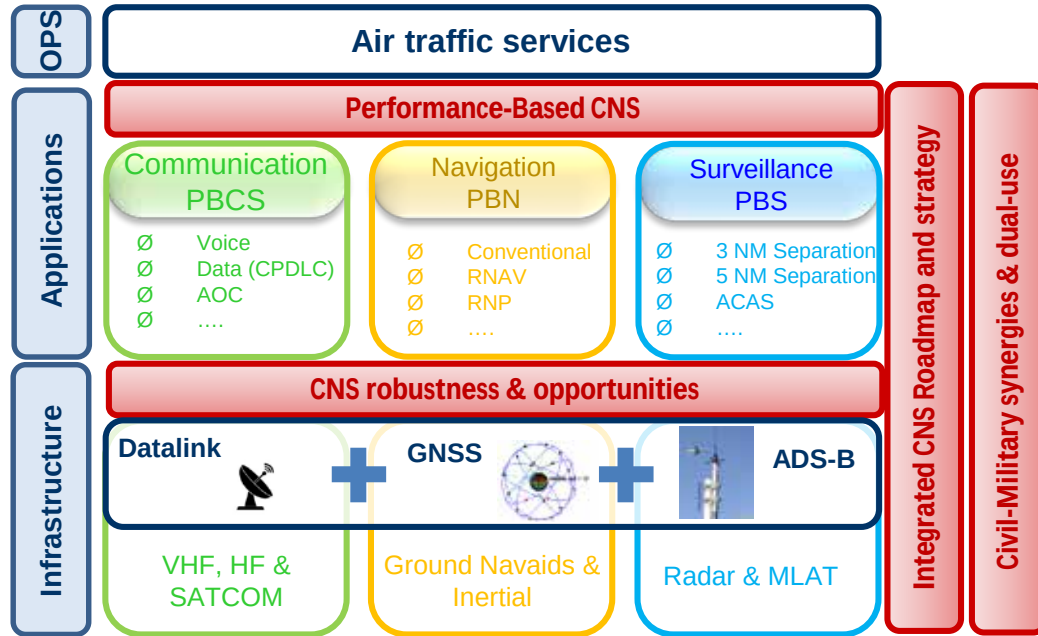


CNS evolution: roadmap & strategy

“A joint achievement between the EATM MP CNS update and
S2020 PJ14 EECNS”

iCNS concept & PJ14.01.01



PJ 14.01.01



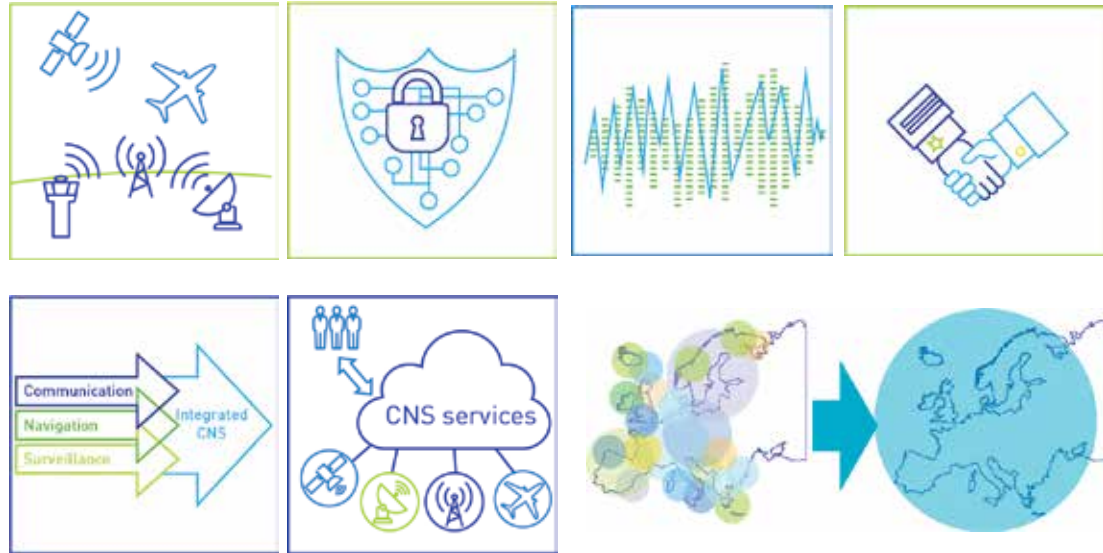
Main deliverables:

- Ø CNS Evolution Roadmap and Strategy
- Ø Performance-Based Integrated CNS
- Ø CNS robustness
- Ø Civil/Military information exchange requirements

CNS Roadmap & Strategy

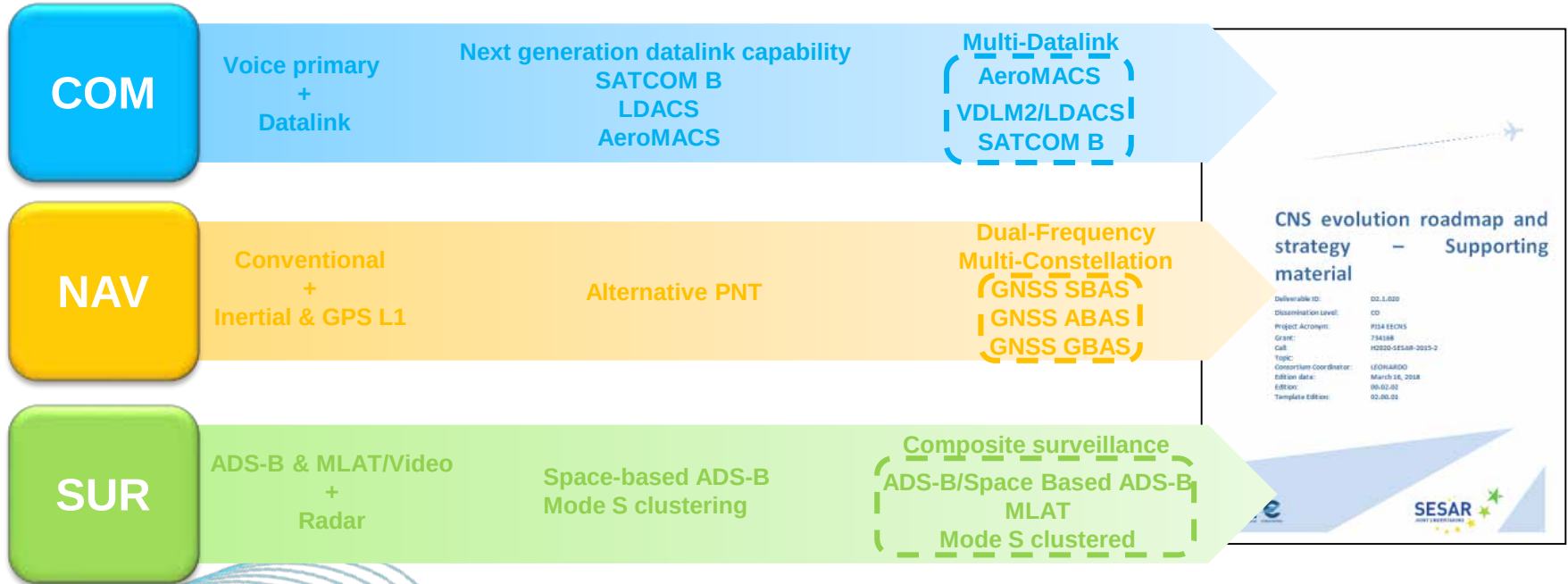
- Top-down approach coming from the SESAR Vision for CNS

- § Increase **digitalisation, connectivity** and **higher automation** levels
- § Implement a **safe, secure and resilient infrastructure**
- § Move from physical assets management to **CNS services**
- § Develop **performance-based** and **integrated CNS concepts**
- § **Combine satellite-based airborne and ground-based CNS**
- § **Rationalize** infrastructure
- § Increase **civil-military synergies** and **dual-use**
- § Ensure an **efficient** and long-term availability of suitable **spectrum**



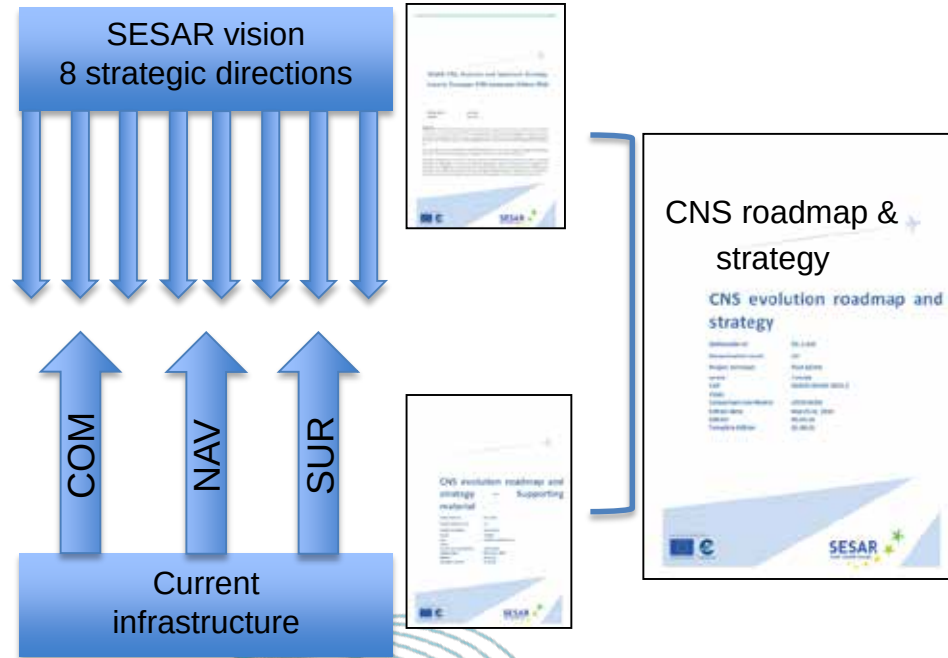
CNS Roadmap & Strategy

- Bottom-up approach from current implementation



CNS Roadmap & Strategy

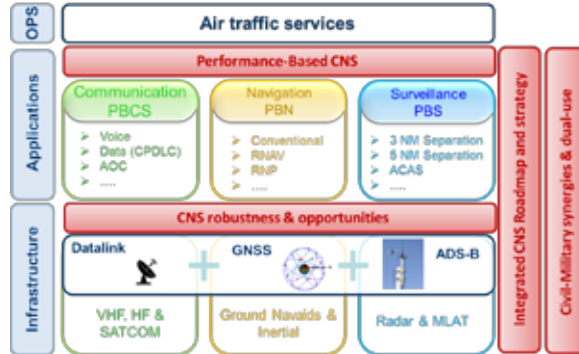
- Combining top-down & bottom-up approach



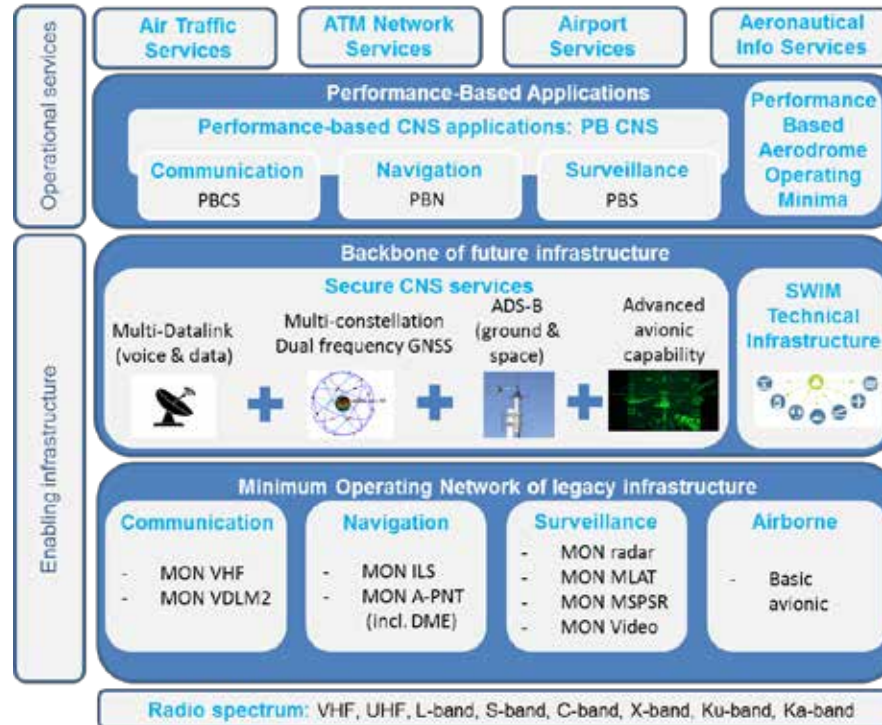
CNS Roadmap development led to:

1. Stress the need for an **integrated CNS Concept**
2. Generalization of the **Minimum Operational Network** concept
3. Definition of the **CNS target architecture**
4. Development of a **transition path**
5. Identification of the CNS **rationalisation opportunities**

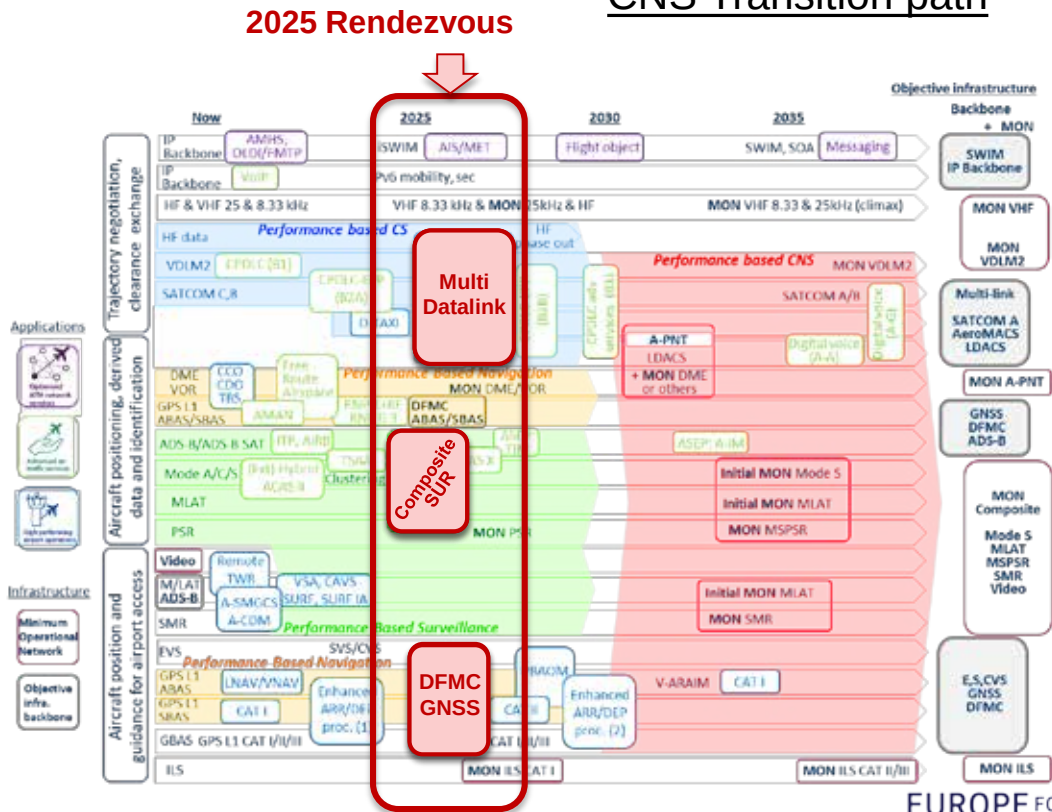
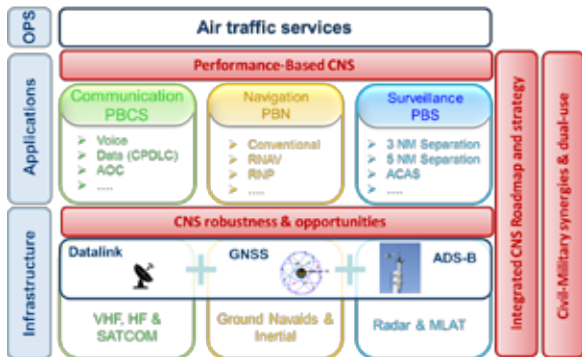
CNS Roadmap & Strategy



CNS Target architecture

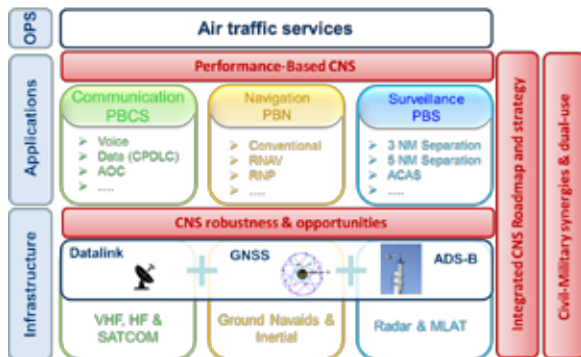


CNS Roadmap & Strategy

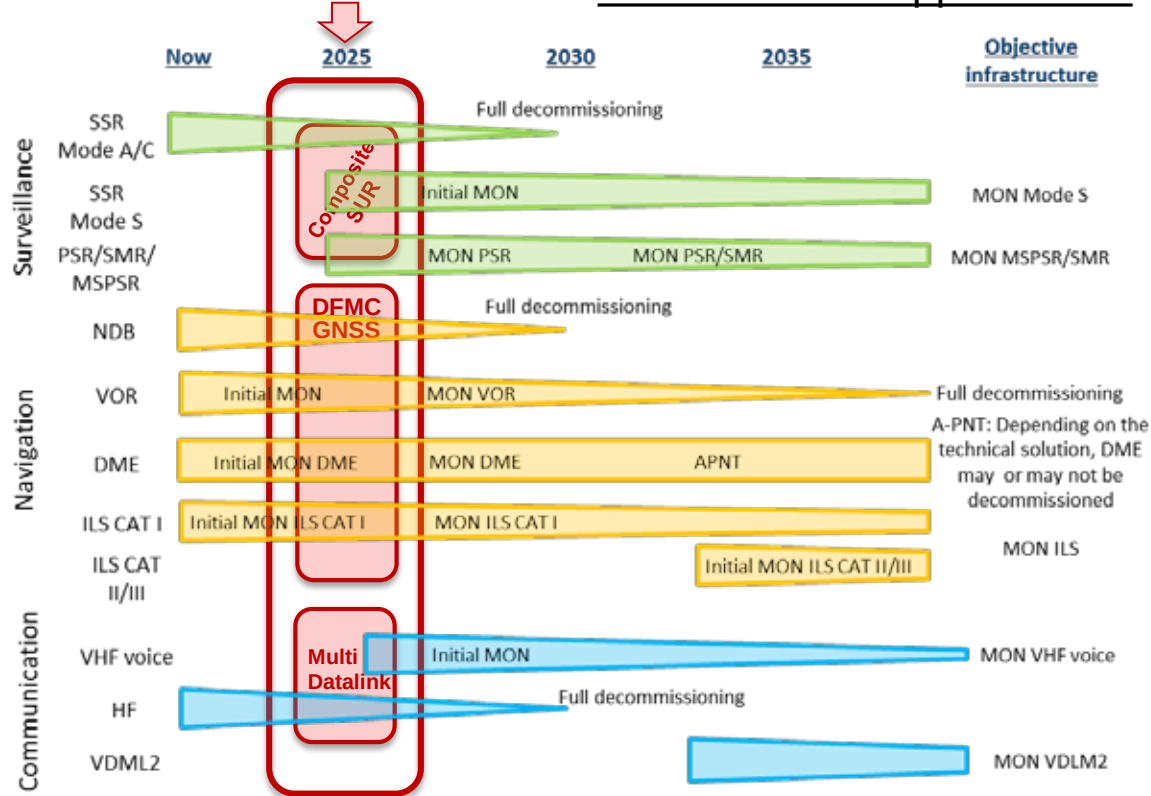


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CNS Roadmap & Strategy



2025 Rendezvous



Way forward

- **Toward a combined CNS Service-based approach and Performance-Based Approach**
 - Service oriented approach will be the focus of the future Integrated CNS solution in SESAR W2
 - Performance-Based is supported at ICAO level following ANC13
- **2025 rendezvous & key questions for a future implementation:**
 - Clarify Service-based (e.g. Governance allowing for a streamlined decision making while giving a seat to all stakeholders, ensure long term availability, service fee control, ...)
 - Which business models?

CNS update in the EATM Master Plan

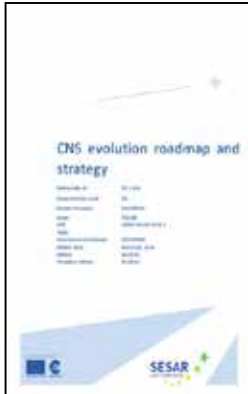
“Future aviation infrastructure supporting the defragmentation of the European Sky”

CNS Roadmap & Strategy within Master Plan

Strategy for
Future CNS
Evolution

Combining Top-Down &
Bottom-Up

CNS
Roadmap &
Strategy



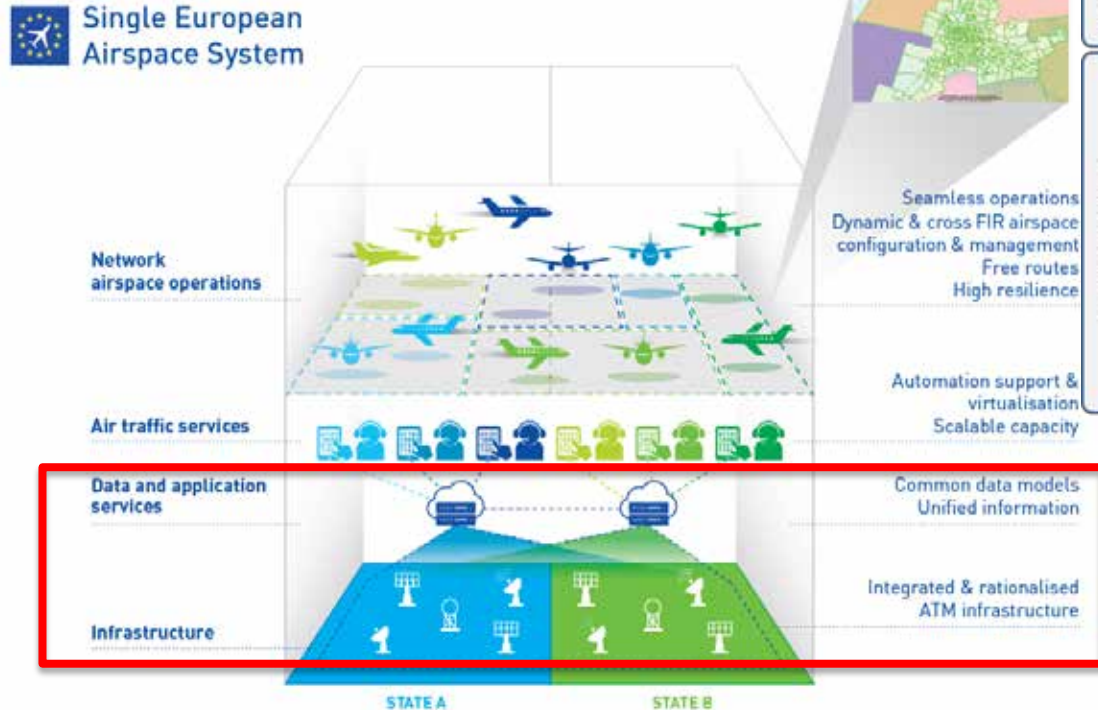
CNS
Solutions



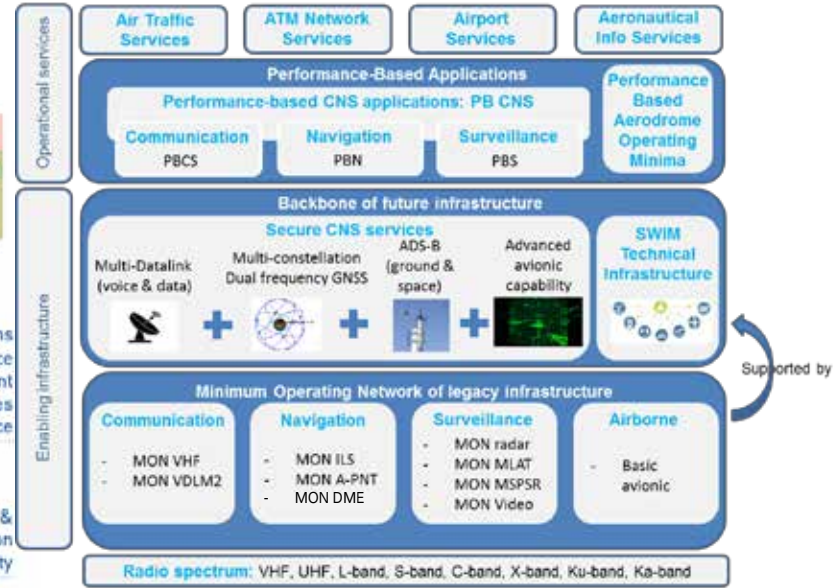
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Target Architecture

Airspace Architecture - Study



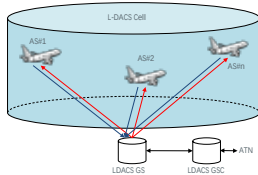
CNS Architecture – SESAR PJ14



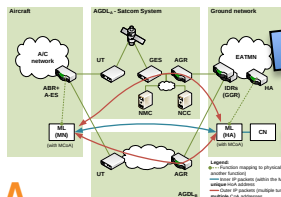
Future Communication Infrastructure

Multi Link Management

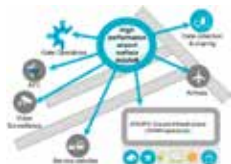
Future Terrestrial LDACS



Future Satellite SATCOM
Class B + A



AeroMACS
ATN/IPS
ATN/OSI + Multilink



GA TIS-B/FIS-B



TRL4



CNS Environment Evolution

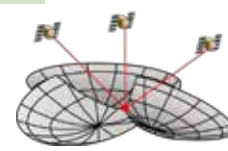
**Wave 1
Data Packs
towards
Wave 2
Call**

Future Navigation Infrastructure

GBAS



MC/MF
GNSS



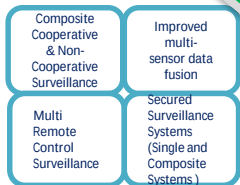
A-PNT



Surveillance
Performance
Monitoring



Evolution of Coop. and
Non-Coop. Surveillance



Future Surveillance Infrastructure

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Way forward

- **Combined CNS Service-based approach and Performance-based approach**
 - Service oriented approach will be the focus of the future Integrated CNS solution in SESAR W2
 - Performance-Based is supported at ICAO level following ANC13
- **CNS Strategy – Key Evolutions within EATM Master Plan**
 - Moving focus from **physical** assets to delivery of **services**
 - Increase **digitalisation**, **connectivity** and **higher automation** levels
 - **Combine satellite-based airborne and ground-based CNS**
 - Implement a **safe, secure and resilient infrastructure**
 - Ensure an **efficient** use and long-term availability of suitable **spectrum**
 - Increase **civil-military synergies, dual-use and stakeholders cross-fertilisation**
 - **Rationalise Infrastructure**

EUROCONTROL CNS SYMPOSIUM OUTCOME

“A compelling evidence of ATM stakeholders’ high expectations on CNS evolution”

EUROCONTROL CNS Symposium 02/03 Oct. 2018

A TWO-FOLD SYMPOSIUM STRUCTURE

PREPARED BY A “FOOD FOR THOUGHT PAPER” SENT TO ALL PARTICIPANTS IN ADVANCE...

1st DAY KEY NOTE + PLENARY SESSIONS

Introduction

Key Note Speech : DECMA Director

A global CNS vision for all attendees

- Institutional
- ANSP
- Airspace users
- Industry
- CNS Service Providers

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2nd DAY BRAINSTORMING SESSIONS + CONCLUSIONS

5 brainstorming co-animated sessions

- CNS rationalisation & modernisation : which enablers and framework to succeed ?
- Technologies convergence opportunities (drones, GA, military, commercial)
- Future datalink for aviation: which technologies ?
- What to expect from performance-based CNS services ,
- CNS long term evolution: is there a need for new CNS systems post 2040 ?

Conclusions

- Brainstorming conclusions
- Symposium conclusion, recommendations and way forward

EUROCONTROL CNS Symposium 02/03 Oct. 2018

A HUGE AND DIVERSE PARTICIPATION : A SUCCESS MARKER !



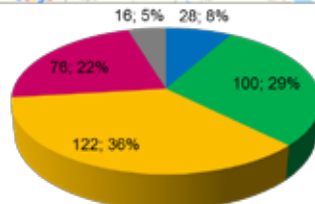
Industry

Institutions

ANSPs, CAA, Ministry of Transportation, MIL

Airlines, Airspace Users

University, Research Facility, Training Centre



348 registered participants



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SPECIFIC BRAINSTORMING SESSIONS CONCLUSIONS

- ñ Unanimous agreement on CNS architecture developed within SESAR2020 PJ14
- ñ Moving toward CNS services implies to take a consideration multiple aspects (cost benefit, charging principle, standardisation, safety, certification, security, operations,...)
- ñ Drones and cyber-security should be integrated in the CNS/ATM evolution
- ñ Spectrum needs to be protected
- ñ CNS/ATM framework needs to include the performance requirements, performance monitoring, service integration & quality of service
- ñ Institutions to generate stakeholders' "trust in change": confidence on the roadmap implementation is needed for investment plans

SYMPOSIUM UNANIMOUS MESSAGES FROM PARTICIPANTS

- ñ Strong leadership and a program management approach is required with proper governance
- ñ Communication and coordination with ALL ATM stakeholders is key and required
- ñ Generate trust: confidence on the roadmap implementation is needed for investment plans
- ñ Costs need to be compensated with benefits. Route charges need to evolve in order to:
 - ñ better distribute the benefit from CNS evolution
 - ñ better reflect what is being used by Airspace Users

SYMPOSIUM GLOBAL CONCLUSIONS AND WAY FORWARD

- ñ Technical solutions are there and mature
- ñ New business models exist (e.g. Performance-based Surveillance as a service)

BUT :

- ñ Too many solutions to specify an affordable and implementable CNS avionics roadmap for all AUs
- ñ A too complex institutional framework

WE NEED :

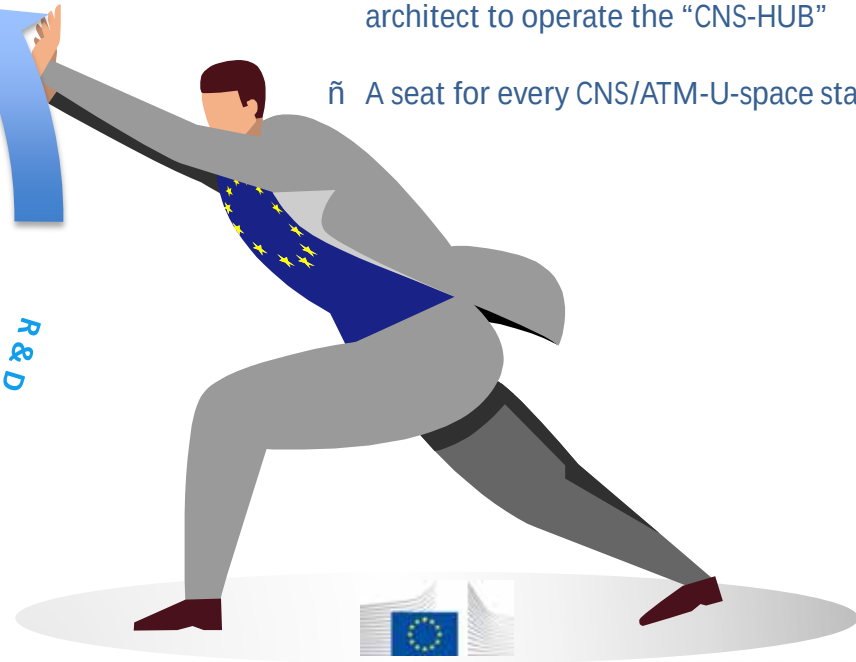
- ñ a strong leadership to decide
- ñ a coordinated and harmonised programme management approach bringing together research & development, standardisation, regulation and deployment with an ad-hoc governance, ensuring a seat to all stakeholders
- ñ a simplified/coordinated institutional framework

DOING NOTHING IS NOT AN OPTION !

OUR DUTY IS TO MAKE IT HAPPEN !

NEXT STEPS FOR CNS FUTURE ?

- ñ A top-down policy
- ñ A joint and collaborative leadership and framework
- ñ A neutral and international organisation as architect to operate the “CNS-HUB”
- ñ A seat for every CNS/ATM-U-space stakeholder



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Integrated CNS, Roadmap & Strategy

Aviation Spectrum

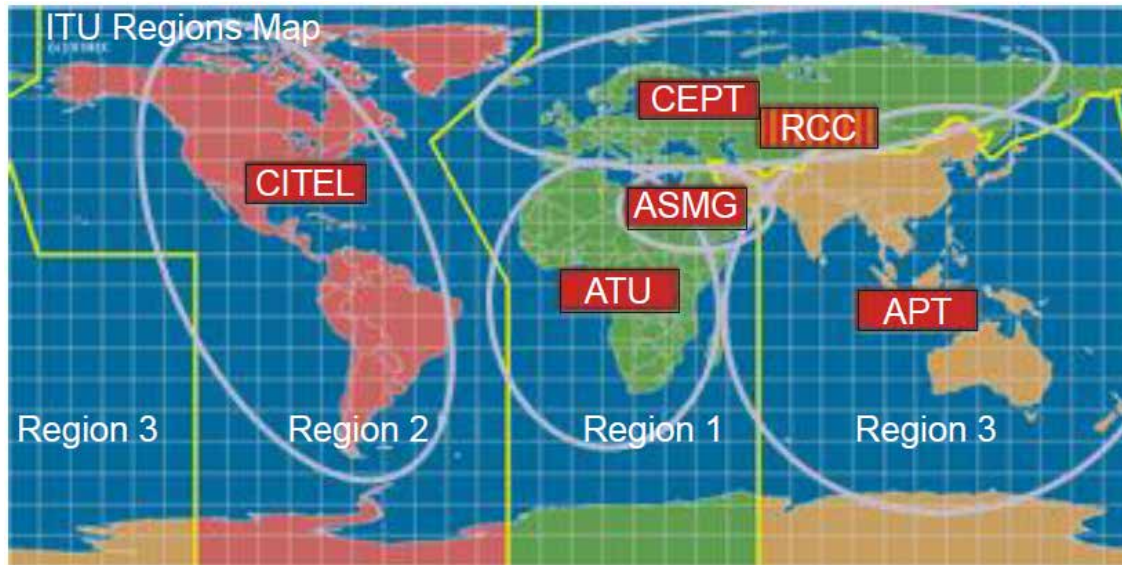
Jacky Pouzet
Head of ATM Communication and Frequency Coordination Unit

Aviation Spectrum

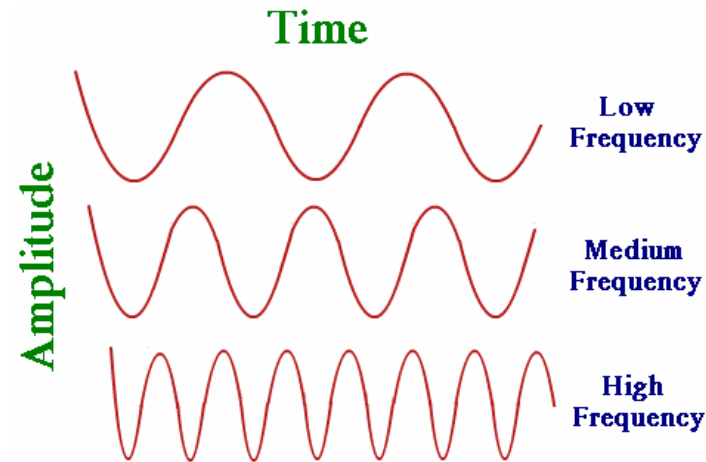


§ SPECTRUM is a key scarce (CNS) resource for Aviation (**Value > 1000B€**)

§ Global Spectrum: Managed by International Telecommunication Union (UN)



Approximate coverage of ITU Regions
by regional telecommunication organizations



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Nature of the bands (cf. ICAO Doc 9718)

AM(R)S: Aeronautical mobile (route) service

AMS(R)S: Aeronautical mobile-satellite (route) service

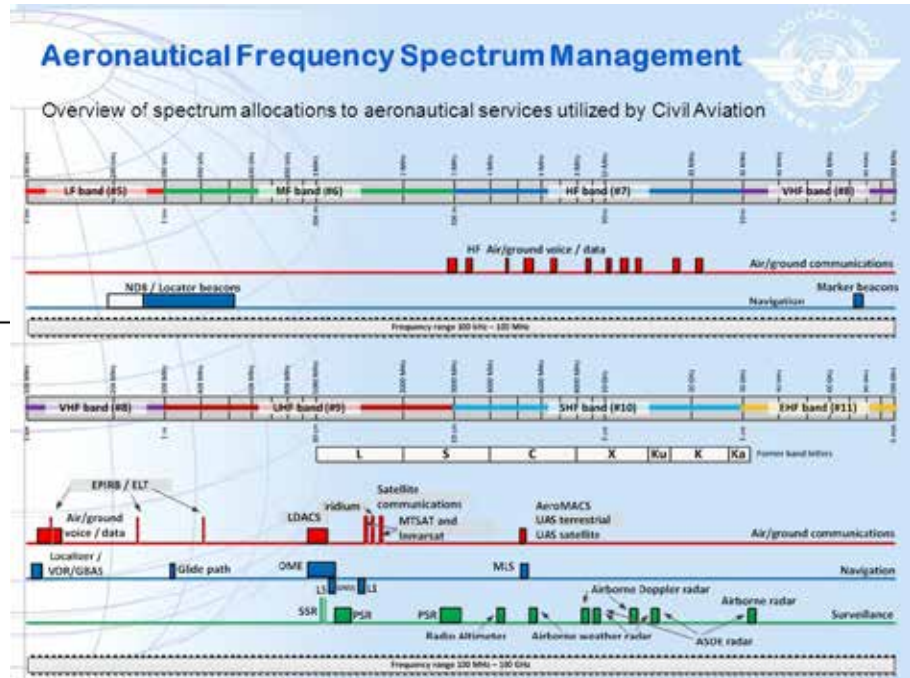
ARNS: Aeronautical radionavigation service

MSS: Mobile-satellite service

RLS: Radiolocation service

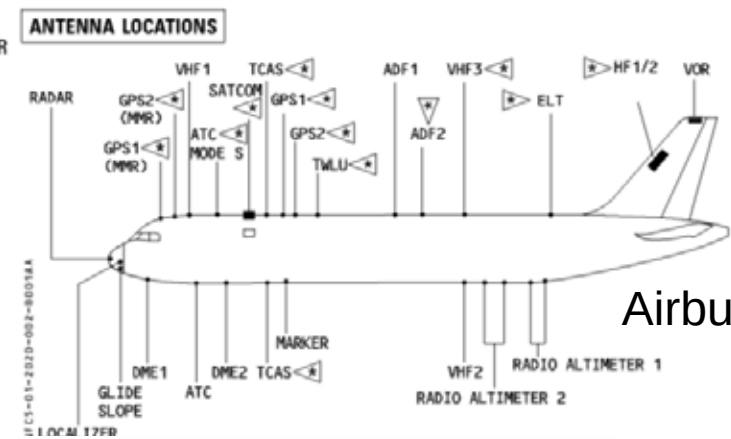
RNS: Radionavigation service

RNSS: Radionavigation-satellite service



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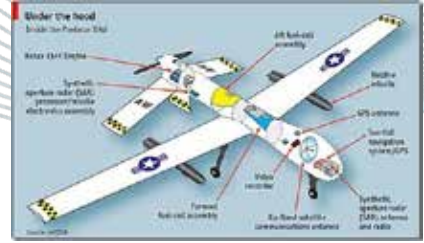
We need bigger aircraft ...to fit all the aeronautical antennas...



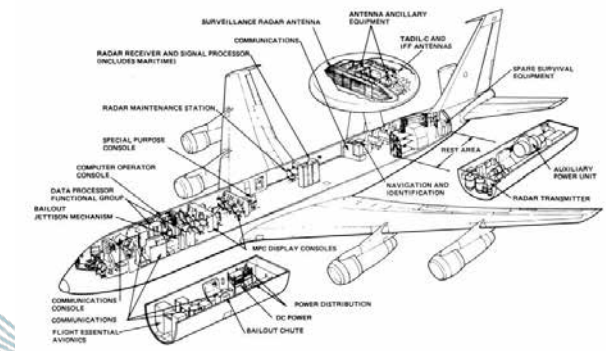
Airbus 320



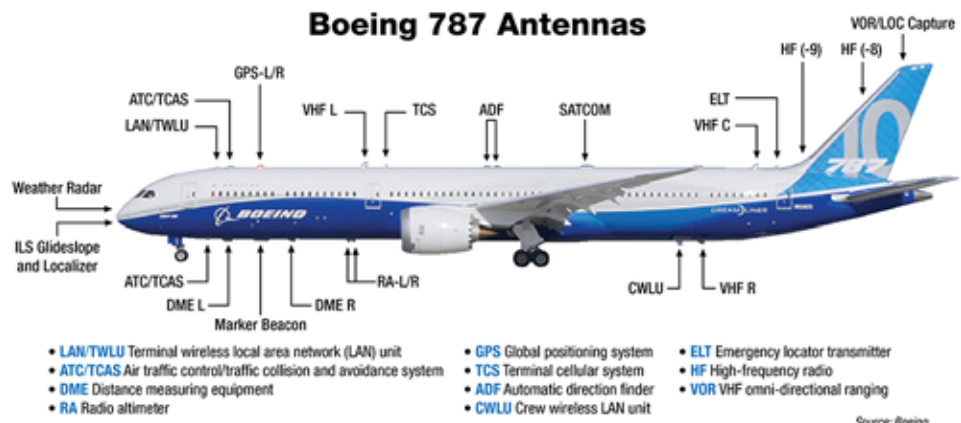
Fighters



And aviation spectrum is ... congested



AWACS



On the ground and in space....

ILS



Radar



VOR



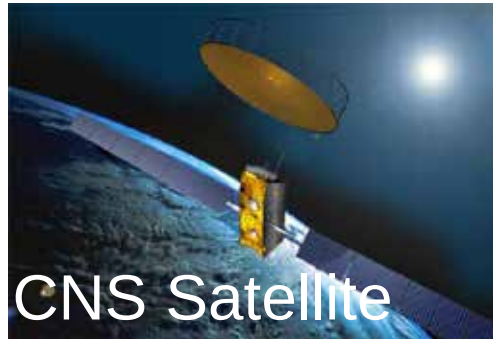
VHF



VOR/DME



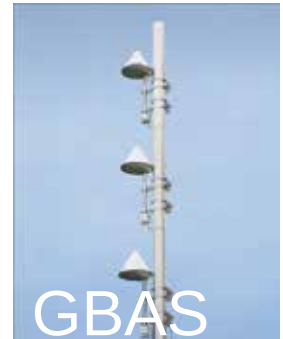
CNS Satellite



MIL systems



GBAS



Aviation Spectrum is congested



VHF



NAV AID

- Ø Ongoing action: The Radio Frequency Function is coordinating the frequencies in Europe (in conjunction with ICAO)
- Ø VHF COM congestion will be solved by the 8.33 implementation.
- Ø **However**
 - Ø More spectrum is required: traffic increase, new services and new airspace users (Drones etc...)
 - Ø Aviation needs to develop/implement more spectrum efficient technologies.

EUROCONTROL view on SPECTRUM

- **Support ICAO position** for the next ITU/World Radio Conference (Nov. 2019)
 - In the short/medium term, aviation spectrum **shall remain protected**.
 - Aviation will not require more spectrum for new services.
- **Sharing spectrum within aviation bands** for new needs (cf. RPAS for instance).
 - Benefit should be obtained from the **CNS infrastructure rationalisation**
 - to propose/decide on an European CNS rationalisation roadmap
- **Advise SESAR to:**
 - Deploy ICAO standardised technology/services in the short term to reduce the congestion **and make the CNS infrastructure improving the network performance**.
 - Provide a clear path for the **CNS technology** evolution (cf. Roadmap).
 - **Study the Perf. Based model** without committing on implementation at that stage.
- In the long term, some of the aviation bands may be share with other aviation partners (RPAS operator, CSP etc...)
- Spectrum is requiring strong civil-military coordination.



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Civil-Military CNS Interoperability

optimising equipage and rationalising infrastructure at reduced cost

Michael Steinfurth

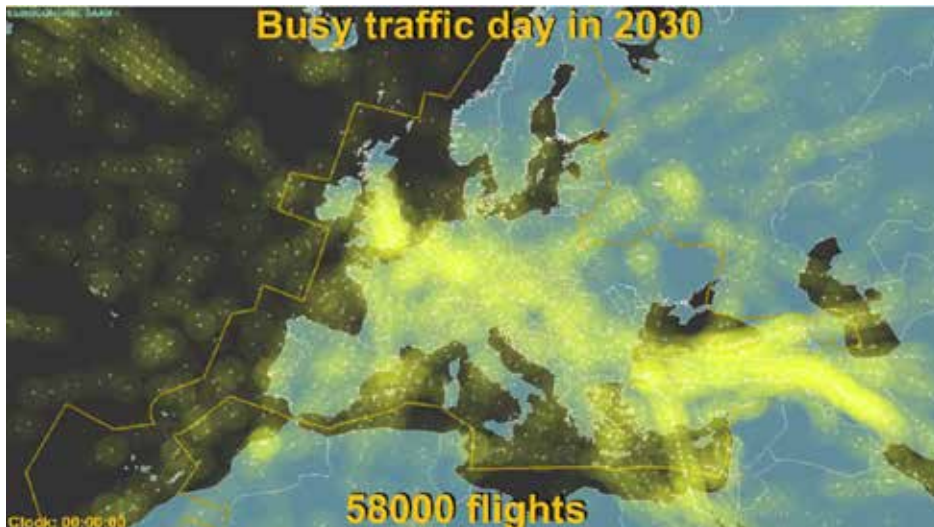
Head of Civil-Military ATM Coordination Division, EUROCONTROL

The Challenge



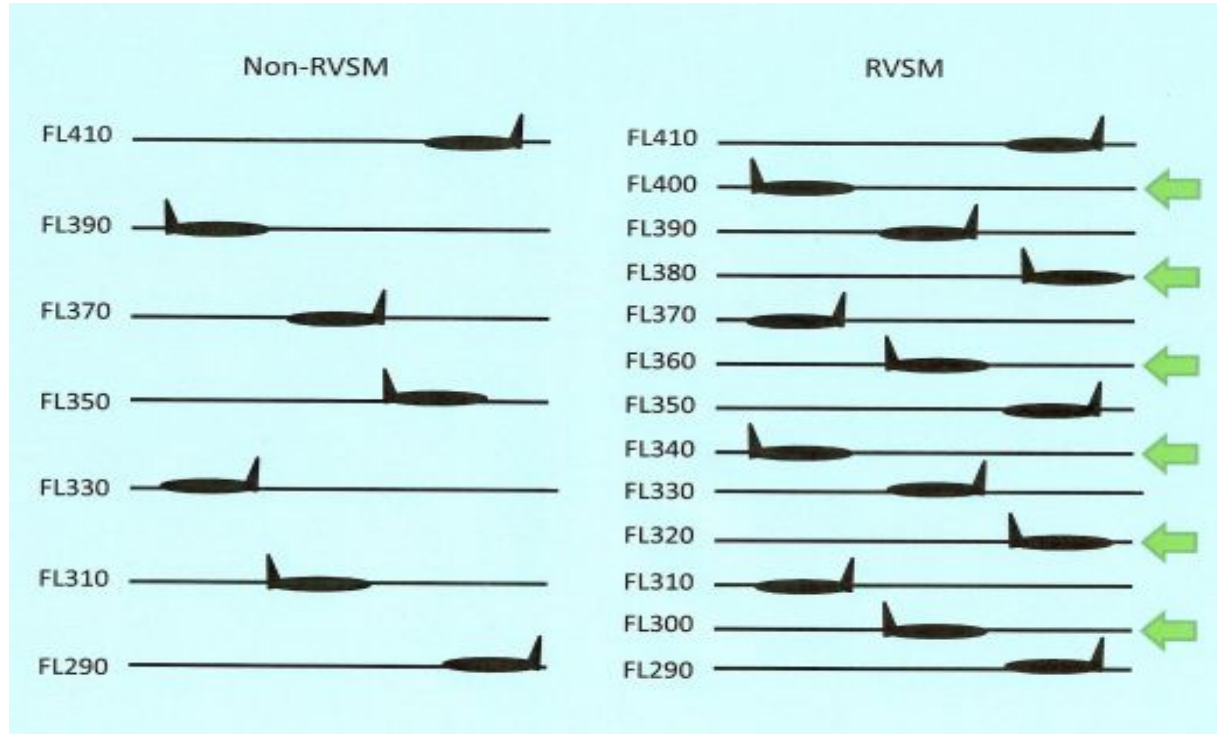
- Increase Capacity, Safety and Efficiency at reduced Cost with less Environmental Impact
- While accommodating changing military operational Aviation Requirements

The CNS Contribution Options

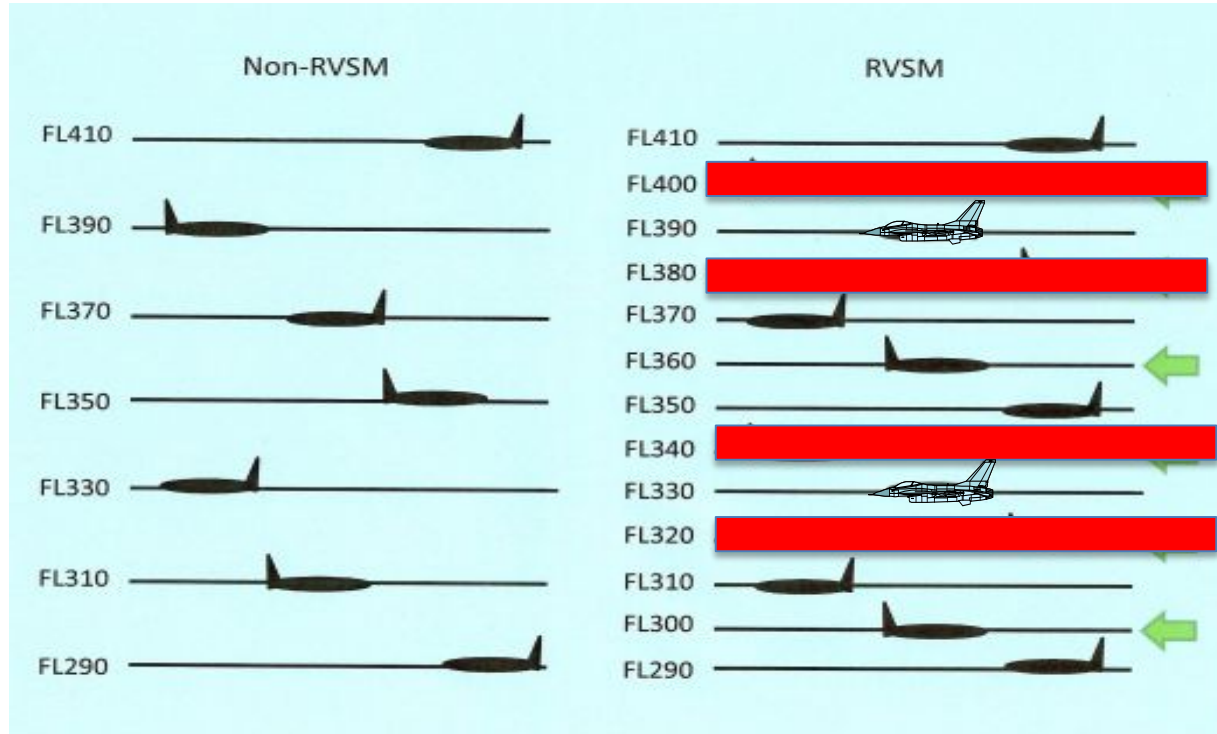


- Enhanced Technology providing required Levels of Performance
- With sufficient civil-military Interoperability, providing similar Performance for both

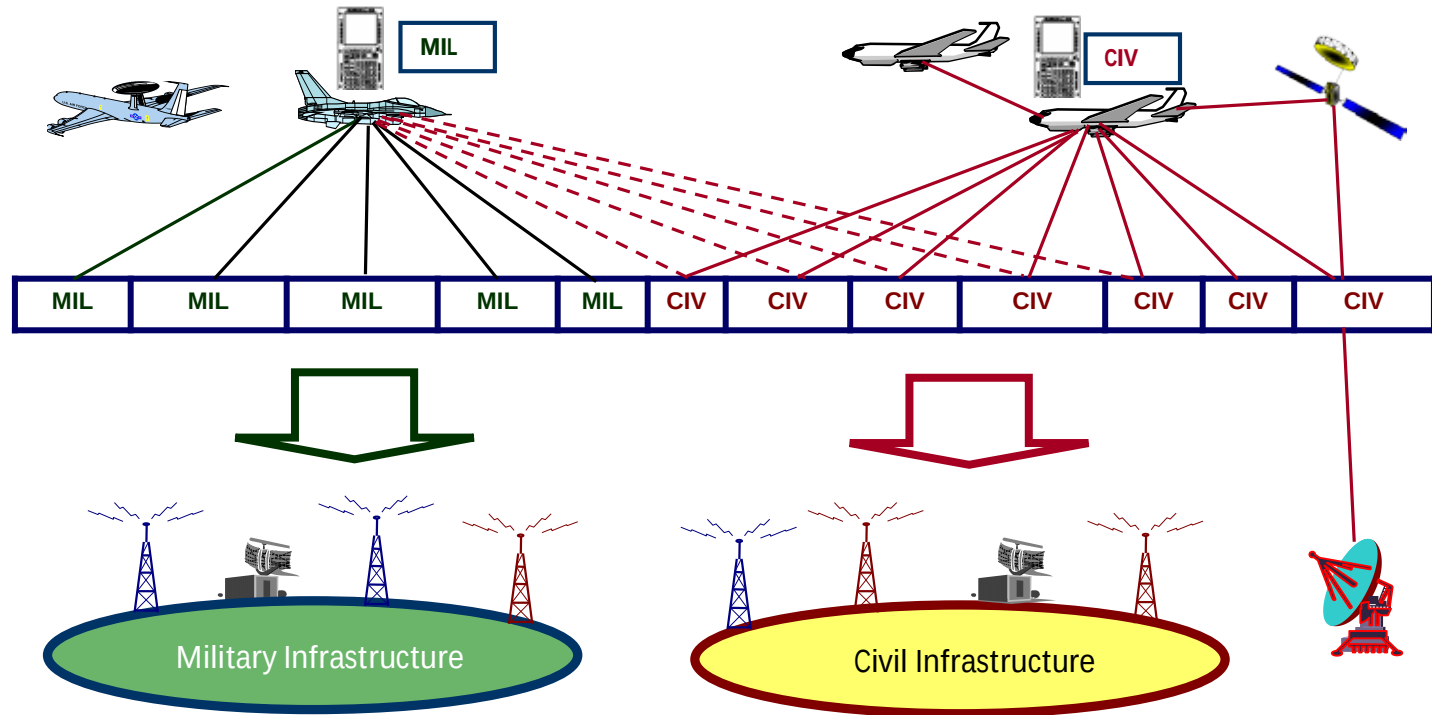
Civil-Military Interoperability = Capacity Multiplier



No Civil-Military Interoperability = Capacity Divider



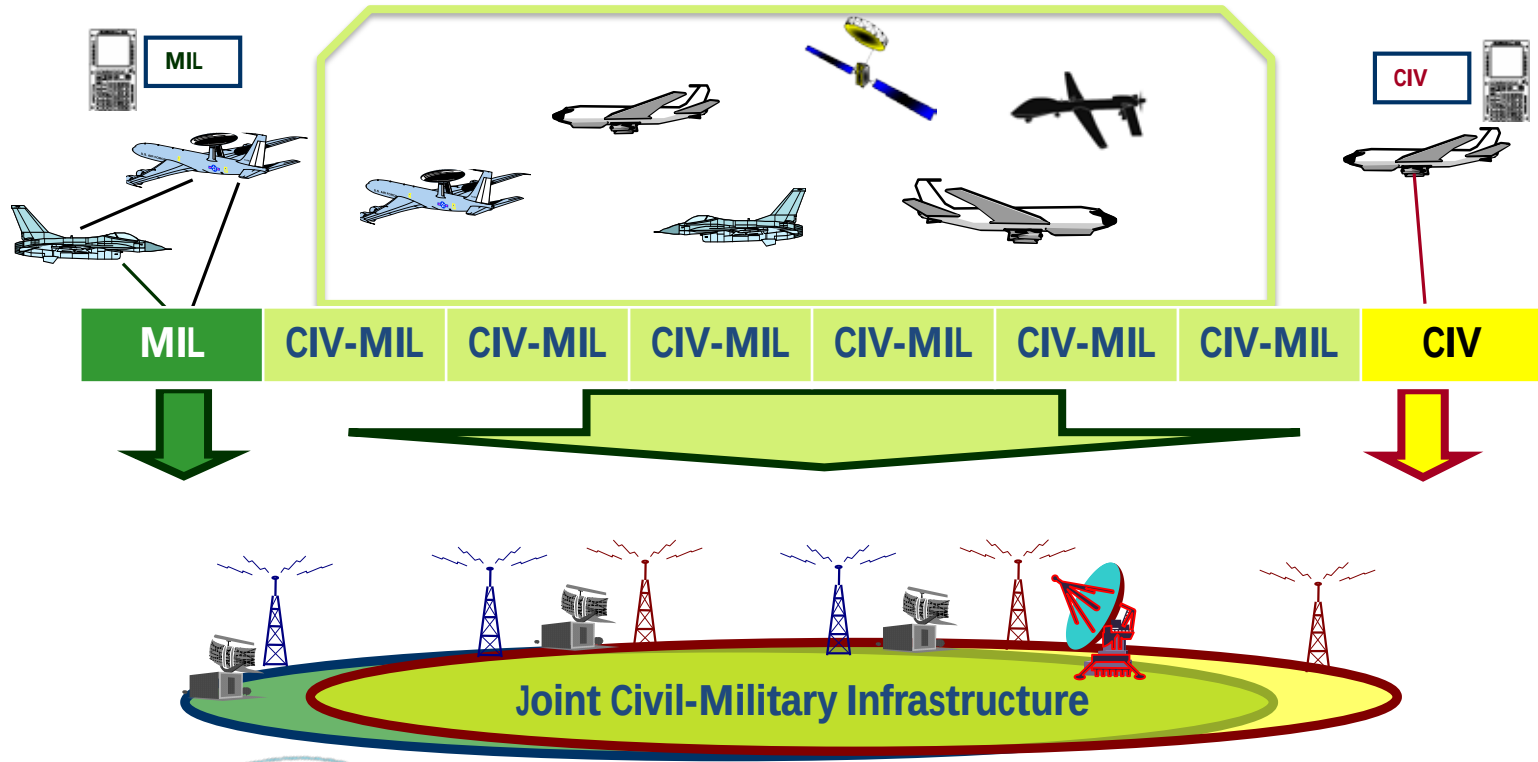
Civil-Military CNS Interoperability - Limited



Different equipage, exemptions, special handling, higher ATC workload

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Civil-Military CNS Interoperability tomorrow = Max



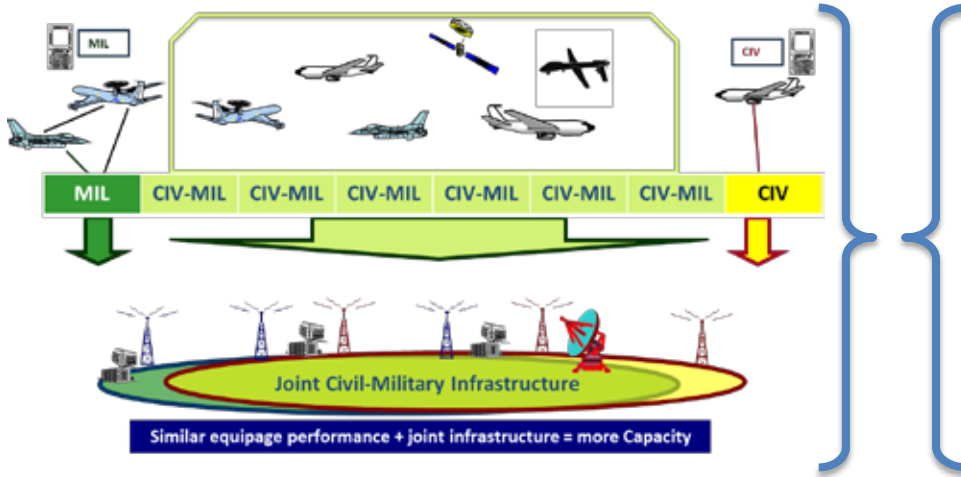
Similar equipage performance + joint infrastructure = more Capacity + reduced Cost

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Civil-Military CNS Interoperability tomorrow = Max

How?

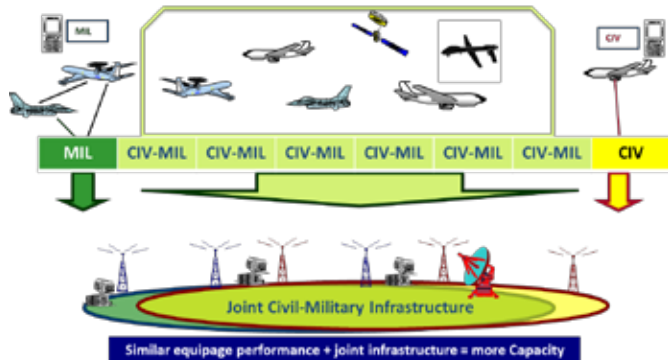
Define military CNS suitable for dual Use



Conceptual Work based on military operational Requirements leading to common Procurement

Civil-Military CNS Interoperability – Way forward?

EDA strategy and action plan for military CNS procurement



EUROCONTROL technical civil-military CNS interoperability roadmap & solutions

SESAR integrating military CNS needs into CNS R&D, Master Plan and Deployment



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Civil-Military CNS Interoperability – Way forward?

EDA strategy and action plan for military
CNS procurement

SESAR integrating military CNS needs into
CNS R&D, Master Plan and Deployment

**Civil-military CNS Interoperability means also
commonly agreed solutions beyond only equipping
military Aircraft with civil ATM required Technology!**

**GND Infrastructure supporting military Aviation might
be cheaper than airborne equipment, but providing
similar levels of Performance!**

EUROCONTROL technical
CNS interoperability roadmap & solutions

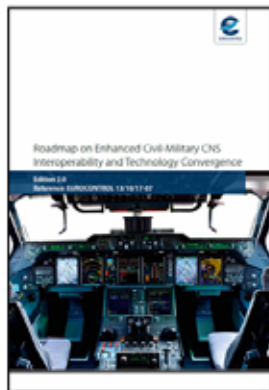


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EUROCONTROL Civil-Military CNS Interoperability Work

<http://www.eurocontrol.int/articles/civil-military-cns-coordination>

EUROCONTROL Civil-Military Technical CNS Guidance



**Supporting
European Civil-Military Aviation**

<http://www.eurocontrol.int/articles/civil-military-cns-coordination>



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CNS Strategy – Military View

The MILITARY in Single European Sky -
Partnering for Excellence in global aviation

Oberstleutnant Dipl.-Ing. Sven Rensmeyer
EDA Project Officer SESAR



EDA'S REINFORCED MISSION

In May 2017, after EDA's LONG TERM REVIEW,
Defence ministers agreed to reinforce the Agency's role and mission

- } as the **main instrument**
for intergovernmental capability planning & prioritisation in Europe
- } as the **prime forum and coordinator**
for the whole lifecycle of capability development
- } as **Member States' central interface & gateway**
towards EU institutions & stakeholders

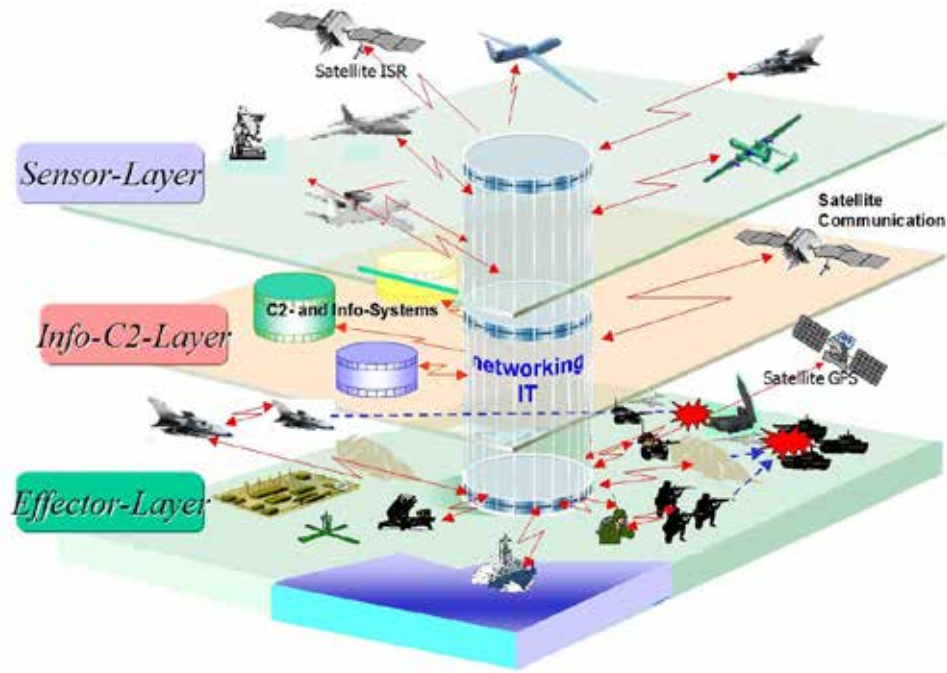


The Fleet – The Stakeholder

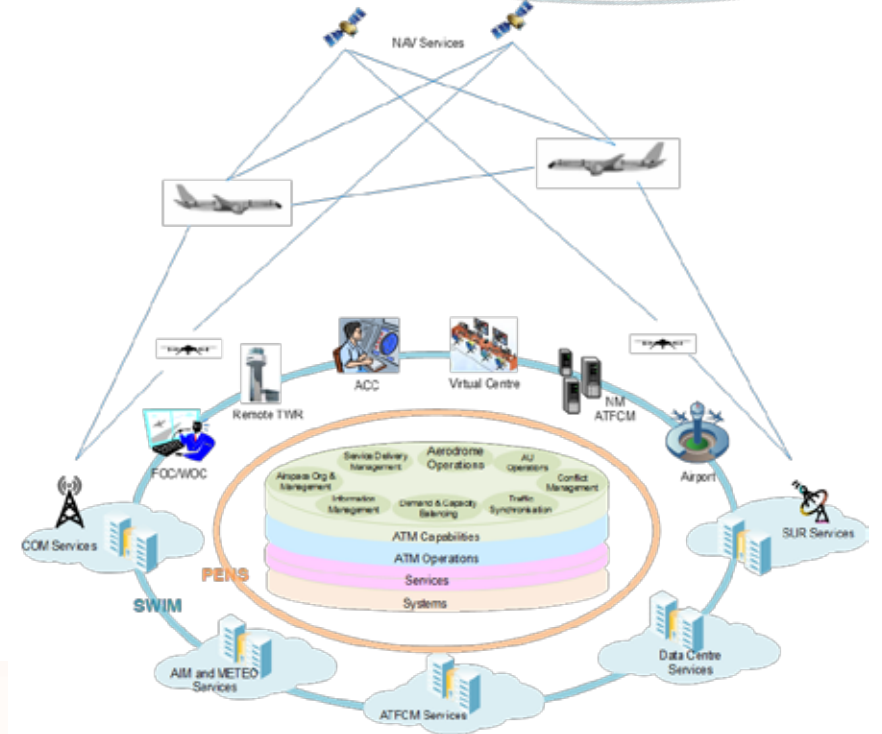


Asset	Number
Combat Aircraft	3365
Helicopters	3733
Light Transport Aircraft	1390
Heavy Transport Aircraft	949
RPAS (All types)	420
Airfield	220

Interoperability is a must



Military crisis environment
Today - Core mission



SES environment
Tomorrow - Enabler

Military CNS Strategy

catastrophe

disruptive events

crisis

peace



DEFEND & SUPPORT

Conclusion

- Let's move forward together
- Civil-Military collaboration is key
Interoperability is a must
- SES shall accommodate the needs of all stakeholders
- Defence and Security is a common responsibility

