

CONSTRUISONS **ENSEMBLE**
LA DÉFENSE DE DEMAIN

Tactical Communications

Nation's perspectives

CONTACT – French SDR Program

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CONTACT OVERVIEW

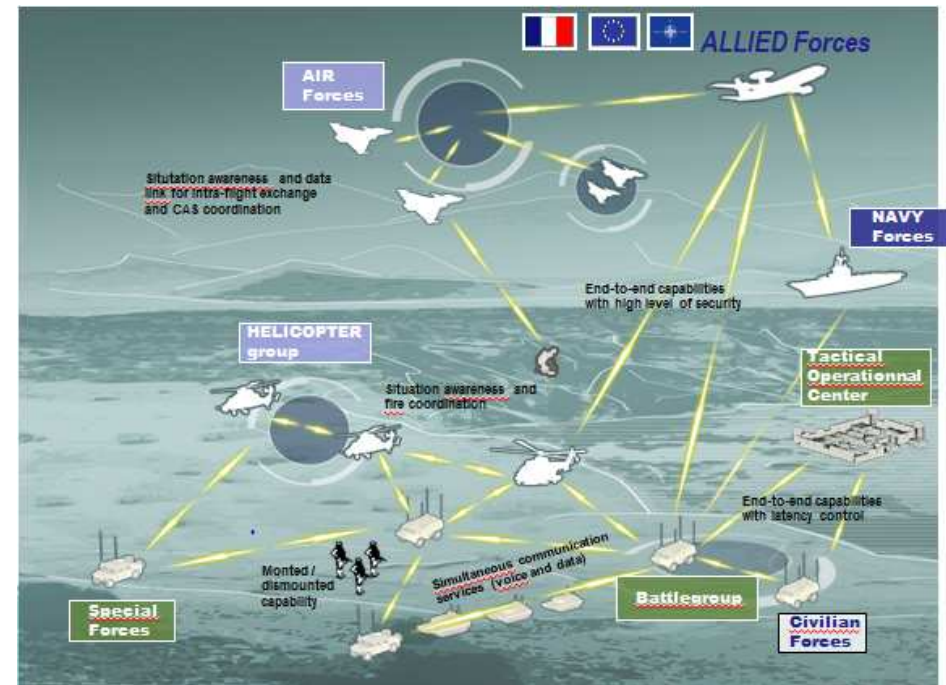
Needs and challenges

Program drivers

Overall roadmap

Needs and challenges

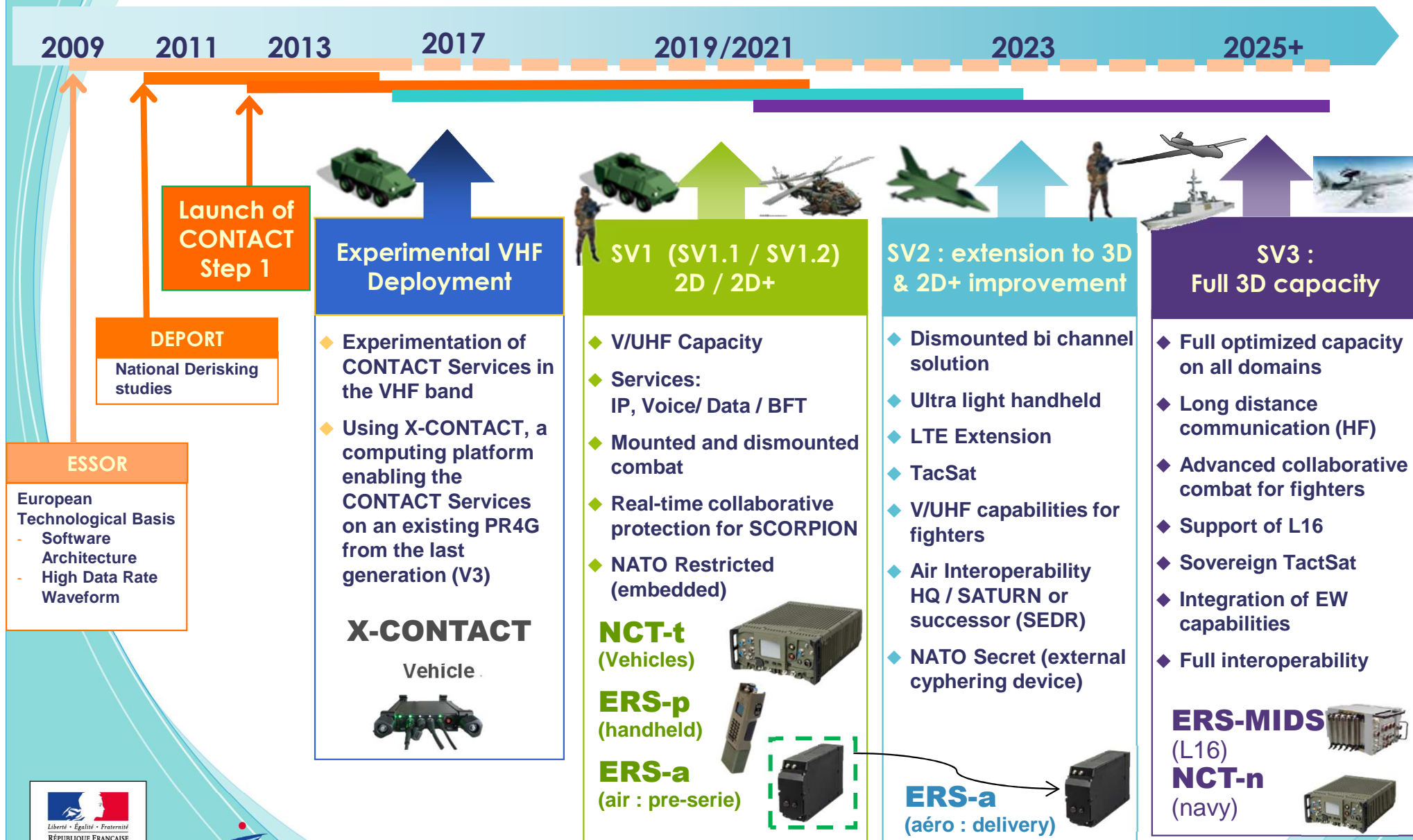
- Operational
 - Joint Multinational Civilian security actors
 - Share quickly the same operational picture
 - Speed up the rhythm of decision making
 - Improve coordination
- Programmatic
 - Smooth migration
 - Economical optimization
- Technical
 - Growing need for data exchange requesting high data rates
 - Secured communications & transmission
 - Large number of nodes
 - Nodes moving differently
 - Various elongations to deal with
 - Optimization of frequency resource



Programme drivers

- Build a new system, not only a new set of radios
 - Joint program, for joint operations
 - Robust tactical network, offering high data rate and end to end security
- Simplify the experience for the user
 - A standard interface for all products
 - Intuitive network planning
- Offer cutting-edge new capabilities, while ensuring continuity with the existing doctrine derived from the PR4G radio inside French forces
 - Implementation of legacy services: Combat Net Radio
 - Ability to operate in the same conditions (e.g. range, jamming level)
- Allow the services to evolve thanks to the SDR technology
 - The system will stay in our forces for ~30 years: it will need growth potential to address future operational needs
- Implement and/or contribute to define the standards in order to foster coalition interoperability
 - SDR architecture: SCA, ESSOR
 - Network: IP Protocols
 - Security: SCIP, NINE
 - Waveforms: ESSOR/COALWNW, NBWF, SEDR ...

Overall roadmap



FOCUS ON STEP 1 PERIMETER

System & Hardware

Secured High Data Rate Tactical Networking System

Networking Core Functionality (Services Delivery)

Core Waveforms optimized for CONTACT services (simultaneous voice & data)

**High Data Rate : ESSOR VF (UHF)
Range : CONVERT (VHF)**

Node Function
Core networking, routing and retransmission between core waveforms

End to End Security (NATO Restricted)

Management System

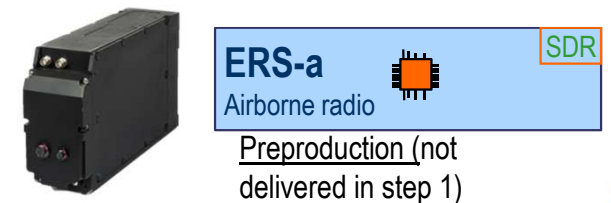
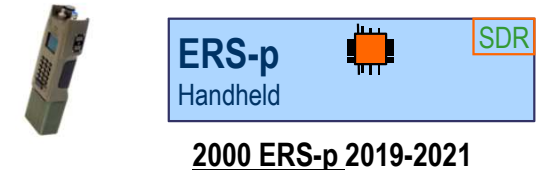
Connectivity extensions

Integrated gateways to external tactical networks (ex : IP WAN)

Support of legacy PR4G Profiles (CNR, PMV3)

Integration of PR4G V3 in CONTACT core network (X-CONTACT+CONVERT)

Secured V/UHF SDR Radios



Other Hardware



Management System
53 Units



Crypto Chip
NATO Secret ready

CONTACT REQUIREMENTS

Legacy Services: Combat Voice
Changes of paradigm (V/UHF, Geo-Services, Security, HMI)
Spectrum issues
Continuity of operations

LEGACY SERVICES

Combat Net Radio voice will stay a must especially under fire

■ Human factors

- The quickest way for complex interaction is the voice
- Commander leadership will hardly be reproduced by a machine order
- Situation evaluation cannot be reproduced by an automatic system (stress of the soldier, ambiance noise)

■ Combat effects

- Troops under fire need to coordinate even if their vehicle has been destroyed and /or the BMS is not available
- A unit in distress should be able to coordinate with a unit being sent for rescue in any situation

- This generates the need to maintain CNR behaviour in modern Waveforms, as well as to support PR4G CNR Profiles

CHANGE OF PARADIGM – V/UHF SYSTEM

A System relying on the VHF and UHF band

- The High Data Rate capability requires to operate in UHF band, and comes at the expense of lower range in comparison to the VHF band which was used formerly for tactical radio systems
- The CONTACT vehicular radio “NCT-t” will operate simultaneously in both VHF and UHF bands
 - It should take advantage on both domains
 - Doing this, it not only aims at interconnecting two different communities
 - It allows to offer dynamically the best service according to the current topology
 - Information is transmitted to the most adequate medium according to different criteria (e.g. quality of service, network load, robustness ...)
- Mitigation of UHF band drawbacks (range, performance in urban environment) trough advanced techniques

CHANGE OF PARADIGM – GEO-SERVICES

Geographical exchanges & transverse channels

- **Network structure is optimized for the majority of exchanges, which are hierarchical.**
- **However, some services are too time-critical to go through hierarchical channels and require direct connectivity between units operating in the same area:**
 - **Blue Force Tracking**
 - **Alerts, including in real-time for Collaborative Protection**
 - **On-demand Geographical Voice Conferences**

CHANGE OF PARADIGM - SECURITY

Security Enhancements

- **An overall tactical network raises new information assurance risks that have to be addressed**
 - Communities are not anymore segregated
 - Information is being relayed through different nodes
 - A local breach could affect the whole network
- **Level of protection has to be increased to mitigate those risks**
 - Full range of protection techniques have to be implemented
 - End to end encryption (allow using relays without compromising the security at the node)
- **A consistent protection has to be offered in a end to end manner covering the 95% of tactical needs**
 - external crypto devices can be used for higher protection needs
- **Programmable crypto chipset able to support national and coalition interoperability crypto requirements**

CHANGE OF PARADIGM – HMI

Embedded services usable through the radio HMI

- The CONTACT system offer “native” critical services that can be exploited through the Human Machine Interfaces of the radios:
 - Geographical BFT
 - Alert
 - Short Messaging Service

SPECTRUM ISSUES

Optimization of Spectrum Usage

- **Data rate expectations are growing, requiring more spectrum**
- **The military spectrum is being challenged by civilian users**
- **In coalition, available resources need to be split between allies, limiting the available spectrum for national use**
- **CONTACT has been natively designed to optimize spectrum usage:**
 - **Scalability (system designed to support up to 2000+ nodes)**
 - **Dynamic sharing of spectral resources**
 - **Cohabitation of several radio networks on the same frequency channels**

CONTINUITY OF OPERATION

Resilience for warfighting

- The network has to be resilient to various events
 - Radio failure or destruction
 - Jamming or unavailability of a radio link
- The deployment can have to be reorganized
 - Entry/exit of new nodes in the network
- The system have to handle smoothly the transition from mounted to dismounted combat
 - Fast synchronization and entry into the network
 - Continuity of communications between the dismounted soldier and the troops that are still inside the vehicle

LESSONS LEARNED

Key levers for a communication system



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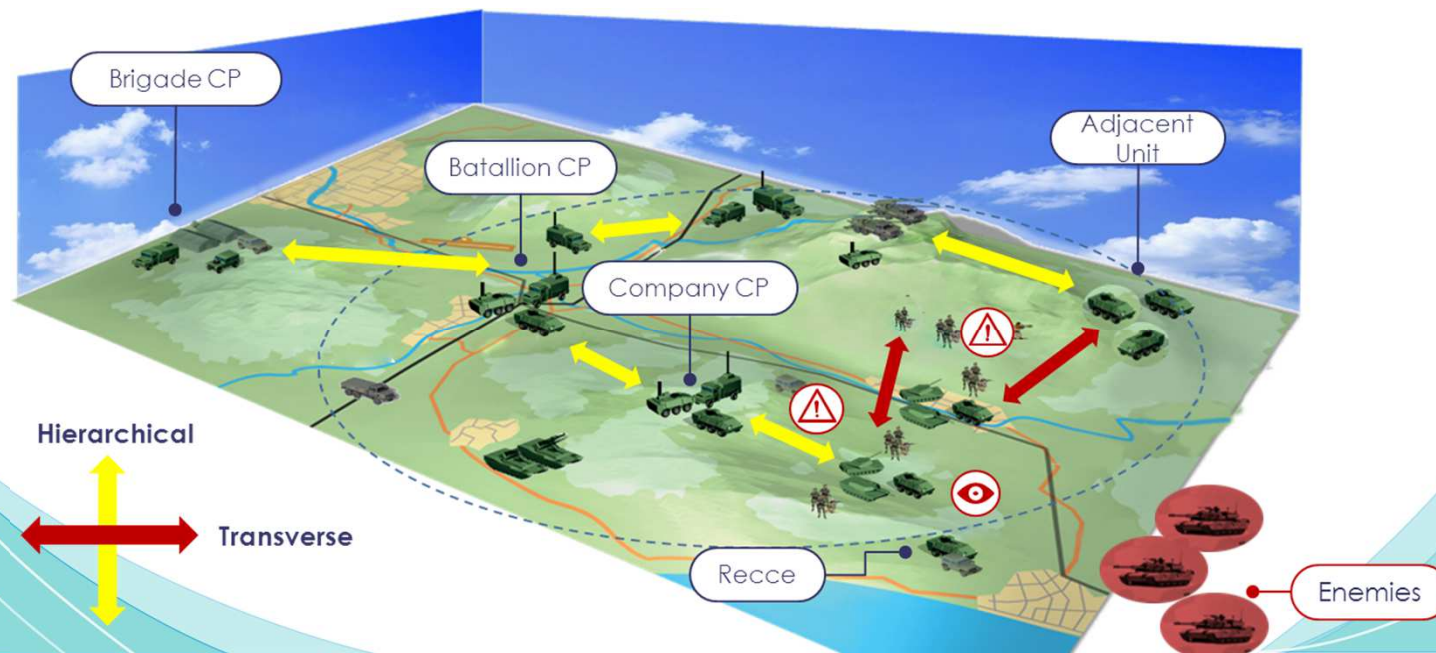
Interconnecting multiple networks

- SDR promises interoperability with the use of a common WF for while relying on national equipment
- However in a deployment it would be surprising to have one WF to cover all needs
- Factors leading to the multiplication and be segregation of networks are between others
 - Sovereignty needs (National network / Coalition network)
 - Operational Domains (Land / Air / Navy)
 - Priorities / Tradeoffs (range, throughput, mobility, QoS, discretion, AJ)
- CONTACT Node Function brings a homogeneous service interface to the User and Information System while interconnecting these heterogeneous networks



Optimizing BFT exchanges

- BFT will help overcome the language barrier in a coalition and is required to avoid friendly fire / collateral damage for nations not sharing the same language
- BFT is a realtime / critical information, relying on the transmission through hierarchical chain is a risk
 - In a coalition it is even worse when considering the need for a gateway between National & Coalition networks
- In addition to hierarchical exchanges it is beneficial to develop geographical communications through the transverse channel
 - compared to a « hierarchical » approach, the accuracy of local situation is preferred to the deployment completeness
 - Optimized for combat & Efficient in terms of ressources
- CONTACT encompasses geographical capabilities



Sharing a common understanding of the coalition

- Although interoperability standards are usual in the air domain, a lot of effort is still on going in the land domain
- In order to get the most benefits in a coalition, there is a need to standardize also architectural elements in addition to waveforms
 - Networking
 - Security protocols
 - Doctrine / Expectations
- The CONTACT Programme is contributing to different existing initiatives

CONCLUSION



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Conclusion

- CONTACT is a integrated system offering a scalable, flexible, resilient, secured, high data-rate overall tactical network
 - address the full spectrum of tactical communications requirements for all the branches of the Armed Forces (Joint operations)
 - robust to jamming, losses of nodes (self healing) and topology variations
 - overall design is consistent to allow spectrum resource usage optimization
 - secured end-to-end through a combination of high-end techniques
 - provide our warfighters with cutting-edge collaborative combat capabilities
- Designing the system, we learned there is still room for standardization to achieve a optimized coalition deployment, between others
 - Doctrine / use cases of Wideband and Narrowband Waveforms
 - Dissemination of Blue Force Tracking
 - Networking at tactical level

Contact info: Advisors from DGA at WINNF Advisory Council (updated)

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