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ANNEXES 1 to 2

ANNEXES

to the

Commission Decision

**on the financing of the 'Preparatory action on Defence research' and the adoption of the
work programme for 2019**

ANNEX 1

Annual work programme for the implementation of the Preparatory action on Defence research for 2019

1.1. Introduction

The main objective of the Preparatory action on Defence research is to prepare and test mechanisms that can identify, organise and deliver a variety of Union funded cooperative defence research and technology development (R&T) activities to stimulate cooperation amongst R&T actors in all Member States.

The focus of the Preparatory action on Defence research is on defence rather than dual-use. Nevertheless it will be complementary with existing Union programmes such as the Specific Challenge "Secure societies – Protecting freedom and security of Europe and its citizens" under Horizon 2020 as well as R&T activities in the Member States and in the European Defence Agency (EDA). Union funding in the context of the Preparatory action on Defence research can only be used for R&T activities related to defence technologies, products and systems, and not to fund military operations.

In line with the objectives given in the 2019 budgetary remark for Item 02 04 77 03 — 'Preparatory action on Defence research' this work programme contains the actions to be financed and the budget breakdown for year 2019.

Legal basis of all actions of the 2019 work programme

Preparatory action on Defence research – Article 58(2) (b) of Regulation (EU, Euratom) 2018/1046 (the 'Financial Regulation')

Budget line

Item 02 04 77 03

Budget

- for actions implemented in direct management (1.2): EUR 4 465 000.
- for actions implemented in indirect management by EDA (1.3): EUR 20 535 000

1.2. Actions implemented in direct management

1.2.1 Hire of external expertise for the assessment of the applications received after a call for proposals

Amount

EUR 200 000

Description and objective of the implementing measure

Approximately 50 contracts for remunerated external experts within the meaning of Article 237 of the Financial Regulation are expected to be awarded in 2019 (2nd semester, stage 1) and 2020 (1st semester, stage 2) for the assessment of an expected number of 200 proposals (two-stage evaluation procedure, 3 experts per application).

1.2.2 Procurement of services for a high level conference of PADR

Amount

EUR 300 000

Description and objective of the implementing measure

Organisation of a high level conference in order to assess the achievements of PADR in view of the implementation of the European Defence Fund in 2021. (One service contract, 2nd semester 2019).

1.2.3 Grants following a call for proposals

Indicative amount of the call

EUR 3 965 000

Description and objective of the implementing measure

One call for proposals (PADR-FDDT-OPEN-03-2019 '*Challenging the future*') will result in the selection of up to 3 projects on potential **disruptive defence technologies**: these projects should demonstrate (convincing experimental proof of concept) the radical impact of technologies of any kind in the area of defence bringing technological superiority over potential adversaries.

Type of applicants targeted by the call

Grants will be awarded to possible new actors in defence research and innovation, including excellent young researchers, ambitious high-tech Small and Medium-Sized Enterprises (SME), visionary research centres of big companies and research and technology organisations. Entities established in a Member State or Norway¹ shall be eligible to apply.

1.3. Actions implemented in indirect management

Management of grants for defence research projects on behalf of the EU

Amount

EUR 20 535 000

Implementing entity

The entrusted actions shall be implemented by the EDA through the delegation agreement signed in 2017 between EDA and the Commission on behalf of the European Union.

The choice of the Agency for the delegation agreement is justified by its knowledge and its recognised experience in the organisation and management of research projects and

¹ Legal entities established in Norway shall be eligible for funding provided that Protocol 31 to the EEA agreement authorises the participation and the financial contribution of the Kingdom of Norway in the PADR. The PADR annual work programme and the Decision of the EEA Joint Committee shall be adopted in the same year.

programmes in the area of defence, its unique role in the Union and its experience from the implementation of the Pilot Project in Defence research in 2015 and 2016, in preparing and launching the call for proposals, organising the evaluation of the proposals, signing the grant agreements, monitoring and controlling the progress of the projects.

The Commission wants to test this mode of management in this area and assess the capability of the Agency to undertake the implementation of work programmes.

Actions regard in particular the use of the IT tools used for the management of Horizon 2020 projects, the establishment of a database of evaluators of the proposals through an open call, the implementation of an ethical scrutiny of the proposals and the establishment of a detailed framework for the treatment of EU Classified Information (EUCI)².

The Commission shall closely monitor the implementation of the entrusted tasks, through regular reporting and meetings with EDA. The Commission shall provide to EDA the technical description of the topics as set out in Appendix to this Annex³ and the rules for participation of the action, in line with the requirements of the Financial Regulation. The Commission will receive the evaluation results and have the right to ask for clarifications and modifications when necessary at any part of the implementation phase.

In accordance with the Delegation Agreement signed with EDA on the 31 May 2017, the Agency shall be allocated up to EUR 1 435 000 to cover expenditure related to the management of the relevant tasks for 2019.

Description and objective of the actions

In 2019, the Agency will run the following actions on behalf of the Union:

- 3 calls for proposals focused on critical defence technologies:

The first call (PADR-EMS-03-2019 '*Electromagnetic Spectrum Dominance*') will result in the selection of one project for research activities at system and component levels for the development of compact, highly performing and lightweight **multifunction radiofrequency systems** (combination of radar, communications and electronic warfare functions), based on a European Active Electronically Scanned Array (AESA) technology, free from any non-EU nations end-user restrictions and compatible with aerial platforms with the possibility to be integrated in other platforms. (Indicative amount of the call: up to EUR 10 million).

The second call (PADR-FDDT-EMERGING-03-2019 '*Emerging Game-changers*') will result in the funding of 5 projects to contribute to the development of breakthrough technologies for defence applications under the following topics:

- low drift, small scale, power efficient, integrable systems capable to deliver **autonomous Positioning, Navigation and Timing (PNT)** services in GNSS denied/contested environments;
- use of **Artificial Intelligence** in defence technologies across the whole military capability spectrum;
- use of **quantum technologies** for defence applications;
- radical solutions for cost-efficient **long-range precision strikes**;
- **augmenting soldier capacity**.

² EU Classified Information

³ The topics and the technical descriptions were defined in close coordination with technical experts from the Ministries of Defence of all the EU Member States

(Indicative amount of the call: up to EUR 7 500 000).

The third call (PADR-US-03-2019 '*Unmanned Systems*') will fund one project on **interoperability standards for military unmanned systems** allowing interoperability of various defence units using autonomous systems. (Indicative amount of the call: up to EUR 1 500 000).

The proposals shall be evaluated on the basis of the following award criteria:

- (a) excellence,
- (b) impact;
- (c) quality and efficiency of the implementation.

Union funding may reach 100% of the total eligible costs. Indirect costs shall be determined in accordance with article 5 of this decision. The award of the grants is expected for the 3rd quarter of 2019 and the duration of the projects is expected to be between 12 and 30 months.

Type of applicants targeted by the calls for proposals

Grants will be awarded to consortia made of legal entities established in a Member State or Norway shall be eligible to apply.

- IN 2019, the Agency will also run the following action on behalf of the Union: call for tenders launched by EDA for independent experts recruited for the evaluation of proposals submitted in response to the calls described above (EUR 100 000).

A more detailed description of these actions is provided in the Appendix.

Appendix
Detailed description of the actions – 2019

Call – Electromagnetic Spectrum Dominance – PADR-EMS-03-2019

Situational awareness nowadays goes well beyond air, sea, land, or space. The electromagnetic environment has become an integral yet still very different part of the modern warfare manoeuvre space. Next to the more traditional functions of sensing and communication, electronic warfare (EW) plays a key role in dominating this environment: knowing how and why the spectrum is used, ensuring the spectrum can be used as deemed necessary whilst denying other actors to use it for their purposes⁴. Advanced electronic architectures allow optimising the combined use of radar, communications and/or EW functions in a single functional integrated system. With more, different and increasingly complex threats emerging - in combination with a rapid deployment in an ever more congested spectrum - there is a critical need to invest in developing advanced radiofrequency (RF) systems for many defence applications in many warfare domains to ensure that Member States can maintain their strategic autonomy while guaranteeing the security of supply of the necessary systems and components.

Proposals are invited against the following topic:

Combined radar, communications, and electronic warfare functions based on European Active Electronically Scanned Arrays for military applications

Specific Challenge:

With smaller manned and unmanned platforms increasingly being used for Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) missions, there is a strong need to design compact, highly performing and lightweight multifunction RF systems. Moreover, with an increasing range of multifunction RF systems and new EW threats appearing rapidly, such platforms should also be resilient to operate in the presence, react to and suppress such systems and threats when participating in military operations and playing a role in the battlefield. A complex yet very promising solution is to develop European advanced Active Electronically Scanned Array (AESA) technology allowing an optimal combination of radar, communication and EW functions into a single multifunction RF system.

Europe has a strong position in advanced military RF systems. Yet the risks are high that the Union becomes severely dependent on suppliers established in third countries for this critical defence technology. This not only limits the strategic autonomy of the Member States but also generates security-of-supply risks. End-user restrictions imposed by third countries (e.g., the US International Traffic in Arms and Export Administration Regulations (ITAR and EAR))

⁴ For the purpose of this call and in accordance to most modern military doctrines/NATO terminology, Electronic Warfare (EW) is not considered as a single discipline, but as an overarching term covering Electronic Attack (EA), Electronic Defence (ED) and Electronic Surveillance (ES).

already endanger the security-of-supply of essential electronic components of certain RF systems.

To remove such important limitations, a research and technological development (R&T) action, potentially later on followed by further and/or development actions, needs to be initialised to design and build in Europe a multifunction RF system based on AESA technology for a broad range of applications, to become available for defence applications in several military domains within the next decade.

Scope:

European multifunction RF systems should integrate several functionalities in one system. This approach requires new system design technologies and the use of new architectural frameworks as well as the integration of electronic components. This would allow the sharing of many RF components and building blocks, managing these via an intelligent automated resource management system, leading to savings in size, weight, power as well as cost and capability benefits. Care should be taken to ensure optimal performance of the overall system whilst keeping it modular and scalable.

At the component level, high-power, high-frequency, broadband components, highly performant under harsh military conditions are key enablers for the realisation of multifunction RF systems. As an example, incremental advances in Si or GaAs-based transistors resulted in operating respectively into the low GHz range and medium power levels. This is no longer sufficient to meet the current demand of increasing the carrier frequencies, achieving broader, instantaneous and tuneable bandwidths, and delivering higher power and efficiencies. For this, completely new devices based on advanced materials, architectures and processes need to be developed and reliably fabricated in relatively large volumes.

As an example, next generation systems, such as photonics-based systems amongst other technologies, are even based on very different technologies, primarily to reach higher performance in the frequency domain while avoiding noisy up and down conversions. This would allow, for example, for synthetic aperture radar (SAR) imaging with superior resolution, broadband ES and EA operation, as well as high-bandwidth data transmission and improved sensor resilience.

Proposals need to include in the proposed activities both (1) a R&D assessment with a criticality mapping and (2) the implementation of balanced R&T activities at system as well as at component level, based on the assessment and criticality mapping.

The proposal should include a high-level description of the key performance indicators (KPIs) for the envisaged functionalities and the methodologies on how to measure them. A report with a detailed description of these KPIs and methodologies should be delivered within 6 months after the start of the project.

1. R&D ASSESSMENT

Proposals should cover an R&D assessment for a joint Union development programme for a multifunction RF (radar, EW and communication) system based on AESA technology without end-user restrictions by third countries, including a technology roadmap. A size, weight, power and cost (SWaP-C) and cooling analysis should be performed to support the proposed solutions, and a cost estimate provided for the development of a prototype (TRL 7) by 2027 based on technologies without end-user restrictions by third countries.

The operational use will be based on the ability of the system to provide radar, EW as well as communication functions⁵.

The system definition should be in line with the following technical requirements:

- the three functionalities should be integrated in a single aerial platform and ideally adaptable to more types of platforms, with an appropriate surveillance and reconnaissance, classification and identification, targeting and fire control, communications and EW capability and the possibility for single antennas/pods to concurrently perform some of them and to switch efficiently between them;
- the use of AESA for EW applications such as ES for detection and identification of waveforms and EA for countering threats should be analysed and assessed in the framework of multifunction system;
- the system should fully cover a bandwidth of 2-18 GHz and partially address regions of the electromagnetic spectrum up to 40 GHz.

Moreover, fully-electronic RF systems⁶ should also comply with:

- the waveform (radar, EW, and communication) shall be digital, i.e., it will be stored and/or processed in digital format, and converted to analogue signal for transmission. In the design, the concepts of Software Defined Radar should be used;
- the antenna pattern should be formed by digital means, i.e., the information (phase or time) to compose the antenna pattern should be sent in a digital format to each - preferably digital - Transmit Receive Module (TRM) which will generate the appropriate signal to the radiating element to form the beam pattern.

The architecture and the functional specifications of the building blocks of the multifunction AESA-based system should be compatible for use in an aerial system, with the possibility to fully or partially adapt the technologies for other systems which are very demanding in terms of SWaP-C. The values of the performance parameters for all three functions and the concurrent modes capability should be analysed in detail.

Concepts of employment and use of the system should be provided as part of the assessment.

The architecture should allow the system to adapt its performance to future improved characteristics of the enabling components and technologies.

Criticality mapping

Applicants should propose a criticality mapping to identify materials, components and/or technologies that need foremost priority support because of technological or economic bottlenecks. Insufficient R&D capacity in the Union at the early stages of the development as well as a lack of industrial capacity (including skills) towards the pre-manufacturing stages of

⁵ A generic scenario to reflect the technical and operational requirements is provided in Annex J to the Calls for Proposals and General Annexes (EUCI classified).

⁶ In the meaning of systems which are not based on photonics-assisted RF generation and/or detection.

the multifunction AESA-based system should be mapped. End-user restrictions imposed by third countries should be avoided.

The deliverables related to the R&D assessment and the criticality mapping will be annexed to the Special Report⁷.

2. R&T ACTIVITIES

The applicants should propose R&T activities at the system level as well as at the component level in line with the proposed roadmap and criticality mapping.

(a) System level

The objective of the proposed RF AESA-based system is to demonstrate the joint and coordinated operation of radar, EW and communications functions in at least a laboratory environment.

In order to achieve this objective, research activities should therefore cover developments, or at least show tangible progress on the following areas:

- broadband antenna array with particular attention to grating lobes and electronic scanning performance;
- for fully-electronic RF systems, a digital beam former with multi-beam capability in Tx/Rx for EW;
- a resource manager able to coordinate the EW functions with the radar and communication ones in order to optimise the overall system performance in various scenarios.

Applicants can decide the extent to which they will cover in their proposal each of the above areas.

(b) Component level

Research activities should cover at least one design-fabrication-test cycle of a high-power, high-frequency, high as well as instantaneous and tunable bandwidth Transmit/Receive (Tx/Rx) module. Consortia should thereby rely on the production capabilities of ideally more than one trustable⁸ fab or foundry established in the Union.

Solutions to optimise the heat dissipation and achieve better and more cost-effective packaging of the integrated circuits should be included in the proposals.

A high-level description of the KPIs for state-of-the-art performance of the envisaged functionalities, and of the methodologies on how to measure them should be included for both subtopics. A report with a detailed description of these KPIs and methodologies should be delivered within 6 months after the start of the project.

Hardware and software products used or developed in the context of both sub-topics should not be subject to non-EU export control regulations.

⁷ Model in Annex I of the 2019 Calls for Proposals and General Annexes.

⁸ I.e. commercially open, with a qualified process.

The solutions or technologies proposed for the defence domain could also be assessed for other potential use, in particular in the security and space domain⁹,

When relevant, results publicly available from EDA and NATO activities and studies should be taken into account for the proposed work. The activities included in the proposals should clearly differentiate from or go beyond work already covered under relevant themes of the Union Research and Innovation Framework Programmes.

The implementation of both R&T subtopics is intended to target at least TRL 4.

The Commission considers that proposals requesting a contribution from the Union between EUR 9 000 000 and 10 000 000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

No more than one action will be funded.

The lifetime of the proposed project should not exceed 30 months.

Expected Impact:

- convincing demonstration of the potential of Union funded research in support of Union critical defence technologies, in particular in the domain of multifunction RF system;
- establish a R&D assessment including a technology roadmap towards a joint Union development programme for a multifunction RF system based on AESA technology with milestones and estimated budget needs;
- ensure secure and autonomous availability of multifunction RF systems to military end-users by 2027;
- contribute to strengthening the European industry and help improve its global position through the implementation of innovative technologies along a new European manufacturing value chain.

Call – Future Disruptive Defence Technologies - PADR-FDDT-2019

The development of new defence products and services very often relies on incremental improvements of existing ones leading to a higher performance or more efficient operation of established capabilities. However, technologies are emerging that could – when used in a military context – radically change the balance of military power between opponents. Such disruptive technologies for defence then lead to game-changing shifts in military paradigms. Exploring innovative technologies for defence use is thus essential to alter or maintain technological dominance.

Proposals are invited against the following topic(s):

⁹ Applicants are invited to consult the Work programme 2018-2020 "5.iii. Leadership in Enabling and Industrial Technologies – Space", and in particular the technical guidance documents listed in the Work programme.

PADR-FDDT-OPEN-03-2019: Challenging the future

Specific Challenge: To lay the foundations for radically new future technologies of any kind with unexpected impact, that aims to bring radical technological superiority over potential adversaries. This topic also encourages the driving role of new actors in defence research and innovation, including excellent young researchers, ambitious high-tech SMEs and visionary research centres of big companies and research and technology organisations.

Scope: proposals are sought for **cutting-edge, high-risk/high-impact research leading to game-changing impact in a defence context**. They must have all of the following essential characteristics:

- **a disruptive impact in a defence context:** the proposal need to clearly address how the proposed solutions would create a disruptive effect when integrated in a realistic military operation;
- **radical vision:** the proposal must address a clear and radical vision, enabled by a new technology concept that challenges current paradigms. In particular, research to advance on the roadmap of a well-established technological paradigm, even if high-risk, will not be funded;
- **breakthrough technological target:** the proposal must target a novel and ambitious science-to-technology breakthrough as a first proof of concept for its vision. In particular, blue-sky exploratory research without a clear technological objective targeting defence applications will not be funded.

The inherently high risks of the research proposed shall be mitigated by a flexible methodology to deal with the considerable science-and-technology uncertainties and for choosing alternative directions and options.

Proposals should include an assessment of the ethical, legal and societal impact of the proposed solutions.

The implementation of this topic should not go beyond the delivery of a convincing experimental proof of concept.

The Commission considers that proposals requesting a contribution from the Union of up to EUR 1 500 000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

The lifetime of the proposed project should not exceed 24 months.

Expected Impact:

- scientific and technological contributions to the foundation of a future technology with disruptive applications in the area of defence;
- potential for future social or economic impact or market creation;
- building leading defence research and innovation capacity across Europe by involvement of key actors that can make a difference in the future, for example

excellent young researchers, ambitious high-tech SMEs, visionary departments of big companies, research centres and universities;

- convincing demonstration of the potential of EU-funded research for defence applications.

PADR-FDDT-EMERGING-03-2019: Emerging Game-changers

Specific Challenge: Anticipated and ongoing advances in several technology areas will continue to have a substantial impact on the defence sector. Emerging technological directions need to be explored and consolidated, in order to analyse and exploit their disruptive potential on the defence sector. The communities that are able to drive this forward need to be encouraged to extend from the participating consortia to a wider European pool of expertise, thus stimulating the emergence of a European innovation eco-system with strong relations with the defence sector around a new technological paradigm, well beyond the world of research alone, including military end-users.

Scope: Proposals are sought for cutting-edge high-risk/high-reward research projects that aim to demonstrate a new technological paradigm within the scope of one or more of the following sub-topics. Applicants can submit proposals which are in scope of several sub-topics but are requested to indicate one sub-topic as the main scope of the proposed research activities.

(1) Autonomous positioning, navigation and timing

Global Navigation Satellite Systems (GNSS) have a profound impact on military positioning, navigation and timing (PNT) services which however critically depend on reliable satellite signals. The availability of these signals cannot be assured under all conditions because operations can take place in GNSS denied/contested environments or because of the physical limitations of the current technology.

A promising complementary device would be autonomous PNT sources that can be used without the need for position or timing updates. Relevant factors for considered solutions should be low drift, small scale, power-efficiency and integrability.

(2) Artificial Intelligence (AI) for defence

The ambition of achieving Artificial Intelligence (AI) drives promising breakthrough technologies, expected to become significant in many fields in the area of defence. Their potential for the defence domain is huge, as AI solutions are expected to play an important role in critical fields such as cyber defence, C4ISR systems, intelligent and autonomous unmanned systems and swarms, electronic warfare, data fusion, logistics and maintenance optimization, information processing and intelligence analysis, mission planning and control, war gaming and training, which could radically accelerate the cycle of military operations and deeply influence the military practices.

Proposals are invited for research activities that apply AI in defence technologies in any part of the military capability spectrum, including for cyber defence.

(3) Quantum technologies for defence applications

The advancement of quantum technologies is expected to impact profoundly military operations. Quantum information processing, quantum communication, quantum key distribution and quantum sensing technologies will probably produce a paradigm shift in many fields, such as C4ISR, navigation, object and chemical detection etc.

Research proposals in this subtopic should address areas in quantum technologies with clear military applications.

(4) Long-range effects

The operational challenges and specificities of the modern military missions and the rapidly growing cost of use of the defence systems require radical solutions for cost-efficient long-range precision strike. The separate or combined use of electromagnetic railguns, guided ammunition and hypervelocity projectiles, among other things, has been proposed and explored with promising results.

Proposals in this sub-area should feature research activities aimed towards solutions which would provide a disruptive change in the area of long-range fire support.

(5) Augmenting soldier capacity

Soldiers have to operate in increasingly demanding and complex environments, performing different and multiple tasks. Soldiers' equipment becomes increasingly heavier and more complex, adding to the challenge of accomplishing their missions in a better, faster and more efficient way. Potential solutions for augmenting the capacity of the soldiers to perform their tasks have been studied, ranging from the enhancement of their physical capacities by using exoskeletons and robotic systems, to applying augmented reality for increased situational awareness.

Research in this area should propose solutions which would radically increase the capacity of the modern soldiers to perform physically demanding or mentally exhausting tasks..

The proposals should include a high-level description of the key performance indicators (KPIs) for the envisaged functionalities and the methodologies on how to measure them. A report with a detailed description of these KPIs and methodologies should be delivered within 6 months after the start of the project.

When applicable, proposals should include an assessment of the ethical, legal and societal impact of the proposed solutions. The inclusion of an assessment of the ethical, legal and societal impact for all the proposed solutions for subtopics 2 and 5 is mandatory.

The implementation of this topic is intended to target TRL 3-4.

The Commission considers that proposal requesting a contribution up to EUR 1 500 000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

The Commission intends to fund the highest ranked proposal per subtopic (with proposals being evaluated separately within each sub-category). In case none of the proposals submitted

to one or more sub-topics are fundable, the proposals second ranked proposal in each of the remaining sub-topics will be ranked following their evaluation score. This ranked list will determine the priority order of funding additional proposals within the limit of the available budget.

The lifetime of the proposed project should not exceed 24 months.

Expected Impact:

- scientific and technological contributions to the development of a new future technology with target applications in the area of defence;
- potential for future social or economic impact or market creation;
- building leading defence research and innovation capacity across Europe by involvement of key actors that can make a difference in the future, for example excellent young researchers, ambitious high-tech SMEs or visionary departments of big companies;
- convincing demonstration of the potential of EU-funded research for defence applications.

Call – Unmanned Systems - PADR-US-03-2019

Unmanned systems are already broadly used by the armed forces to conduct a wide variety of tasks. Technological improvements and breakthroughs in microelectronics, data processing, guidance, navigation and control, as well as increased complexity of the military tasks and missions are expected to broadly expand the use of unmanned systems in the defence domain. The extensive, novel and perhaps intensive operation of unmanned systems in homogeneous and heterogeneous swarms, operated by or/ and operating together with human actors requires addressing technical aspects concerning the interoperability and standardisation of different systems, equipment, components, procedures in order to maximise and optimise the adoption and integration of unmanned systems in the armed forces.

Proposals are invited against the following topic:

Interoperability standards for military unmanned systems

Specific Challenge:

Interoperability of defence systems is key for the ability of different forces to operate safely and effectively together in joint or combined operations. It can be challenging for the armed forces to achieve desired levels of interoperability. Interoperability relates on a technical level to the possibility of connecting or commonly using equipment and systems. This can be enhanced by e.g the use of open standards or joint architectures. But interoperability can also require interlocking processes and can even have implications on concepts of use and employment of systems. The increased use of unmanned systems (UXS, in which "X" can stand for "A" (aerial), "S" (surface), "G" (ground) or "U" (underwater)) of modern forces in multi-national operations require multi-national interoperability, cross-domain interoperability, effectiveness, as well as adaptability of systems to mission and mission intensity, which may imply upgrade and adoption of novel payloads or maintaining and upgrading equipment at state-of the art or standardising the human-machine interaction.

Scope: Interoperability can exist at different levels. Proposals are invited to focus on interoperability and standardisation of systems, subsystems, components and procedures of complex UXS platforms in a network centric environment. Proposals can address, amongst other, topics such as:

- the coordinated use of multiple platforms, datalink aspects (including standardised security), and standardisation of control stations to simultaneously control several platforms and to control the handover between stations;
- intra-system interoperability: interoperability between the subsystems and payloads within a system, with standard interfaces, leading to plug-and-play connection capability, making it thus easier to install new and/or change mission payloads;
- standardisation of the modules, interfaces and information formats to simplify the design of new and the upgrade of existing UXS;
- robotic hardware standardisation to allow for the exchange of robotic elements in military applications;

- interoperability between UXS; manned systems and UXS; soldiers, manned systems and UXS;
- concepts for interoperability between military units utilizing autonomous systems.

The proposed activities should include a demonstration of the effectiveness of the proposed approach.

The proposals should include a high-level description of the key performance indicators (KPIs) for the envisaged functionalities and the methodologies on how to measure them. A report with a detailed description of these KPIs and methodologies should be delivered within 6 months after the start of the project.

The Commission considers that proposals requesting a contribution from the Union up to EUR 1 500 000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

When relevant, results publicly available from EDA and NATO activities and studies should be taken into account for the proposed work. The activities included in the proposals should clearly differentiate from or go beyond work already covered under relevant themes of the EU Programmes.

No more than one action will be funded.

The lifetime of the proposed project should not exceed 24 months.

Expected Impact:

- convincing demonstration of EU-wide research cooperation in defence research;
- promotion of intra-/inter-system interoperability for unmanned systems;
- increase of modularity and reduction in life cycle costs for unmanned systems;
- enhancement of the effectiveness of military personnel and systems.

Evaluation experts

This action will support the use of appointed independent experts for the evaluation of proposals, where appropriate.

Type of action: recruitment of remunerated external experts within the meaning of Article 237 of the Financial Regulation

Indicative budget: EUR 300 000 from the 2019 budget.

ANNEX 2

Justification, conditions and methodology of the lump sum approach applicable to the grants awarded under the Call PADR-FDDT-OPEN – 03-2019 'Challenging the future'-

1. FORM OF GRANT AND CATEGORIES OF COSTS COVERED

Grants under the Preparatory Action for Defence Research (PADR) may take the form of a lump sum, for calls or topics specified in the Work Programme 2019.

This lump sum will be determined for each grant by the Commission on the basis the following principles:

- (a) the lump sum must be an approximation of the beneficiaries' underlying actual costs;
- (b) the applicants must propose the amount of the lump sum on the basis of their estimated direct and indirect project costs and in accordance with the method described in Section 3;
- (c) the proposal must show the costs and categories of costs covered by the lump sum, may contain only costs that would be eligible for an actual costs grant and must exclude costs that are ineligible according to the provisions of Regulation (EU, Euratom) 2018/1046 (the 'Financial Regulation' or 'FR') (Article 186(3) FR);
- (d) the Commission will apply the method in Section 3 to fix the lump sum, based on the proposal and the evaluation result;
- (e) the 25% flat rate for indirect costs and reimbursement rates are included in the calculation of the lump sum (see Section 3).

Payments do not depend on the costs actually incurred.

The lump sum will be paid by the Commission, if the corresponding work packages of the action have been properly implemented in accordance with Annex 1 of the grant agreement (and provided that all other obligations under the grant agreement have been complied with).

Lump sums whose conditions have been fully met during a reporting period are paid to the coordinator.

Lump sums whose conditions have not been fully met during a reporting period are not paid, but could be paid in the subsequent reporting period if the conditions are fully met.

Lump sums whose conditions are not met in any reporting period are not paid and the grant is reduced by an amount up to the value of the lump sums concerned following a contradictory procedure with the coordinator or beneficiary concerned.

2. JUSTIFICATION

Simplification is the central aim of the Commission in the management of grant schemes and needs to be reflected in its design, rules, financial management and implementation.

Lump sum funding, when compared to reimbursement of actual costs, provides considerable simplification potential. It removes all obligations on cost reporting and financial audits, thus removing a major part of the administrative burden on beneficiaries and enabling efficiency gains in the implementation of grants. At the same time, lump sum funding strongly increases the focus on the scientific-technical performance and output of projects and improves the quality of results and their exploitation.

Lastly, the lump sum approach is desirable in PADR in order to:

- minimise the implementing costs of a specific strand of the preparatory action which will be implemented in direct management mode by the services of the Commission;
- test the lump sum process on a limited sample of projects to build the necessary standard documents and procedures before extending these to the next MFF programme.

Furthermore, lump sums are fully in line with the Commission's initiative Budget Focused on Results and the underlying principles of the new Financial Regulation.

Risks of irregularities and fraud and costs of control

The Commission will verify at the time of preparation of the grant, during the implementation of the action or afterwards (through technical checks, reviews or audits), compliance with the conditions for using lumps sums.

As a direct consequence of removing all obligations on cost reporting and financial ex-post audits, financial error rates will be minimised.

Pre-financing will follow the standard H2020 rules, and will be fixed in the grant agreement.

There is no report of actual costs, and there are normally no financial checks, reviews, or audits. Beneficiaries have no obligation vis-à-vis the Commission to document costs incurred for the action but they remain subject to the accounting rules under the applicable national law.

Checks, reviews, and audits will focus on the technical implementation of the action, in particular on the fulfilment of the conditions for releasing lump sums, or on other aspects of the grant agreement such as ethics and research integrity, dissemination and exploitation of results, management of intellectual property, and gender equality.

If such controls reveal that the conditions for payment of the lump sum had not been met (e.g. a particular work package had not been completed), and that an undue payment was made to a beneficiary, the Commission is entitled to recover up to the amount of the grant.

3. METHOD TO DETERMINE THE AMOUNT OF THE LUMP SUM

3.1 Grant proposal

- (a) The applicants must provide in their proposal a breakdown of the lump sum showing the share per work package (and, within each work package, the share assigned to each beneficiary and linked third party);
- (b) the proposal must describe the activities that are covered by each work package;
- (c) proposals for lump sum grants must contain the resources and a detailed cost estimate per work package and per beneficiary and linked third party;
- (d) the applicants must fill in a detailed budget table which shows the costs of each beneficiary in the following categories:
 - personnel costs, separately for each category of staff;
 - costs of providing financial support to third parties, when the possibility is provided for in the topic;
 - travel costs;
 - costs of equipment, infrastructure, and other assets (depreciation costs);
 - costs for consumables;
 - costs of other goods and services;
 - capitalised and operating costs of 'large research infrastructure', when the possibility is provided for in the topic;
 - costs of internally invoiced goods and services;
 - costs of subcontracting.

It may include only costs that would be eligible for an actual costs grant and must exclude costs that are ineligible under the Financial Regulation.

Beneficiaries must make a declaration that they have followed their own usual accounting practices for the preparation of the budget.

Indirect costs should be calculated by applying a flat rate of 25% to the direct cost categories that qualify for indirect costs.

3.2 Evaluation

- (a) Proposals will be evaluated by the Commission with the help of outside experts. The experts will assess the quality of the proposals in terms of scientific and technological excellence, expected impact and quality and efficiency of the implementation. The evaluation will be made in two procedural stages. Only the applicants who will pass the first stage will be invited to present a full proposal with a detailed provisional budget.
- (b) Experts with the necessary financial know-how will then check the detailed budget estimate and look whether the resources proposed and the split of lump sum shares along the delivery of work packages allows achieving the activities and expected outputs. Experts should check that proposals include the declaration by beneficiaries of having used their own accounting practices. For each work package, the budget estimate will be assessed for accuracy and appropriateness in view of the proposed resources.

- (c) Following proposal evaluation, the authorising officer may adapt estimated cost items that appear unjustified or not in line with the requirements in point 3.1 above (including in case of recommendations from the expert evaluators). If cost items are adapted, the lump sum and the lump sum breakdown will be modified accordingly during grant preparation.
- (d) The final lump sum is included in the grant agreement as the maximum grant amount. It is calculated by applying the reimbursement rate set out in PADR work programme (100%) to the total estimated eligible costs detailed in the budget table and after possible corrections of the responsible authorising officer.

4. NO-PROFIT AND CO-FINANCING PRINCIPLES AND ABSENCE OF DOUBLE FINANCING

As the lump sums will only cover eligible costs, the Commission will not finance the full actual costs of the supported actions. Therefore, the methodology described in Section 3 complies with the principles of no-profit, co-financing and absence of double funding as required by the Financial Regulation.

The usual conditions for ensuring that the no-profit, co-financing and absence of double funding principles are complied with, also apply to lump sums:

- (a) The cost estimate in the grant proposal is detailed and subject to an in-depth check by the evaluation committee to ensure it represents an approximation of actual eligible costs as described in points 3.1 and 3.2.
- (b) The reimbursement rates set out in the PADR work programme are reflected in the calculation of the lump sum.
- (c) Double funding is avoided by identifying the project costs that are covered by the lump sum.
- (d) Proposals will be evaluated with the help of outside experts, and according to the principles presented in section 3.2.