CNS evolution: roadmap & strategy

“A joint achievement between the EATM MP CNS update and S2020 PJ14 EECNS”
iCNS concept & PJ14.01.01

Main deliverables:

- CNS Evolution Roadmap and Strategy
- Performance-Based Integrated CNS
- CNS robustness
- 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

- Air Traffic Services
- ATM Network Services
- Airport Services
- Aeronautical Info Services

Performance-Based Applications
- Performance-based CNS applications: PB CNS
  - Communication
    - PBCS
  - Navigation
    - PBN
  - Surveillance
    - PBS

Backbone of future infrastructure
- Secure CNS services
  - Multi-Datalink (voice & data)
  - Multi-constellation Dual frequency GNSS
  - ADS-B (ground & space)
  - Advanced avionic capability

Enabling infrastructure
- Minimum Operating Network of legacy infrastructure
  - Communication
    - MON VHF
    - MON VDLM2
  - Navigation
    - MON ILS
    - MON A-PNT (incl. DME)
  - Surveillance
    - MON radar
    - MON MLAT
    - MON MSPSR
    - MON Video
  - Airborne
    - Basic avionic

Radio spectrum: VHF, UHF, L-band, S-band, C-band, X-band, Ku-band, Ka-band
CNS Roadmap & Strategy

Rationalisation opportunities

2025 Rendezvous

Integration CNS Roadmap and strategy

Multi Datalink

GNSS

DFMC

Objective infrastructure

MON Mode S

MON PSR

MON PSR/SMR

MON MSPSR/SMR

MON ILS

MON VHF voice

MON VDLM2

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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”

Paul DUNKLEY
SJU Programme Manager – Enabling Infrastructure
Target Architecture

CNS Architecture – SESAR PJ14

Airspace Architecture - Study
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

<table>
<thead>
<tr>
<th>1st DAY KEY NOTE + PLENARY SESSIONS</th>
<th>2nd DAY BRAINSTORMING SESSIONS + CONCLUSIONS</th>
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<td><strong>Introduction</strong></td>
<td><strong>5 brainstorming co-animated sessions</strong></td>
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<td>Key Note Speech : DECMA Director</td>
<td>• CNS rationalisation &amp; modernisation: which enablers and framework to succeed?</td>
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<td><strong>A global CNS vision for all attendees</strong></td>
<td>• Technologies convergence opportunities (drones, GA, military, commercial)</td>
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<td>• Institutional</td>
<td>• Future datalink for aviation: which technologies?</td>
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<td>• ANSP</td>
<td>• What to expect from performance-based CNS services?</td>
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<td>• Airspace users</td>
<td>• CNS long term evolution: is there a need for new CNS systems post 2040?</td>
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<td>• Industry</td>
<td><strong>Conclusions</strong></td>
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<tr>
<td>• CNS Service Providers</td>
<td>• Brainstorming conclusions</td>
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<td></td>
<td>• Symposium conclusion, recommendations and way forward</td>
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**PREPARED BY A “FOOD FOR THOUGHT PAPER” SENT TO ALL PARTICIPANTS IN ADVANCE…**
A HUGE AND DIVERSE PARTICIPATION: A SUCCESS MARKER!
Unanimous agreement on CNS architecture developed within SESAR2020 PJ14

Moving toward CNS services implies to take a consideration multiple aspects (cost benefit, charging principle, standardisation, safety, certification, security, operations,...)

Drones and cyber-security should be integrated in the CNS/ATM evolution

Spectrum needs to be protected

CNS/ATM framework needs to include the performance requirements, performance monitoring, service integration & quality of service

Institutions to generate stakeholders’ “trust in change”: confidence on the roadmap implementation is needed for investment plans

Detailed and complete CNS Symposium conclusions: https://www.eurocontrol.int/events/communication-navigation-and-surveillance-symposium-time-conceptual-change-cns
SYMPOSIUM UNANIMOUS MESSAGES FROM PARTICIPANTS

- Strong leadership and a program management approach is required with proper governance.

- Communication and coordination with ALL ATM stakeholders is key and required.

- Generate trust: confidence on the roadmap implementation is needed for investment plans.

- Costs need to be compensated with benefits. Route charges need to evolve in order to:
  - better distribute the benefit from CNS evolution
  - better reflect what is being used by Airspace Users
Technical solutions are there and mature
New business models exist (e.g. Performance-based Surveillance as a service)

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

WE NEED:
a strong leadership to decide
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
A simplified/coordinated institutional framework

DOING NOTHING IS NOT AN OPTION!
OUR DUTY IS TO MAKE IT HAPPEN!
NEXT STEPS FOR CNS FUTURE?

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

Aviation Spectrum

Jacky Pouzet
Head of ATM Communication and Frequency Coordination Unit
SPECTRUM is a key scarce (CNS) resource for Aviation (\textit{Value > 1000B€})

Global Spectrum: Managed by International Telecommunication Union (UN)

Approximate coverage of ITU Regions by regional telecommunication organizations
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
We need bigger aircraft
...to fit all the aeronautical antennas...

And aviation spectrum is ... congested
On the ground and in space....

- ILS
- Radar
- VOR
- VHF
- VOR/DME
- CNS Satellite
- MIL systems
- GBAS
Aviation Spectrum is congested

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

- **Support ICAO position** for the next ITU/Word 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.
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
Civil-Military CNS Interoperability tomorrow = Max

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

Joint Civil-Military Infrastructure
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

“As civil as possible, as military as required!”
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?

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 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
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

<table>
<thead>
<tr>
<th>Asset</th>
<th>Number</th>
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<tbody>
<tr>
<td>Combat Aircraft</td>
<td>3365</td>
</tr>
<tr>
<td>Helicopters</td>
<td>3733</td>
</tr>
<tr>
<td>Light Transport Aircraft</td>
<td>1390</td>
</tr>
<tr>
<td>Heavy Transport Aircraft</td>
<td>949</td>
</tr>
<tr>
<td>RPAS (All types)</td>
<td>420</td>
</tr>
<tr>
<td>Airfield</td>
<td>220</td>
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Military crisis environment
Today - Core mission

Interoperability is a must

SES environment
Tomorrow - Enabler
Military CNS Strategy

catastrophe

crisis

defensive & support

disruptive events

peace
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