

Introduction of Dynamic Spectrum Access technology in NATO Europe tactical communications

LtCol Bart Scheers, Dr Ir

Presented by Vincent Le Nir, Dr Ir

Dept. Communication, Information Systems & Sensors (CISS)

Royal Military Academy, Belgium

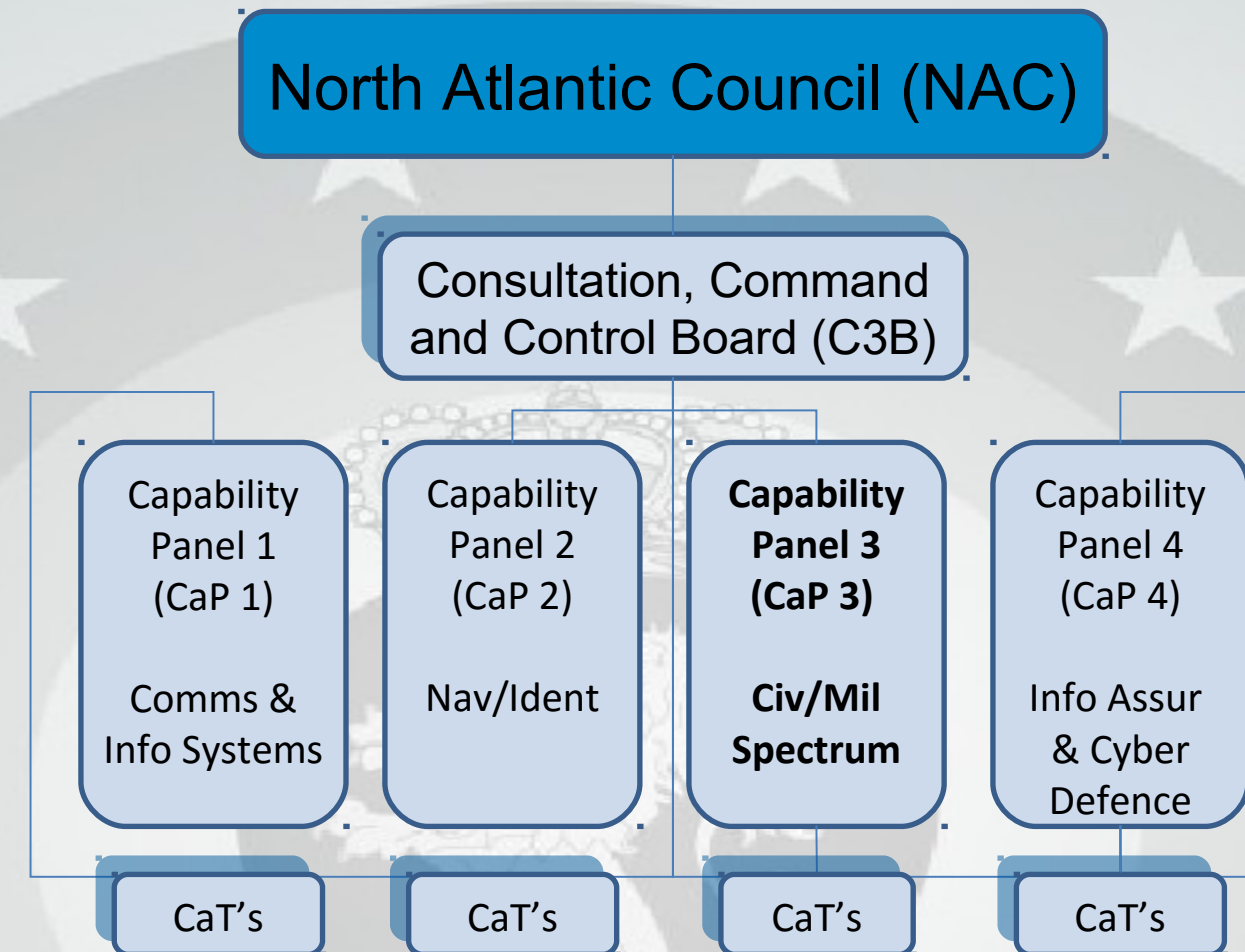


Outline

- Introduction
- Current situation
- Roadmap
- NATO CAP3 answer
- Way ahead
- Summary

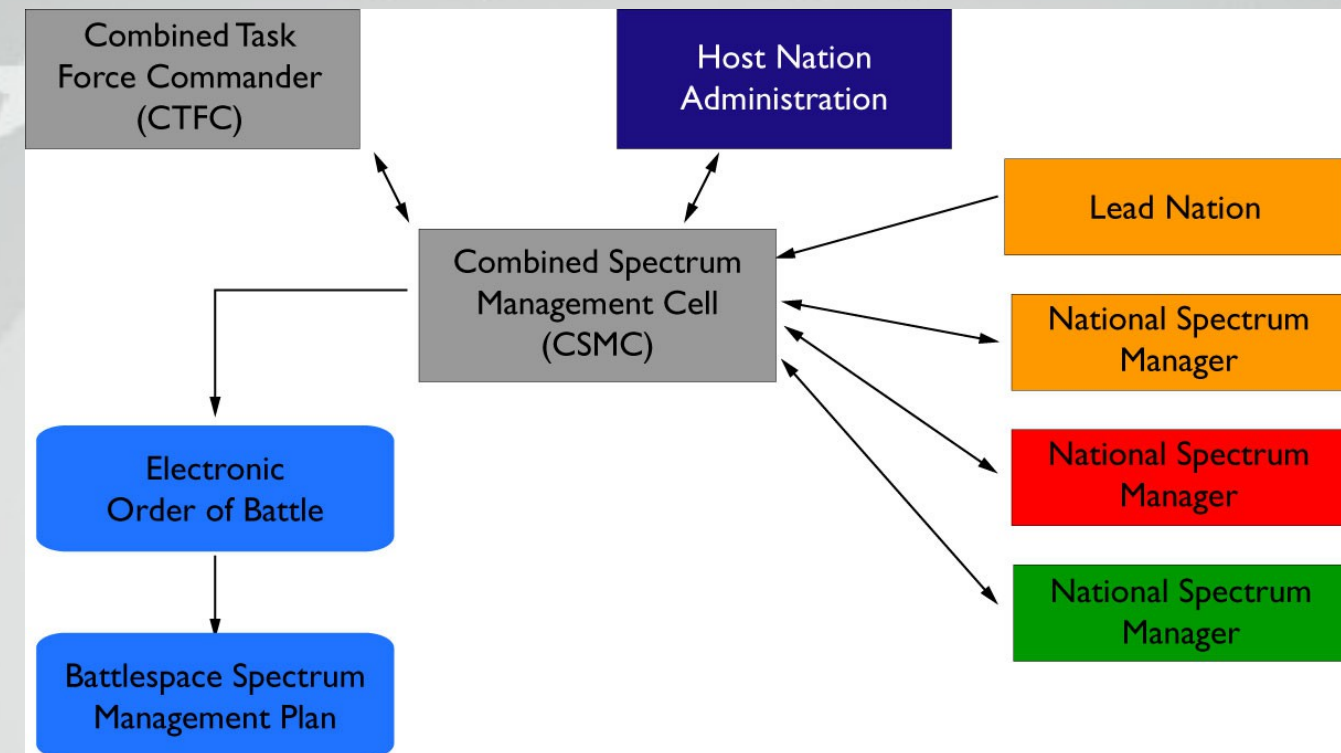
Current NATO spectrum management

- 3 levels of spectrum management :
 - Strategic level = homeland/ National frequency planning
 - Operational level : in Ops theatre
 - Tactical level
- Strategic spectrum Management
 - Management and the coordination is done by Capability Panel 3 (CaP3)
 - Static frequency allocation, based on a data base (SMIR)
 - Man in the loop



Current NATO spectrum management

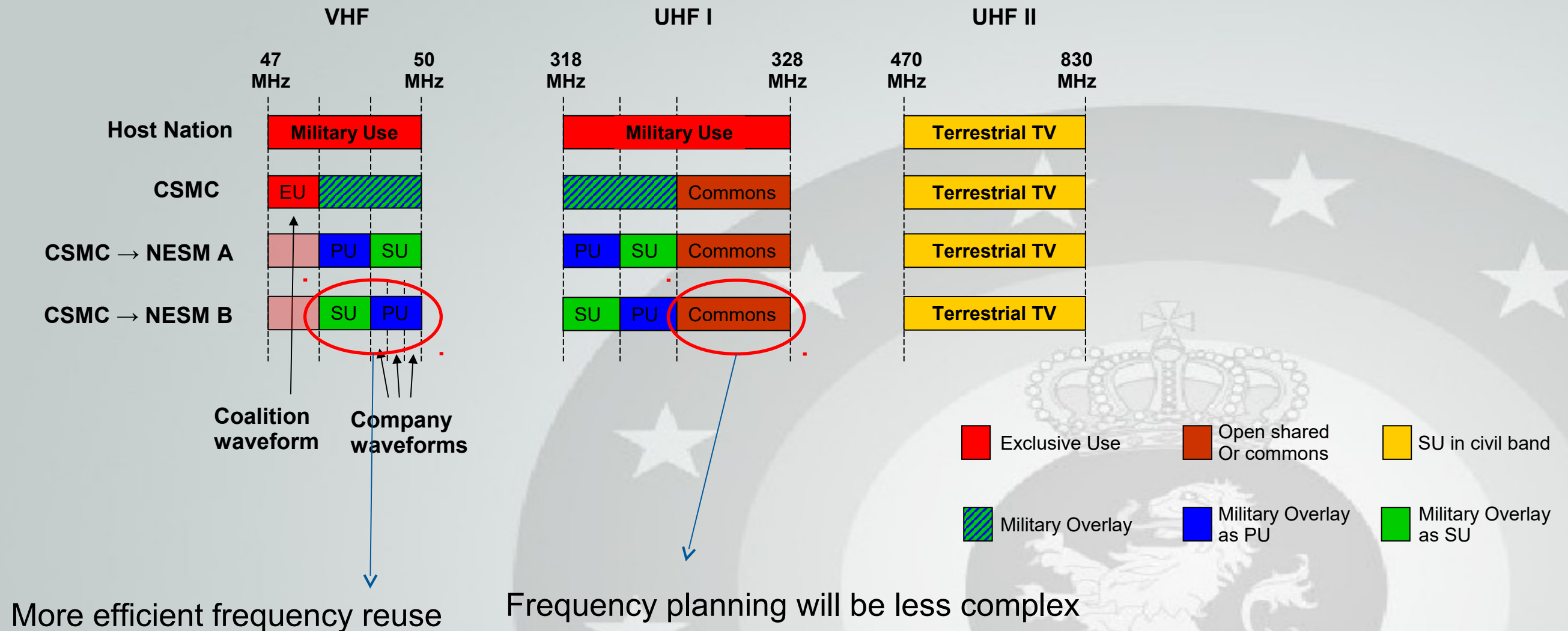
- NATO frequency planning in Operations
 - Responsibility of the Coalition Spectrum Management Cell (CSMC)
 - Static frequency allocation, based on a data base (SpectrumXXI)
 - Man in the loop
 - Can become very complex ! → lot of actors



What are the possible benefits of DSM for NATO?

- Driving factors to introduce DSM in military communications
 - Spectrum scarcity
 - Static frequency allocation → inefficient use of spectrum
 - Deployment burden
 - DSM → faster deployments + less frequency management overhead
 - Improve Mission Success (? how to measure this ?)
 - First two bullets
 - DSM → more robust link (in case of jamming or bad channel conditions)
- To show bullet 1 and 2, we present a simple Future DSM planning example
 - Scenario :
 - Peace keeping operation in a non-NATO country
 - Coalition with 2 Battle Groups of 2 different nations (A and B)

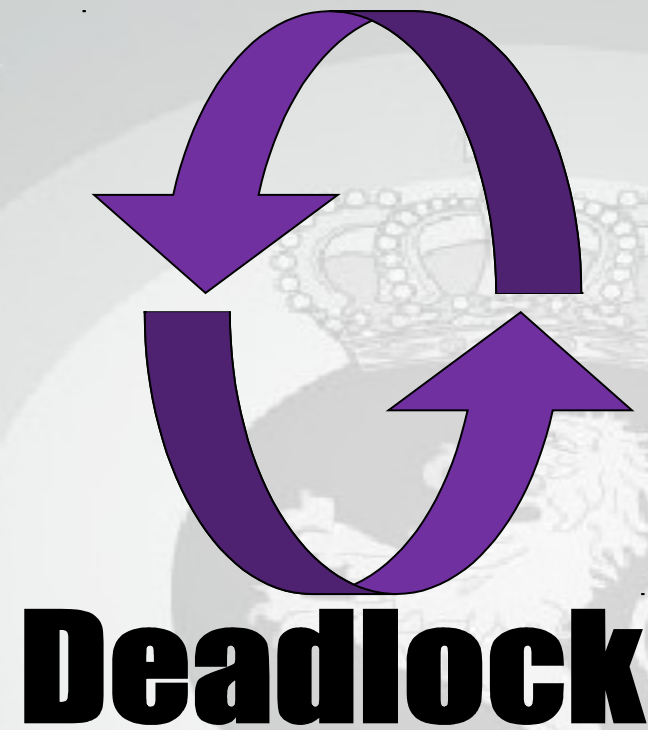
A simple Future DSM planning example



The deadlock in the development of tactical DSA systems

After 16 years of research, No MOTS equipment available to military users

- Reasons
 - Technology is not proven
 - Military are not an early adopter
 - Industry sees no market
 - Uncertainties about regulations
 - No Concept of Operation (CONOPS) in NATO



Current situation of Cognitive Radio Research in NATO and EDA

- NATO : STO
 - RTG IST-077 on cognitive radio in NATO (2008-2011)
 - RTG IST-104 on cognitive radio in NATO II (2012-2015)
 - RTG IST-140 on cognitive radio networks (2015-2018)
- EDA : CORASMA Project (2010-2013)
 - 7 countries : FRA, BEL, DEU, ITA, POL, PRT, SWE
 - Development of high fidelity simulator for CR networks
- EDA : MAENA Project (2016? - 2018?)

Roadmap for Cognitive Radio in the Military

- How to break the deadlock ? → IST-077 proposed roadmap
- Aim of the roadmap :
 - Lift the uncertainty about regulation
 - Introduce CR in a controlled way
- 2 principles for the introduction of CR and DSM
 - From the user point of view : 'Make it an evolution, not a revolution'
 - From the technical point of view : 'First learn to walk before you learn to run'

Roadmap for Cognitive Radio in the Military

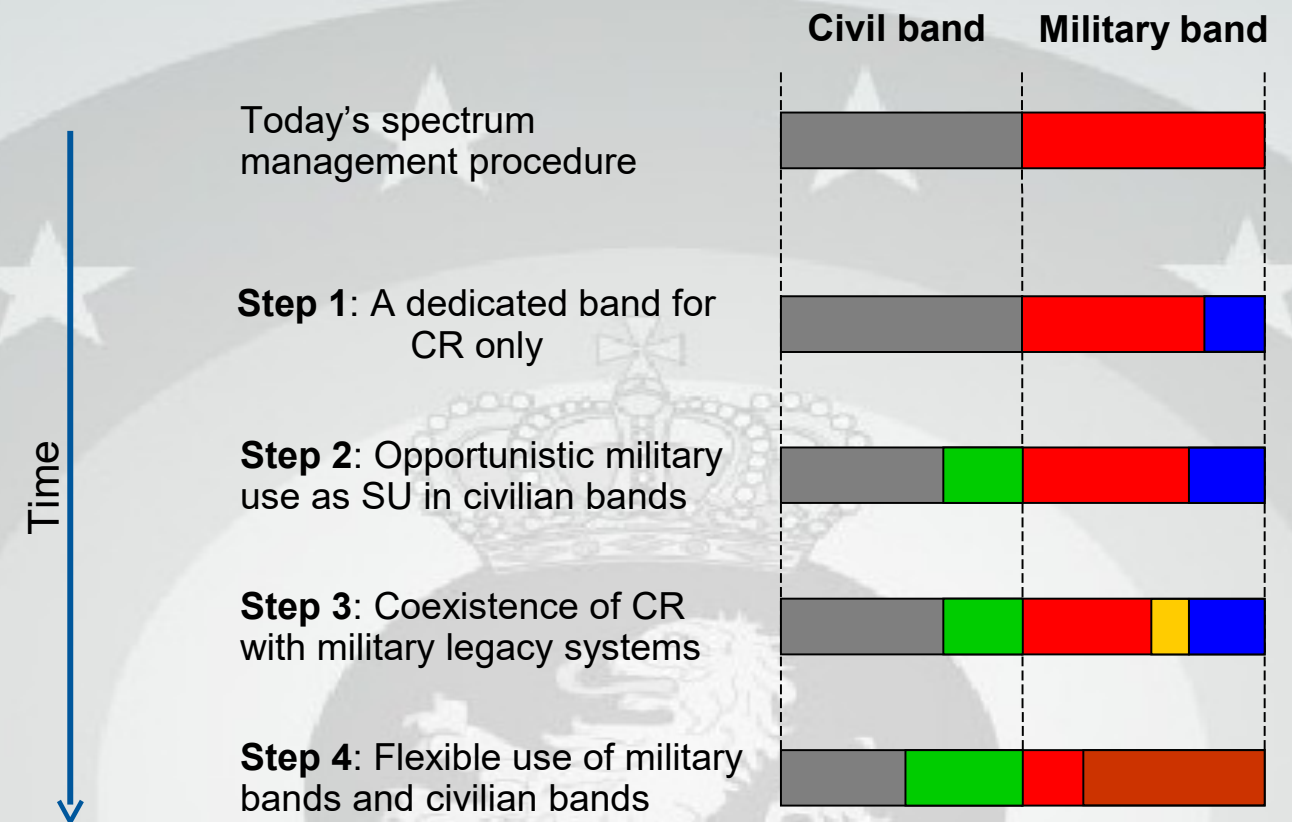


Roadmap for Cognitive Radio in the Military

- First step = Dedicated band in an 'open sharing model' for CR systems (= DSA capable, interference tolerant systems) only.
- Motivation
 - No risk for interference with legacy systems
 - Relaxation of CR system requirements
 - The concept of a license free band is known (e.g. ISM band)
 - Compatible with the way NATO manages its harmonized bands
 - Incentive for industrial R& D (cfr ISM band)
 - Playground to prove the concept
 - It will take away the uncertainties about regulations
- Possible bands for this Dedicated band (from a technical/tactical point of view) :
 - 5 to 10 MHz in the UHF band I (225-400 MHz)
 - UHF band II (790-960 MHz), UHF band III(1350-2690 MHz)
 - SHF band for short range wireless networks (4400-5000 MHz)

Roadmap for Cognitive Radio in the Military : Next steps

- Step 2 : As secondary user in civil bands (e.g. TV white space,)
- Step 3 : As secondary user in Military bands
- Step 4 : flexible use of Military frequency bands + dedicated band for legacy (and critical) systems



NATO CAP3 answer

In Oct 2012, this roadmap has been presented to NATO Mil CAP 3 with the question to reserve a dedicated band for DSA within the NATO harmonized UHF band.

- CAP3 liked the idea of a controllable step by step approach for the introduction of DSM in military communications. However, ...
- NATO Mil CAP 3 refused to dedicate a 5-10 MHz band (UHF) for Cognitive Radio systems
 - UHF band is too crowded. NATO can not reserve a band as long as there are no systems
 - Industry needs to take the risk for breaking the deadlock

Way ahead

- Way ahead : 3 options
 1. Wait and see : industry will gradually introduce cognitive features in their product.
 - The evolution will be mainly driven by civil applications
 - No harmonisation of DSA bands between NATO partners
 - No harmonisation of CONOPS
 - NATO will have no control on introduction of CR
 2. Create a dedicated DSA band (first step) at the national level
 - No harmonisation of DSA bands between NATO partners
 - There will still be a need for a common CONOPS within NATO partners
 3. First step = Create an harmonized Military dual-priority band at NATO level

Way ahead

- What is a dual-priority band ?
 - Inspired on Pluralistic Licensing concept, developed within COST-TERRA and ACROPOLIS
 - Two services are defined
 - Priority Access service
 - Cognitive Access service
 - Priority Access service
 - Service for legacy (native) systems with no DSA capability
 - Systems can experience limited interference
 - Cognitive Access service
 - For systems with DSA capabilities and no pre-assigned frequencies
 - Systems need to give priority to the first service
- Advantages of the Military dual-priority band as a first step
 - It can be introduced without jeopardising spectrum availability of existing systems
 - Sets out a clear spectrum access strategy

Summary

- Facts:
 - Today's static spectrum management is complex and based on static frequency allocation
 - DSA has to date not been adopted by the military
 - There is a deadlock (technology not proven ↔ no guaranteed market nor regulation)
- How to break the deadlock ?
 - Need for a CONOPS within NATO ! Future work
 - Need for a clear spectrum access policy for DSA → a step by step Roadmap was presented to CAP3
- CAP3 will not implement step 1 (dedicated band for DSA)
 - Lack of available spectrum → NATO will not reserve a band for systems that does not exist
- Way ahead : The **military dual-priority band**, defining two services
 - It will not jeopardize spectrum availability of existing systems
 - Can be a nice compromise between the arguments brought up by CaP3 on the dedicated band of the initial roadmap