

## **EDF-2021-MATCOMP-R: Advanced materials and structures, and critical electronics**

### **Proposals are invited against the following topics:**

**EDF-2021-MATCOMP-R-PHE:** Materials and structures for enhanced protection in hostile environments

### **Budget**

The Union is considering a contribution of up to EUR 40 000 000 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.**

### **Specific challenge**

Military platforms and military personal protective equipment have to ensure a high level of protection against a large scope of threats and reduce risks of injuries for mounted and dismounted soldiers. This topic is motivated by three long-term challenges:

- New protective systems with the required ballistic protection levels call for substantive investment but after a few years of deployment, the level of protection is most of the time unknown and decisions to discard, redeploy or upgrade, are often taken on uncertain basis or not taken at all. Therefore, the first challenge is to improve proving and certification of durability of current and new materials and protective systems in order to increase the confidence for procurement agencies and industries.
- Soldiers are not sufficiently protected against certain threats and new solutions must be developed to reduce the risk of injuries. The second challenge is to find materials, which could protect against new threats.
- The third challenge is to find new concepts of materials, which will be more environmentally friendly, and could reduce EU dependence on certain industries, for instance oil industries. This will ensure Europe's capability and independence regarding export control constraints from non-European entities on such critical and strategic materials.

Adequate testing facilities are of utmost importance in all phases of the material and processes development, especially for screening candidate solutions, to generate experimental data (mechanical, thermal, physical, chemical properties, etc.). Hence, the design of new test facilities is to be encouraged.

### **Scope**

The topic encompasses research activities on existing materials or new materials or concepts of protection taking into account the specificities listed in the following sections. All types of materials can be considered, for instance: ceramics, polymers, thermoplastics, metals, textiles, hybrid polymer composites, damping materials, nanoparticles and nanocomposites, metamaterials (where the properties of the armour will depend not only on the properties of the material, but also from its structure), .... Considered technologies also include protective systems, non-destructive testing, design methods and tools, numerical modelling and

characterization and testing methods. The scope of the topic includes consideration of cost/performances and lifetime/recyclability compromises and the fact that materials and raw materials should as much as possible come from European sources to secure the European supply chain. The establishment of this European industry will require working in parallel on all materials manufacturing stages: raw materials (powder, UHTC, etc.), materials manufacturing processes, characterisation of the materials obtained, non-destructive control technology for advanced materials manufacturing. Proposals must also identify elements of a platform to test the outcome of current and future projects in terms of performance and functionality relevant to the activities performed during the project.

### **Targeted activities**

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

- Activities aiming to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence;
- Studies, such as feasibility studies to explore the feasibility of new or improved technologies, products, processes, services and solutions;

On the objective of maintaining the ballistic performances when ageing naturally or artificially the proposal must address in particular:

- A study on the state of the art of ageing capabilities of materials or protective systems to identify necessary further development in Europe,
- Improvement of knowledge of ageing capabilities of materials or protective systems and their dependence on different environmental and operational conditions,
- Study of methods to detect potential failures (non-destructive testing...),
- Study of methods to optimize decision to discard, redeploy or upgrade.

On the objective of protection against new threats that are not considered today for vehicles and dismounted soldiers, the proposal must address in particular:

- Research activities to improve knowledge, products and technologies of materials or protective systems against novel threats,
- Improvement of design methods and tools.,
- Improvement of numerical modelling and characterization and testing methods,
- Study of innovative concepts, new materials, new processes, assemblies or design methodology,
- Study to estimate requirements concerning weight/cost and eco-design. The compromises cost/performances and lifetime/recyclability must be addressed.

On the objective of improved materials protecting against current threats the proposal must address in particular:

- Research activities to improve knowledge, products or technologies in order to reduce weight and costs of armour and protective systems against standardized threats,
- Improvement of numerical modelling and characterization and testing methods,

- Study of eco-design capabilities and requirements for future systems (bio-sourced raw materials, recycling...). The compromises cost/performances and lifetime/recyclability must be addressed
- Activities aiming to improve damper technology to increase the dynamic reliability of the frame armour structure

On the testing platform, the proposal must address:

- Study to identify existing services and explore the feasibility of new or improved services to screen candidate solutions and test their protection levels against military requirements and to generate experimental data, taking into account accessibility for new and non-traditional players in the defence sector.

### **Functional requirements**

The proposed materials technologies should fulfil the following requirements:

- Withstand ageing (naturally or artificially) while maintaining the ballistic protection performances
- Have reduced weight and cost
- Be compliant with REACH and safety/environmental constraints (eco-design) with as little defence exceptions as possible.

Protective materials against new threats should consider one or more of the following list of threats:

- level 5 to 6 from STANAG 4569,
- laser for protecting equipment inside the vehicle,
- microwaves,
- blast overpressure and fragmentation threat for the dismounted soldier.

Other exploratory threats may potentially be considered. The proposed materials design methods should take into account the final use of the material.

Concerning the protection against new threats and the improved materials protecting against current threats, materials and raw materials should as much as possible come from European sources. The materials manufacturing routes of the proposed technologies must reduce implementation time and costs. Particular attention will be paid to the possibility to produce complex and/or small materials parts, to minimise (or avoid) the machining post- densification, or to assemble different parts.

### **Expected impact**

- Enhance protection of soldiers against current and future threats
- Optimize life-cycle cost of protective equipment
- Facilitate the development of new materials and capabilities that a single Member State or individual government or company cannot afford alone;
- Foster an EU autonomous industrial sector;
- Reduce the time and cost for development of protective materials or systems;

- As far as possible, reduce dependency on critical raw materials for the design phase, or use recycling routes for the components/subcomponents;
- Contribute to the strategic autonomy of the EU
- Contribute to characterization and testing of materials to foster the integration of the outcome of current and future systems into existing systems.