA Agreement)
- Single Sky Committee

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SESAR Phases

EUROCONTROL

Definition phase 2006-2008

Managed by **EUROCONTROL**

Resulted in the **European ATM Master Plan**

Development phase 2008-2014

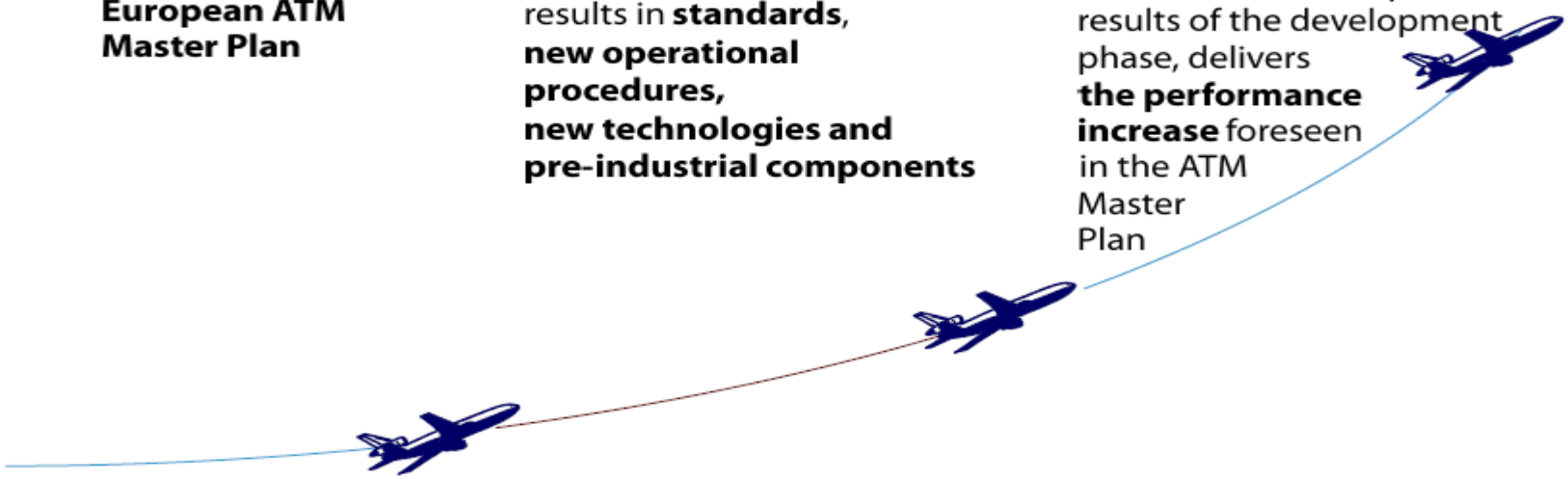
Managed by the **SESAR Joint Undertaking**

Based on the Master Plan, results in **standards, new operational procedures, new technologies and pre-industrial components**

Deployment phase 2014-2025

Managed by **Deployment Manager** nominated by EC in December 2014

Industrialise and implement the results of the development phase, delivers **the performance increase** foreseen in the ATM Master Plan



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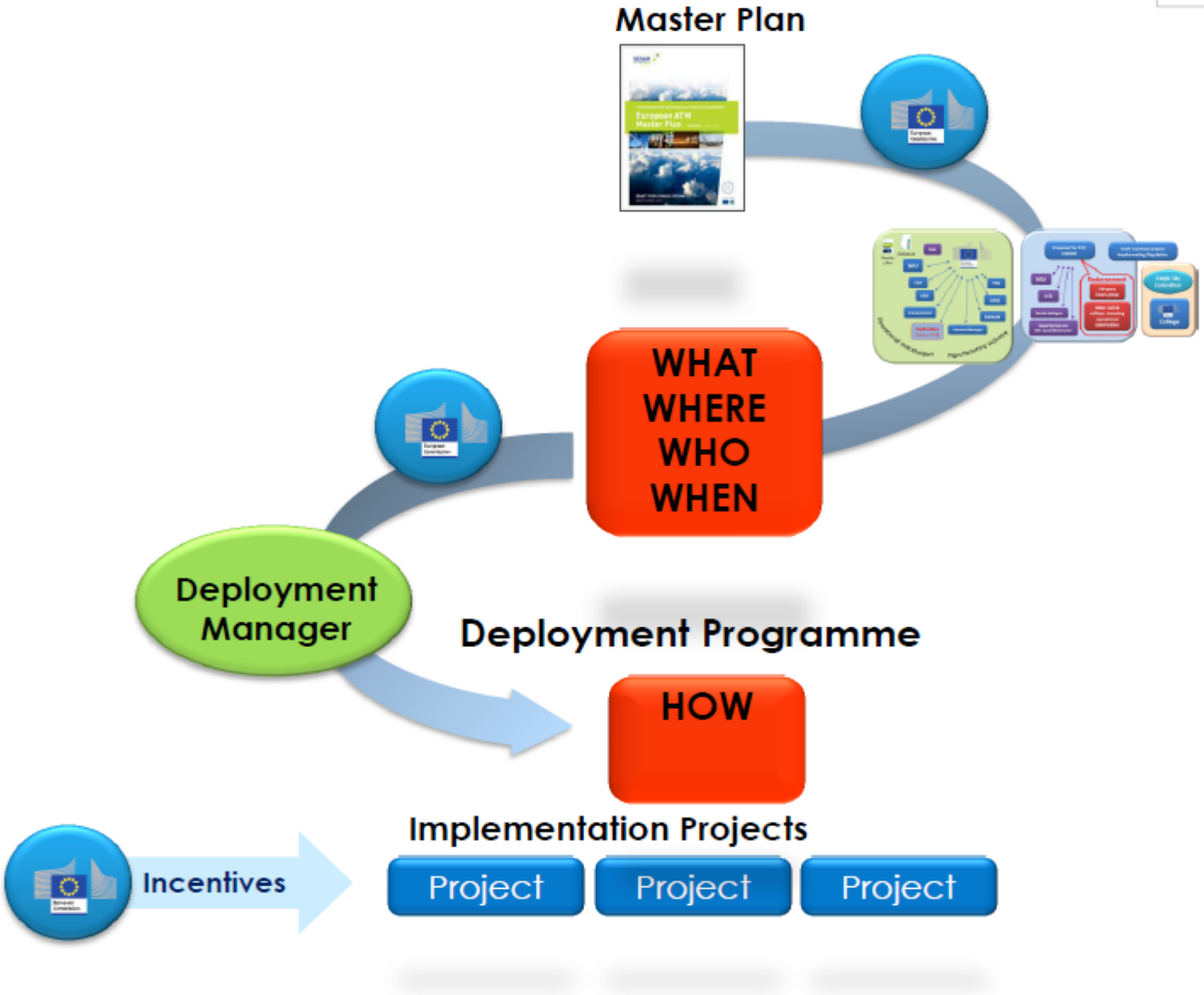

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6 ATM Functionalities

Key functional improvements addressing critical network performance deficiencies

1. Extended AMAN and PBN in high density TMAs
2. Airport Integration and Throughput Functionalities
3. Flexible Airspace Management and Free Route
4. Network Collaborative Management

Building the infrastructure of the future

5. iSWIM: ground-ground integration and aeronautical data management & sharing
6. Initial Trajectory Information Sharing: air-ground integration towards i4D

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Challenges

- Coordination between NSA-ANSP-Airspace Users-MIL-Manufacturing Industry, EC-EASA-EUROCONTROL
- Working groups/committees/task force
- Funding- For Norway 's investments related to PCP - calculated approximately 1.2 billion NOK
- Includes acquisitions , restructuring , development and training costs
- Avinor is in renewal phase of current ATM system. Implementation of the PCP obligations will be part of this project
- Implementation Risks – risk of delays, implementation/ synchronization challenges, Deployment Manager

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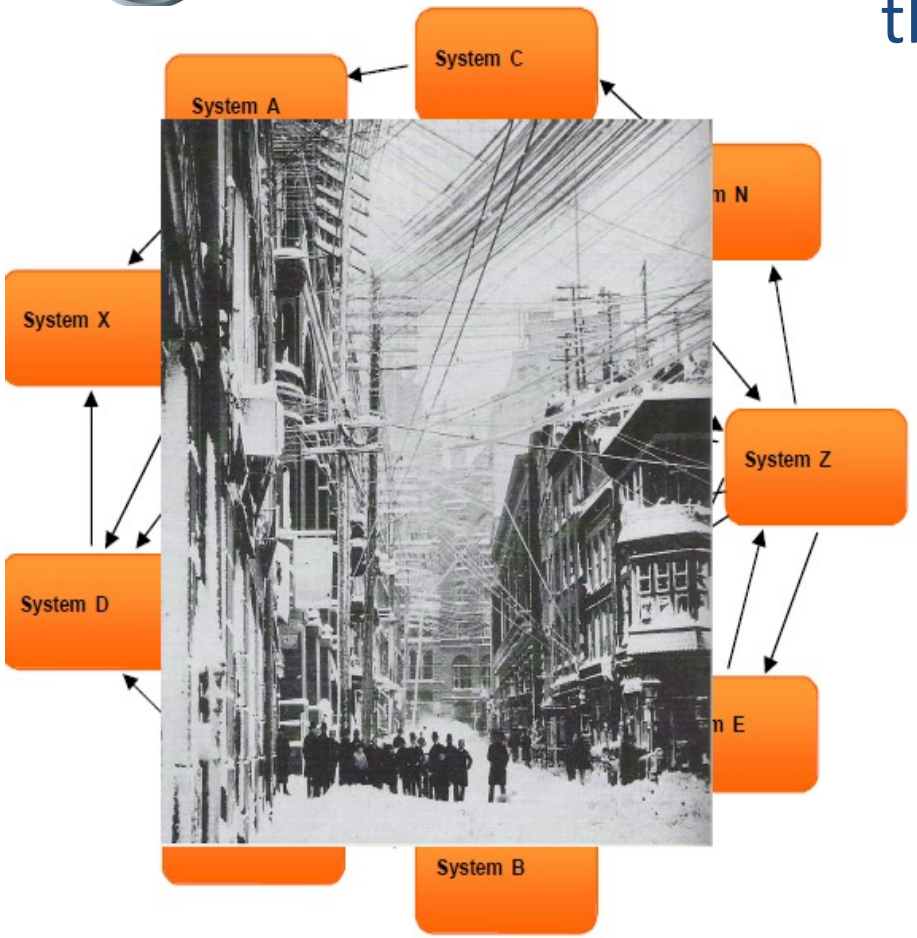
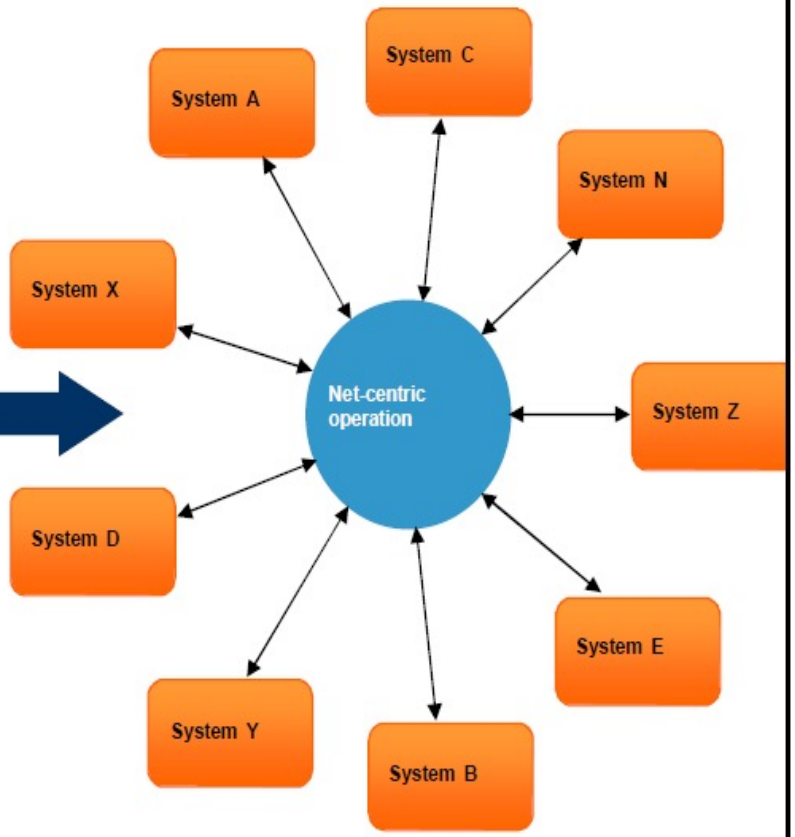
Out with the old – In with the new - SWIM





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Challenges of System Wide Information Management

- Safety and security are one (Sikkerhet and Sikkerhet)
- Cyber Security concerns in SWIM-IP based networks with countless interfaces/vulnerable to attacks
- Hacking of avionics/ATM systems (A/C Manufacturers-Cyber Sec. experts conflicting)
- Frequency jamming of aircraft or ATC
- Remote Virtual Towers (RVT)
- Remotely Piloted Aircrafts (RPAS)
- Drones

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Work in progress

- Lack of cyber-security regulations
- Lack of AMC/GM for ANSPs and NSAs
- EASA-Consultation with security experts
- Cyber Security Roadmap
- Planned to develop regulations/AMC and GM to help ANSPs, Manufacturers and NSAs

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Summary

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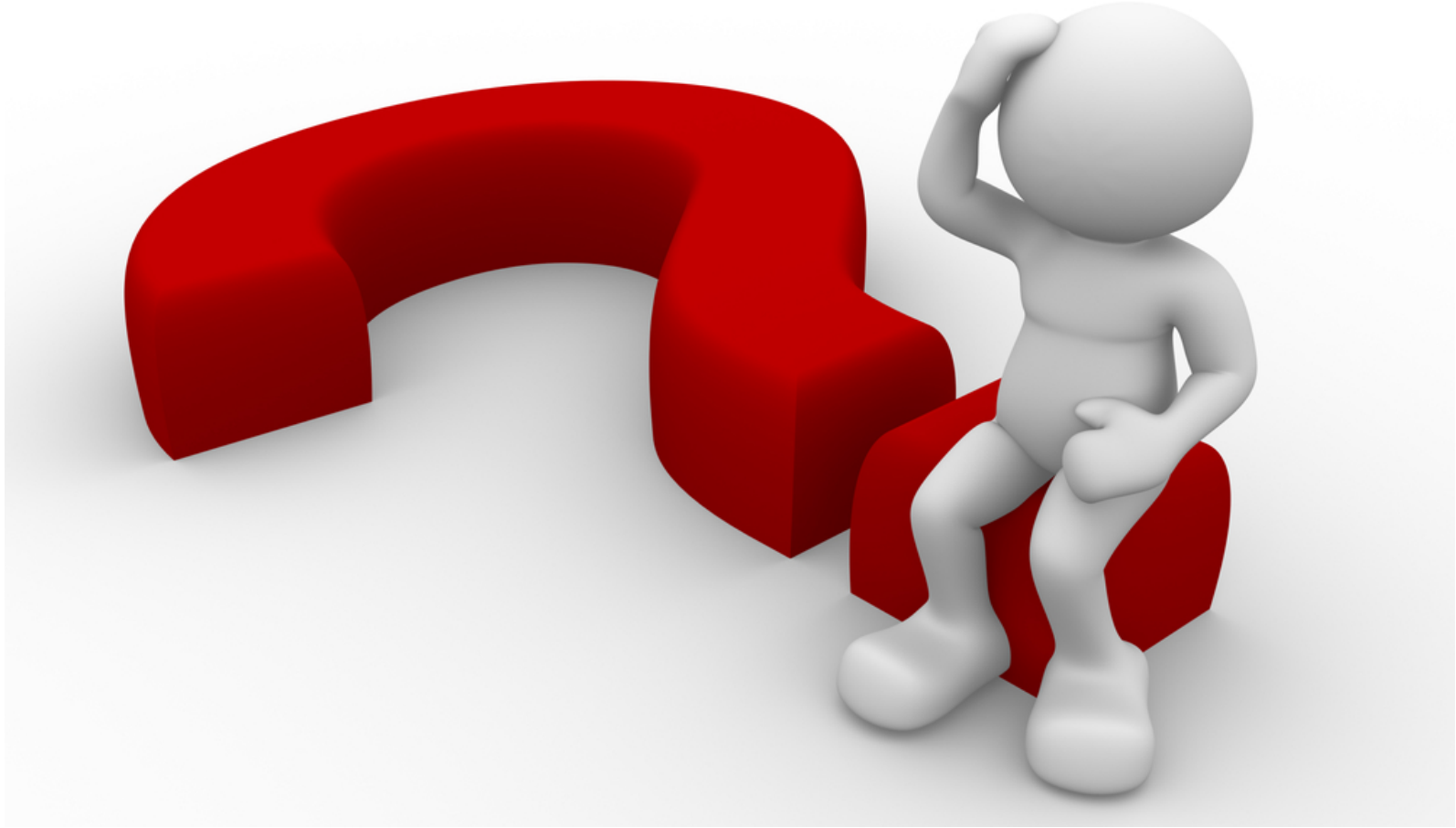

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