

EDF-2021-C4ISR-D: ISR and advanced communications

EDF-2021-C4ISR-D-COMS: Robust defence multi-dimensional communications

Budget

The Union is considering a contribution of up to EUR 70 000 000 to support proposals addressing the abovementioned topics and their associated specific challenge, scope, targeted activities and main functional requirements.

Several actions, addressing different topics, may be funded under this call.

Information superiority is key to achieve operational advantage against the enemy. Today, EU Member States (MS) armed forces use a variety of specialised communication means to coordinate and share relevant information during operations. In the tactical domain, to comply with the very demanding environment in high-intensity combat, radio communications systems have been designed with advanced mechanisms for discrete and robust communications, which results in limited data rate capabilities.

Current tactical data links and communications systems have operational and coalition limitations including vulnerabilities that need to be addressed. Wideband and reliable communication for operational interoperability, mobility and security that is robust against detection, acquisition and jamming are key capabilities for defence operations and electronic warfare, including far from the battlefield. However, robust, resilient and performant communications and software defined based network architectures will be a key competence to build and deploy next generation military communication systems.

In the context of collaborative warfare, sensors' data must be shared and collectively analysed, including by means of big data analytics and artificial intelligence, in view of an efficient operational decision-making. This requires ad-hoc, any to any, ubiquitous, broadband, secured and low latency connectivity, which 5G technology could provide in certain operational scenarios.

An integrated tactical 5G bubble could offer a complementary and interoperable broadband capacity at the tactical level to increase information sharing, possibly speeding up the deployment of command posts, enhancing intelligence, surveillance and reconnaissance (ISR) data sharing and contributing to improve bases' logistics and security.

Therefore, it is needed to study 5G technologies with the target to integrate them (or a subset) in tactical CIS (Communication and Information Systems) to supply additional capabilities supporting specific missions and operational scenarios. A standardized and interoperable joint communication system or network is needed. Industry already has formulated flexible standards, like 5G and SDN¹ solutions and network architectures potentially based on software-driven approaches, edge computing and slicing, that pave the way for next generation networks.

¹ Software defined network

Specific challenge

The specific challenge of this topic is to assess identified use cases, whereby 5G will bring improved operational capacities and build corresponding interoperable 5G solutions matching the military constraints in terms of robustness, resilience, security, sovereignty and manageability, and at the same time ensuring efficient interoperability of the 5G solutions with military networking technologies.

Scope

The proposals must address the development of a LTE²/5G integrated tactical bubble based on a robust defence multi-dimensional communication design, using commercial and military secure hardware, software and architecture, digital transceivers, considering multi-functional digital antenna systems, all with a SWaP-C (Size, Weight, Power and Cost) approach.

In particular, the proposals must lead to the identification and assessment of operational use cases where 5G will bring benefits, analyse the merits, the implementation guidelines, including eventual modifications, and prototype selected use cases, and the area of hardening, if necessary, will be identified and the militarisation/customization tasks will be further defined and assessed. The objective is to help optimising the 5G solutions for the intended military user taking care of the best combination of operational constraints and available 5G computing power.

The proposal must provide tested solutions covering all aspects from devices, infrastructure, security and orchestration of the overall system providing an optimized solution, in order to best integrate 5G solutions with other military network types that might be present in the use cases.

Among others, examples of potential military 5G use cases should possibly consider to:

- Provide secure and robust command, control and communication providing information relevant at C2 (Command and Control) level for ISR and, in the future, for cyber situational awareness.
- Remotely control unmanned vehicles and robots *e.g.* For surveillance and reconnaissance information.
- Integrate 5G network enabling augmented/virtual reality for mission planning, training and operational use.
- Integrate 5G network enabling smart warehouses, smart field health care and supply/logistic solutions.

² Long Term Evolution

Targeted activities

The proposals must cover the following activities as referred in article 10.3 of the EDF Regulation, not excluding possible upstream and downstream activities eligible for development actions if deemed useful to reach the objectives:

- Studies, such as feasibility studies to explore the feasibility of new or improved technologies, products, processes, services and solutions;
- The design of a defence product, tangible or intangible component or technology as well as the definition of the technical specifications on which such design has been developed which may include partial tests for risk reduction in an industrial or representative environment;
- The development of a model of a defence product, tangible or intangible component or technology, which can demonstrate the element's performance in an operational environment (system prototype);
- The testing of a defence product, tangible or intangible component or technology. The proposals must address in particular the following objectives:
Studies:
 - EU Member States defence forces use case analysis for Homeland defence and Expeditionary operations with an emphasis on interoperability (land, maritime and air domains).
 - Evaluation of 5G standard and SDN systems to answer to the different use cases (including gap analysis) and new operational concepts (*e.g.* tactical cloud).
 - Analysis of concepts for adoption of an appropriate industry standard to military needs of EU Member States.
 - Definition of requirements for 5G military systems, considering also interoperability with other military radio networks.
 - Study on how to combine 5G systems with other network types that might be present in an operation
 - Analysis on use case needs according to 5G system constraints to select underlying network architectures.
 - Analysis on how to improve cyber-resilience capabilities and, in general, 5G robustness against detection, acquisition and jamming (*e.g.* using ad-hoc resources management procedures, specialized antenna systems).
 - Presentation of the study results and execution of a demonstration with use cases, also to permit to evaluate the gaps in the 5G technologies for a secure integration with the tactical networks.

Design:

- Definition of 5G solutions (including tactical bubbles) and SDN solutions applicable to centralised and distributed systems.
- Definition of the system architecture, subsystems and interfaces, and guidelines for implementations, etc.), considering also interoperability with other military radio networks.
- Definition of the security environment and solutions, considering secure overlays exploiting existing military standards.
- Selection of a subset of use cases for demonstration, simulation and prototyping.
- Definition of the scope for adoption of an appropriate industry standard to military needs.

- Definition of the system architecture for adoption of an appropriate industry standard to military needs.
- Definition of a testbed for the adoption of an appropriate industry standard to military needs.
- A proposal for potential subsequent projects that should be generated according to the operational needs of the EU Member States.

Prototyping for implementation of selected use cases (to be consolidated along the implementation):

- Development of a prototype consisting in multiple integrated tactical bubbles in military networks including demonstration and/or prototyping of different interoperable tactical bubbles and end-to-end tactical networking, also integrated with military assets.
- Presentation, if possible, of the study results and execution of a demonstration with use cases.

Testing:

- Testing of the supported operational capabilities and present solutions for life cycle management, with the aim of increasing efficiency and cost-savings.

Functional requirements

The proposed solutions must fulfil the following requirements:

- Utilising 3GPP³ 5G standards (NR⁴, 5GC⁵, slicing, FWA⁶)
- 5G Stand-alone solution
- Redundancy and security needed for critical solutions. Especially solutions considering the needs in terms of confidentiality, integrity and availability, when facing threats (including cyber threats) corresponding to the military use cases for ‘active cyber defence’
- Interoperability and integration with existing military infrastructure
- Low EMC⁷ impact
- Implementation in a highly regulated spectrum
- Support for multi-dimensional operations
- Flexibility in network design leading to differentiated services in rapidly changing levels of conflict
- Leveraging commercial 5G networks for certain use cases
- SWaP for the different use cases
- Ease/rapidity of deployment and associated tools (orchestration)
- Low maintenance solutions, for long-term deployment
- Interconnection of sensor technologies
- Human factor integration (HFI)
- Interface for integration in mobile control units

³ 3G Partnership Program, Global Standardization organization for the Mobil standards 3G, 4G, 5G and 6G

⁴ New Radio, the new radio optimized for mid- and high band radio spectrum specified by 3GPP

⁵ 5G Core Network

⁶ Fixed Wireless Access – the use case replacing fibre to homes and offices

⁷ Electromagnetic compatibility

- Robustness in design, including radio silence within seconds, broadcasting downlink without disclosing the receiver, millimetre waves usage, flexible/self-configuring network design and backhaul
- Support for geofencing⁸.

Expected impact

The long-term effects should benefit a future strong, competitive and innovative technical and industrial defence development within EU Member States, by contributing to sovereignty, security of supply and security. In particular, the expected impacts are:

- To allow command entities to base their decisions on suitable timely and accurate information and to be able to transmit information swiftly and securely to relevant actors. This includes command, control and communication (C3), intelligence, surveillance and reconnaissance (ISR), sensors and electronic warfare.
- To reduce the cost for European military missions through verified knowledge of using COTS⁹/MOTS¹⁰ products in civil- and peacekeeping defence environments , thus to increase efficiency and cost-saving across the life cycle and benefit from cost.
- To create a European reference for standardised Tactical bubbles and hybrid SDN technologies for interoperability of SDN solutions that will improve the capabilities of the European defence industry to develop and supply state-of-the-art communication solutions.
- To reinforce interoperability of EU Member States armed forces, interoperability of SDN solutions with NATO FMN¹¹ initiative.
- To contribute to an increased EU military autonomy in this strategic area, where major actors are heavily investing.
- To create a European ecosystem platform for secured 5G devices and infrastructures, including hybrid networks (utilizing both civilian and military radio technologies), configuration and management tools and cyber security fit for military use.
- Demonstration of adaption of an appropriate industry standard to military needs.

⁸ Geofencing is the use of the global navigation satellite system (GNSS) and/or local radio-frequency identifiers (such as 5G radio base stations, Wi-Fi nodes or Bluetooth beacons) to create virtual boundaries around a location.

⁹ Commercial off the shelf, using standard products and software, rather than customer tailored products. Benefitting the purchasing organisation.

¹⁰ Military making use of COTS (and the high development pace of consumer products).

¹¹ North Atlantic Treaty Organization's Federated Mission Networking