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ANNEX 3

ANNEX

to the

Commission Implementing Decision

on the financing of the European Defence Fund and the adoption of the work programme for 2025 - Part 2 and amending Implementing Decisions C(2023) 2296 final and C(2024) 1702 final as regards financial support to third parties

ANNEX 3

2025 call topics description

Table of contents

1. Content of the document

This document contains the description of all topics to be addressed by the eight EDF 2025 calls for proposals.

2. Call topic descriptions

2.1. Call EDF-2025-RA

- **Targeted type of actions:** Research actions
- **Form of funding:** Actual costs grants following the call for proposals
- **Targeted type of applicants:** Any eligible consortium as defined in Articles 9 and 10(4) of the EDF Regulation
- **Indicative budget for the call:** EUR 182 000 000 for 8 call topics addressing 7 categories of actions

2.1.1. EDF-2025-RA-MCBRN-ATE: Autonomous triage and evacuation

- **Indicative budget:** EUR 10 000 000 for this topic under the call EDF-2025-RA.
- **Number of actions to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

Large Scale Combat Operations (LSCO) between peer adversaries can result in mass casualty scenarios where the need for casualty care and evacuation dramatically outstrips available medical resources. Unmanned air, ground and sea vehicles could significantly improve evacuation capacity and enable rapid automated or fully autonomous battlefield triage, also under Chemical, Biological, Radiological and Nuclear (CBRN) conditions and in high intensity fighting areas, resulting in faster and more efficient care, increasing life and limb saving opportunities in the early stages of the evacuation chain. This call topic therefore addresses the urgent need to develop and validate innovative Robotic and Autonomous System (RAS), i.e., autonomous and robotic-assisted capabilities that address the specific challenges of military battlefield triage and evacuation in mass casualty scenarios, including CBRN contamination and ongoing high intensity fighting spots with limited or no access of first responders.

Specific objective

The development of unmanned military platforms for surveillance, reconnaissance and kinetic attack missions is progressing rapidly. Unmanned systems have the potential to substantially increase the RAS CASEVAC[1] evacuation capacity in mass-casualty scenarios, including

[1] RAS within the CASEVAC system combines autonomous CASEVAC platforms with sensors monitoring the patients during transport. It is a combination of "plug and play" command and control (C2) on the CASEVAC platform and health monitoring sensors following the patient, provided either by the combat medic or soldier equipment (health wearables). It should also be possible to add sensors that detect and identify potential CBRN-threats during the autonomous CASEVAC process of injured soldiers. The health sensors added to the CASEVAC platform provides real-time monitoring of the injury severity and vital signs for effective triage prediction/update.

CBRN contamination and ongoing high intensity fighting areas with limited or no access of first responders, and to expedite the triage, diagnostic and initial treatment process from the point of injury. The concept of autonomous triage in LSCO should be based on life threatening indicators as a minimum (i.e., covered in the START[2] algorithm). However, the realisation of such capabilities requires development of dedicated solutions that provide innovative damage site inventory of casualties, extraction, and unmanned systems (various platforms) with the ability to monitor and assess the health status of injured soldiers and adapt their behaviour accordingly. RAS CASEVAC platforms need to be able to continuously adapt their route and speed to all environment and weather conditions, unexpected events, threat level and the condition of on-board patients, while providing physical protection.

Scope and types of activities

Scope

This call topic targets two technologies that have the potential to save lives in LSCO mass-casualty scenarios, namely: (i) RAS within the CASEVAC system including autonomous battlefield triage, and (ii) autonomous CASEVAC system improving the overall logistics chain to/from the battlefield. The required novel functionalities include safe transportation of casualties to a suitable medical treatment facility following the golden hour timeline whilst providing a basic level of physical protection (towards shrapnel, small-arms fire and all-weather conditions) and patient monitoring.

Proposals must address the development of a RAS CASEVAC multi-role approach. Time is of the essence in LSCO missions so the proposals must explore easy re-configurations concepts and compatibility between different payloads – medical and non-medical – through an Interoperable Modular and Scalable Architecture (IMOSA) approach. This allows quick interchangeability of components and interoperability between different missions for the autonomous platform, including a "plug-and-play"[3] capability for (wearable) monitoring sensors and (wearable) patient care sensors, combined with remote patient assistance.

Proposals must address RAS within the CASEVAC system including autonomous battlefield triage. Particular attention should be paid to trusted autonomy for effective networked and autonomous and automatic CASEVAC missions, including a swarm-based manned-unmanned teaming (MUM-T) in demanding denied/contested environments.

The possibility of standardised interfaces should be explored to allow the integration of a variety of patient monitoring and CBRN-sensors to be used in different configurations depending on the CASEVAC mission, and to facilitate the use in defence, civil and dual-use configurations for efficiency in the logistics chain (evacuation chain). In addition, proposals may also address the potential synergy for use by law enforcement and other governmental use.

[2] The Simple Triage and Rapid Treatment (START) system is designed to assist the combat medic to triage the most seriously injured patients in 30 seconds or less – i.e., based on primary observations like Respiration, Perfusion, and Mental Status (RPM) and body temperature.

[3] Plug-and-play refers to the capability of systems to automatically recognise and assemble various system elements, like sensors, weapons, and control nodes, into a single integrated "supersystem" or system-of-systems. Plug-and-play systems can be rapidly reconfigured without interrupting operations – adding, removing, and rearranging system elements and sensors in response to evolving threats and changing scenarios.

Proposals must:

- Evaluate integration of sensors of the wounded soldier status during CASEVAC. This includes “plug-and-play” C2 to/from the chosen CASEVAC platform and integrate monitoring of patients during CASEVAC.

- Include a comprehensive model of the physiological evaluation of the casualties, which may be fed asynchronously with information acquired from the casualties health status and from the surrounding environment. Information needed to forecast the route and adapt the autonomous system behaviour in line with the degree of injuries.

- Evaluate integration of miniaturised sensors for CBRN detection and identification and monitoring (DIM).

- Define the specific autonomous platforms to be used to provide RAS CASEVAC and START capabilities.

Proposals should also:

- Reflect on different concepts of autonomous triage from an ethical perspective, but also regarding the perspective of responsibility. The concept of autonomous triage in LSCO should be based, as a minimum, on life threatening indicators covered in the START algorithm.

- Address explainability of the forecasting and of the assessments obtained through automated procedures.

- Foresee detailed alternative approaches to the assessment of casualty status, especially in view of the lack of large databases on which Artificial Intelligence (AI)-systems can be trained.

- Increase the casualty evacuation capacity and the triage process expedition at the point of injury.

- Adapt to prevalent weather and environment conditions, threat levels, and the condition of on-board patients for autonomous casualty evacuation platforms, in addition to react to unexpected events that might happen in the local environment during navigation.

- Define methods to achieve physical protection for patients and systems during evacuation.

- Define methods to achieve platforms’ survivability.

- Address platforms’ reusability (e.g., CBRN DIM and decontamination).

- Examine the potential of fully autonomous battlefield triage, based on innovative AI-based algorithms.

- Remain operational in all weather conditions, including sub-zero temperature and snow-covered conditions.

In addition, proposals may address:

- Real-time multimodal fusion of field-collected information to provide a comprehensive and accurate situational overview.

- Integration and suitable graphical tools for cooperation among different specialists, services and C2 systems, considering federated mission networking as standard for interoperability.

- Existing platforms (UxV[4]) for surveillance, reconnaissance, and missions, as they relate to increasing evacuation capacity and expediting triage processes.

- Capability of autonomous triage and evacuation platforms' self-defence (e.g., navigation in mined areas, C-UAS and MANPADS[5] missiles self-defence).

Types of activities

The following types of activities are eligible for this topic:

Types of activities (Art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (optional)
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No

[4] Unmanned vehicles
[5] C-UAS: Counter Unmanned Aerial System. MANPADS: Man-portable Air Defence Systems.

Types of activities (Art 10(3) EDF Regulation)		Eligible?
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Study:
    - The feasibility of AI-based autonomous triage following the START algorithm, as a minimum.
    - RAS CASEVAC in harsh conditions and across contested environments, where GNSS[6] signal and communication links could be denied.
    - Means to allow swift and safe casualty extraction from the ground and "hand-over" between different types of platforms and or operators.
    - Automatic or autonomous functions to optimise platform behaviour (planning and operation) based on risk assessment and available (sensor) data considering:
        - Patient condition and stabilisation efforts.
        - Time to destination related to golden hour elapsed time.
        - Patient condition deterioration related to speed dependent transport performance (e.g., risk of opening of wounds due to platform vibration, shorter route in difficult terrain vs. longer route in easy terrain).
        - Resource management at destination.
        - Threat level.
    - Definition of the system and system of systems (swarming) architecture gathering functional and non-functional requirements for the individual systems (UAVs, UGVs, USVs) and the overarching system of systems, evaluation technologies, specifying swarming behaviours, ensuring interoperability with standards, and assessing risks.

[6] Global navigation satellite system

- Design:
    - Proof-of-concept technology demonstrations and evaluations of the (separate) developed functions for health status indicators. These should be performed in representative military scenarios.
    - Autonomous triage reflecting START algorithm.
    - Monitoring during RAS CASEVAC transport, multi-modal casualty transport with physical safety measures and adaptive behaviour.
    - RAS CASEVAC.
    - Showcasing the applicability of proposed solutions in military structures and the military decision-making process, by implementing them in the EU hosted wargaming simulation/exercise (e.g., by one or more partnering or associated Ministries of Defence, HEDI[7]).
    - Develop a proof-of-concept mission planning tool that integrates inputs from all systems to create a cohesive operational plan. Enable real-time updates to the mission plan based on incoming data and changing conditions.

In addition, the proposals should cover the following tasks:

- Study:
    - The feasibility of autonomous or robotic-assisted systems for initial stabilisation of casualties before extraction and transport, e.g., to control haemorrhage.
    - Integration of commercial wearables into CASEVAC platform related to health monitoring of patients (health ring, electronic ID[8]-tags, RFID[9]-tags, smart-watches, smart-textile, etc).
- Design:
    - RAS medication during transport based on the casualty monitoring data, according to the improved first aid spectrum, e.g., painkillers, CBRN medical countermeasures.
    - Potential for a more autonomous battlefield triage, using innovative AI-based algorithms, should be examined.

The proposals should substantiate synergies and complementarity with foreseen, ongoing or completed activities in the field of medical logistics, notably through EU funded actions related to mass casualties scenarios.

[7] Hub for EU Defence Innovation (HEDI), see https://eda.europa.eu/what-we-do/research-technology/hedi
[8] Identification
[9] Radio frequency identification

Functional requirements

The proposed product and technologies should meet the following functional requirements:

- Plug-and-play capabilities.
- Miniaturised sensors.
- Either stand-off (non-contact) sensors on a small UxVor Quadruped, or wearable biosensors that are already worn or autonomously (without human intervention) placed on the casualty during the triage process.
- Robust estimation of health status indicators and vital signs in realistic battlefield conditions, including day and night, on soldiers equipped with body armour and camouflage face paint and with body movements characteristic for injured soldiers.
- RAS battlefield triage (e.g., using innovative AI-based algorithms).
- RAS allocation of evacuation priority, at the point-of-injury (PoI) and casualty collection point (CCP), based on the estimated vital signs and indicators, using existing battlefield triage methods adhering to current best practices for mass-casualty triage.
- Autonomously detecting and localising casualties at PoI, in all weather and visibility conditions, using sensors on unmanned vehicles.
- Continuous monitoring of casualties during transport using body-worn wearables or stand-off sensors, including the ability to provide alerts if health status deteriorates.
- DIM of CBRN injuries including application and monitoring of indispensable antidot-therapy.
- Protecting casualties from harsh weather effects (rain, wind, extreme temperatures) and enemy fire during CASEVAC.
- Autonomous platform provided with onboard data processing to filter and preprocess data before transmission.
- Capability to real-time and low-latency communication link between the command centre and all deployed units.
- Integration of data from multiple sources to create a unified, coherent picture of the field situation.
- Ability to detect, classify, and track objects of interest (e.g., injured individuals, obstacles) with high accuracy.
- Coordinated triage actions between different platforms (swarming).
- Adherence to relevant standards and protocols to ensure interoperability with existing defence systems.

Expected impact

The outcome should contribute to:

- Increase knowledge on technology and requirements and accelerate the development of life-saving technologies by capitalising on the unmanned vehicle development and develop complimentary defence medicine related autonomous functionalities.
- Proof-of-concept demonstrations highlighting the possibilities and potential limitations with autonomous vehicles for casualty transportation and triage.
- Create an R&D technology development roadmap for RAS CASEVAC platforms.
- Improve accuracy and speed in locating and evaluating casualties.
- Reduce risk exposure for combat medics and medical personnel.
- Human-machine teaming technology development.
- Dismounted soldier system development.
- Ethically acceptable decision algorithms.

2.1.2. EDF-2025-RA-C4ISR-MIDS-STEP: Multifunctional Information Distribution System

- **Indicative budget:** EUR 39 000 000 for this topic under the call EDF-2025-RA.
- **Number of actions to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

The Multifunctional Information Distribution System (MIDS) is an indispensable C4ISR capability to facilitate international conflict prevention and crisis management in all phases of operations. EU Member States (MS) and EDF Associated Countries have already used various types of MIDS in recent operations to provide tactical Link 16 interoperability between their major platforms (e.g., fighters, frigates, etc.).

The EU commonly agreed EU defence objectives underline the need for C4ISR to enhance situational understanding, decision-making and coordination of forces and effects across land, sea, air, space, and cyberspace.

In the coming years, MIDS capability is threatened to fall totally under the control of non-EU manufacturers with MS relying on non-EU terminals to carry out their missions. Due to the sensitive nature of military operations and the restrictions on technology transfer that prevent MS and EDF Associated Countries from adapting the MIDS terminal to EU platforms, the development of a EU MIDS is key to reduce dependency on non-EU solutions and to ensure sovereignty in this strategically relevant area.

Specific objective

The MIDS is an advanced information distribution system that provides Communication, Navigation and Identification (CNI) capabilities in an integrated form for application to air, land and maritime tactical operations. These capabilities are provided in support of operational tasks through the ability of the system to:

- Distribute encrypted information at a high data rate in Electromagnetic Countermeasures (ECM) environments.
- Interconnect scattered sources of information such as surveillance, support, and intelligence on a continuing real time basis with selectable levels of connectivity among force elements such as weapon systems, weapon controllers and decision-making commanders.
- Provide mobile surface and airborne force elements with a relative navigation capability within a common position reference grid.
- Provide an identification capability through the dissemination of crypto-secure position, velocity, and identity information concerning both friendly and hostile force elements.

The specific objective of this topic is to design, develop and build a demonstrator of a radiocommunication system that provides this critical defence capability to respond to future security challenges.

This call topic contributes to the STEP objectives, as defined in STEP Regulation[10], in the target investment area of deep and digital technologies.

Scope and types of activities

Scope

Proposals must design, develop and test a demonstrator of a European Fighter MIDS (F-EMIDS) terminal with an innovative SCA (Software Communication Architecture) to exceed or be at least comparable to the systems and capabilities available at the time of its entry into service.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (optional)

[10] Regulation (EU) 2024/795

Types of activities (art 10(3) EDF Regulation)		Eligible?
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Studies:
    - Set up the configurations to be recognised in the design.
    - Identify, analyse and mitigate critical technical risks especially regarding overall integration and certification considerations.
    - Perform a life-cycle-cost-analysis and management.
    - Contribute to the definition and analysis of the Concept of Operations (CONOPS) supported by the relevant stakeholders.
- Design:
    - Select applicable technologies.
    - Design the needed modules.

- Cover detailed design activities after the Preliminary Design Review (PDR) until at least the Critical Design Review (CDR) of the Fighter MIDS (F-EMIDS) terminal (i.e., terminal form fit designed for fighters).
- Manufacture all functional modules and components of the demonstrator.
- Ensure manufacturing ability with efficient supply chain.
- Perform laboratory functional testing to:
  - Evaluate system functions and electronic warfare (EW) performance.
  - Verify functions and properties against technical requirements.
  - Validate preliminary requirements against operational needs and mission requirements.

Functional requirements

The proposed product and technologies should meet the following functional requirements:

- Transmit and receive Link 16 datalink following the ATDLP-1.75[11] which encompasses:
  - Waveform (WF) signal generation.
  - WF reception.
  - Interaction with the host system to configure the radio.
  - Interaction with the host system to exchange Link16 messages.
  - Interaction with the host system to exchange Voice.
- Transmit tactical data with Host platform according to ATDLP-5.16[12].
- Include TACAN capability to be implemented into the fighter environment. The Air/Air and Ground/Air mode are required. No transponder requirement is required (only the ping network function).
- Include future airborne stealth WF capability as growth potential in terms of:
  - Baseband WF signal generation and interfaces with front-end antennas.
  - Baseband WF reception.
  - Security function with a Secure Data Unit SDU (crypto component).
  - Interaction with the host system to convoy operational messages.
- Include other capabilities in the airborne environment in term of:

[11] Technical Characteristics of the Multifunctional Information Distribution System (MIDS) - VOL I & VOL II – NATO ATDLP-1.75 Edition A

[12] Tactical Data Exchange - Link 16 / NATO ATDLP-5.16 Ed C Ver 1:2019 / STANAG FT (RD) 5516 Ed 9

    - Cosite environment using suppression signal (input / output).
    - Built in test, monitoring, and status to report to the operator.
    - Navigation information exchange.
    - Message Filtering.
    - Cryptographic elements management.
- Comply with Software Defined Radio SCA standards. All elements necessary for the targeted WF to be executed are required. These elements are not only in terms of hardware to support software processing and waveform processing, but also the operational environment for the SDR.
- Support the WF operational life cycle and in charge of maintaining data during standby.
- Encompass hardware constraints, such as:
    - Mechanical.
    - Thermal.
    - Interference protection requirements.
    - Constraints related to security for the global F-EMIDS radio.
    - Constraints related to security for the EL16 WF.
    - Constraints related to security for the airborne stealth WF.
    - Constraints related to security for the EMIDS-C security rules.
- Include various capabilities linked to the design to support security, safety, and airworthiness rules.
- Apply required engineering rules and regulation rules.

Expected impact

The outcome should contribute to:

- Improve EU sovereignty and autonomy of EU Member States' and EDF Associated Countries' Armed Forces when deployed in coalitions.
- Enhance C4ISR[13] interoperability between EU Member States' and EDF Associated Countries' armed forces and other partner Nations.
- Reduce dependencies on non-EU suppliers by boosting the EDTIB and promoting the development of a EU solution.

[13] Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance

- Europe’s resilience and EU technological sovereignty.

2.1.3. EDF-2025-RA-ENERENV-PSR: Propulsion system for next generation rotorcrafts

- **Indicative budget:** EUR 25 000 000 for this topic under the call EDF-2025-RA.
- **Number of actions to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

The objective of this call is to develop and mature the technologies required for a new state-of-the-art, breakthrough, affordable, efficient, and high-power (above 3000 shp / 2.237 kW) engine for future generation of EU military rotorcraft systems.

Specific objective

The objective of this research topic is to better understand and analyse the future needs EU Members States and EDF Associated Countries and the transition to future rotorcraft features, concepts, and capabilities, and to derive specific design parameters for next generation propulsion systems. Conception and pre-design of an alternative propulsion system for rotorcraft platforms must be performed.

There are currently no civil applications for a turboshaft engine in the considered EU Next Generation Rotorcraft (ENGR) power range. Hence, there is a need to develop new relevant technological bricks for a European high-power engine.

Indeed, the development of a new engine may be longer than for a new rotorcraft. It is therefore needed to work on both topics simultaneously and in a consistent manner so that effects of the engine are considered in the rotorcraft architecture and vice versa.

Scope and types of activities

Scope

The proposals must address:

- A new propulsion system for rotorcraft platforms with a breakthrough engine that closes the technological gap in the power-range above 3.000 shp / 2.237 kW.
- A significant increase of efficiency and performance indicators compared to the actual state of the art propulsion systems for rotorcraft platforms.
- Ensure that the propulsion system for rotorcraft platforms’ architecture and power requirements match the requirements of the ENGR.
- Improve propulsion system for rotorcraft platforms’ capabilities to meet military requirements for the future operations and particularly for multi-mission military

rotorcraft (such as armed reconnaissance, strike, combat, and ordinary search-and-rescue (SAR), MEDical EVACuation (MEDEVAC), CASualty EVACuation (CASEVAC), utility, air assault and close aerial support) and flexible mission requirements, such as low emission signature, high operational availability, reliability and maintainability.

- Minimise deterioration caused by harsh environments (e.g., sand, dust, maritime, ice, snow, water, wide range of temperatures, etc.)
- Reduce fuel usage and ensure high power-to-weight ratio by a highly efficient thermodynamic cycle, for example, by ensuring a high-pressure ratio compressor, a high-temperature combustor and turbine, low-emission combustor, and highly efficient and light weight power turbine. To achieve this goal, an advanced fuel system as well as an advanced control and monitoring system must also be studied.
- Reduce costs through design concepts for minimum life cycle costs.
- Use green technologies aiming at significantly lowering CO_2 emissions on the entire lifecycle and notably improving sustainability and recyclability.
- Reduce the risk for the future full propulsion system for rotorcraft platforms development program as much as possible, thanks to early research and pre-development and maturation of key technological bricks.
- In addition, the propulsion system for rotorcraft platforms must be ready for the use of conventional fuels, Sustainable Aviation Fuels (SAF) and provide robustness for the usage of combustible fuels of lower qualities (e.g., higher sulphur content, impurities) in different regions of the world with anomalous specifications, e.g., Jet A, JP, SAF, Avgas, Mogas.
- Maximise operational usability by increasing times between inspections and overhaul.

  However, proposals should not address research activities on rotors, gearboxes and shafts and should be limited to the engine itself and its components (for example the fuel system as well as the engine control and monitoring system).

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (mandatory)

Types of activities (art 10(3) EDF Regulation)		Eligible?
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Generating knowledge:
    - Identification of hybridisation concepts that brings benefit to a rotorcraft (for example: micro-hybridisation, series hybridisation, parallel hybridisation, etc.)
    - Identify new generation of materials for rotorcraft engines applications.
    - Study on artificial intelligence (AI) for engine control and monitoring.

- Integrating knowledge:
    - Preparation of technological and integration solutions for next generation propulsion system for rotorcraft platforms for military applications. These should be produced, developed, and manufactured with the objective of

ensuring EU sovereignty and providing optimal performance and reliability for the targeted wide-range applications.

- Possibilities to integrate technological developments developed through other civil or military projects for a propulsion system with a reduced environmental footprint, through hybridisation solutions and operation with new Sustainable Aviation Fuels (SAF), but also allowing more autonomous operation.

- Studies:
  - Maturation of technologies to achieve specific performance (aerodynamic, thermal, regulation system, potential hybridisation, or electrification of propulsion, etc.) at an affordable cost and easy to maintain.
  - Scalability and dissemination of the results into other products and in various types of aircraft and/or platforms.
  - Study of an engine design adapted to a variable-speed rotor helicopter.
  - Study on improved engine & fleet management and on concepts for adapting civil engine fleet management systems on military applications for improved availability and reduced life cycle costs (LCC).
  - Cost-benefit analysis and forecast of effects on maintenance-effort for each technology.
  - wide usage of 3-D-printed components and novel manufacturing processes associated with innovative repair solutions.
- Design:
  - Design of a propulsion system for rotorcraft platforms that fulfils the requirements mentioned herein.
  - Possibility to perform real-time engine monitoring, trouble shooting and predictive performance and maintenance in deployed operations with remote assistance through virtual reality, augmented reality tools by using a digital twin and AI-based prediction tools. Troubleshooting, predictive performance and maintenance should also be operative offline for some specific operations when external communication is not allowed or not possible.
  - Design an engine with very simple and lean maintenance: Highly connected engine with data-driven services for highly predictive maintenance and condition-based maintenance.
  - Extended life for engine components and equipment.
  - Standardisation and significant reduction of parts, devices, and modules.
  - Any other solution that must contribute to optimise lifecycle costs, such as advanced fuel, control, and monitoring systems, that includes new fuel pump

technology to provide increased fuel flow, higher accuracy of the fuel metering system to deliver the required performance (unprecedented power density, responsiveness…) and new control laws to deal with a hybrid-electric propulsion system.

In addition, the proposals may also cover the following tasks:

- Study of the technologies developed in the frame of this call, as they may also benefit other propulsion solutions and different rotorcraft applications.

The proposals must substantiate synergies and complementarity with foreseen, ongoing, or completed activities in the field of military rotorcrafts, notably those described in the call topic EDF-2021-AIR-R-NGRT related to *Next Generation Rotorcraft Technologies* and EDF-2024-DA-AIR-NGRT related to *Next Generation Rotorcraft*, to ensure that the engine and the rotorcraft architectures remain consistent.

Functional requirements

The proposed product and technologies should meet the following functional requirements:

- Scalable technologies to cover a power-range above 3.000 shp / 2.237 kW.
- Specific Fuel Consumption (SFC) reduction by 25 to 35 %, compared to in-service engines of the same power class.
- Horsepower to weight ratio best in class at the time of its entry into service.
- Lower production and operational costs compared to what the future competition could offer thanks to new manufacturing processes and means, innovative maintenance concepts and high level reliability/ availability of the engine components.
- Substantially reduced aircraft fuel burn and hence CO_2 emission, compared to the actual standard.
- Compatible with current and future Sustainable Aviation Fuels.
- Very high level of availability in all military operating conditions.
- Capacity to operate in harsh environments (e.g., sand, dust, maritime, ice, snow, water, wide range of temperatures, etc.) without significantly degrading the engine performances and availability.
- Improve the engine robustness to make the engine safer, more reliable, and simpler to operate.
- Reduced detectability and increased survivability (i.e., very low infrared (IR) and noise signature).
- Higher electrical power capacity for future on board systems and hybridisation requirements.

- With regards to the propulsion system (twin-engine system), it must allow the crew to cruise on a "single engine mode" as a normal operating mode of the helicopter.

Expected impact

The outcome should contribute to:

- Versatile European propulsion system to fulfil the increasing systems power demand.
- Affordable propulsive system such as cost competitive for the whole life cycle.
- Robust and reliable system with good maintainability, even when operating in harsh environments.
- Easy to maintain and repair such as supported by predictive maintenance tools (digital twin) and 3D intuitive documentation and instructions for maintenance crews.
- Sovereign European propulsive solution for new rotorcraft applications.
- Reinforce the EU sovereignty and independence on these strategic platforms through the strengthening of the EU supply chain and integration of EU Member States' and EDF Associated Countries' system capabilities and provide a product free from export control restrictions by non-EU or non-EDF Associated countries.

2.1.4. EDF-2025-RA-MATCOMP-CDA-STEP: Chiplet for Defence Application

- **Indicative budget:** EUR 25 000 000 for this topic under the call EDF-2025-RA.
- **Number of actions to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

A new paradigm is proposed by the development of the so-called "chiplet" approach, where a chiplet is an integrated circuit block that has been specifically designed to work with other chiplets to form more complex integrated systems. This approach can be used for System in Package (SiP) (heterogeneous integration) in which the System is subdivided into functional circuit blocks.

Chiplets offer a new opportunity for defence electronics, overcoming the limitations of generic components like FPGAs (offering a single solution with limited performances) and ASICs (offering high performances but with high development costs due to the specific development). Chiplet architecture offers an interesting opportunity to reduce the development costs thanks to the reuse of existing blocks and to decrease the manufacturing cost thanks to higher yield compared to large monolithic dies. It may also benefit from use of off-the-shelf chiplets to limit development costs and reinforce the resilience of the supply chain. In addition, chiplets-based architectures are scalable: the addition or removal of chiplets enables the performance and/or functionality adjustment of the SiP.

Chiplet technology in combination with heterogeneous packaging has been widely used in increasing performance of commercial CPUs. The chiplet technology combined with heterogeneous packaging offers the possibility to integrate chiplets processed in different technologies into the same package, thus offering the possibility to develop very compact and innovative System in Package.

Specific objective

The objective is to explore the possibilities the chiplet[14] technology in combination with heterogeneous packaging can add to systems used for defence applications. Combining e.g., chiplets made in different technologies (GaN, GaAs, Si etc) and with analogue, mixed analogue/digital and digital functions may lead to new capabilities in processing power and still achieve a reasonable cost level and power consumption. New and/or improved devices can be made by exploring chiplet technology in various fields of defence applications such as, but not limited to: radar systems, Electronic Warfare systems, communication systems, munition applications, signal processing applications.

This call topic contributes to the STEP objectives, as defined in STEP Regulation[15], in the target investment area of deep and digital technologies.

Scope and types of activities

Scope

This topic aims to explore the development and sharing of a common hardware library of chiplets and their military applications. This require a thorough analysis of possible architectures, and the design of minimum one military application.

The proposed architectures should use EU-based technologies where available. Taking in account the existing EU manufacturing facilities and the civil programs such as Chips JU[16], proposed architecture should address:

- The non-dependence for defence systems to integrate this solution.
- The cost efficiency of the solution for low volume quantities (including NRE).

Particular attention should be placed on the power consumption, as this is an important issue for several applications.

The scalability of the architecture, in other words the possibility to adjust the SiP performances and/or functionalities through the addition or removal of chiplets in the design, should be presented and analysed.

In addition, proposals may address the integration of security features (cybersecurity) in the architecture, especially for protecting the resulting SiP.

Types of activities

[14] In this call, the chiplets used in the final demonstration should be fully tested according to their specifications, which implies they are Known Good Dies (KGD).
[15] Regulation (EU) 2024/795
[16] https://www.chips-ju.europa.eu/

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		Eligible?
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (mandatory)
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Generating Knowledge:
    - Analysis of the current state of the art in different type of use-cases where chiplet-based architectures are implemented: processing, signal conversion, mixed-signal, or others.
    - Demonstration of the advantages of chiplet architectures for defence applications.
    - Identification of the available technologies (chiplet and integration) in and outside Europe which can or need to be used in chiplet-based components,

with a description of the supply chain of each identified technology and an estimation of the technology benefits.

- Integrating knowledge:
    - Define electronic functions of military systems that can or should be realised with “chiplet” approach.
    - Having identified the available and needed technologies, identify benefits and risks for defence (defining shortfalls and possible dependency risks for each technology).
- Studies:
    - Explore the feasibility of chiplet architecture for defence:
        - Define which components-of-the-shelf can be used, which chiplets need to be developed and with which performances for a given feature.
        - Study the possible interface solutions between the chiplets.
        - Identify the best compromise between performance and sovereignty (security of supply), capacity for scalability (in memory, cells, number of processing cores…) and specialisation (compute accelerator, specific RF front-end…) from one defence application to another, security, and reliability.
        - Define the possible supply-chain, considering the use of EU foundries, especially for sensitive components (sensitive meaning subject to export control restriction) and the adequation of the supply chain to the targeted volume.
        - Identify cost drivers of the targeted architecture configuration.
- Design:
    - Definition of targeted performances: Define expected functions and their technical specifications for minimum one type of military application based on the “chiplet” approach.
    - Definition of the partial and risk reduction tests needed to validate the proposed design.
    - Proposed design must:
        - Integrate multiple (at least two) chiplets using different technologies or nodes.
        - Be compatible with the studied supply-chain optimisation.
        - Be compatible with the de-risking tests.

- Evaluation of the final design in terms of performances and supply-chain optimisation on a representative demonstrator.

In addition, the proposals should cover the following tasks:

- Design:
    - The design should cover the scalability of the architecture (addition or reduction of the amount of chiplets of one single type in the architecture).

The proposals may also cover the following tasks:

- Design:
    - Design of more than one type of military application, with the associated specification, test definition, design and evaluation.
    - A design that addresses scalability of different features at the same time (for instance: adding memories chiplets and processing cores for a given architecture). This may cover specification, test definition, design, and evaluation.
    - Include security features.
    - Include features dedicated to the implementation of Artificial Intelligence in the system.
    - Software development may be included for the need of the evaluation of the demonstrator(s).

The proposals should substantiate synergies and complementarity with foreseen, ongoing or completed activities in the field of advanced packaging and advanced semiconductor nodes, notably those described in the call topics EDF-2022-RA-MATCOMP-PACOMP, DIGITAL-JU-Chips-2023-SG-CPL-3 and DIGITAL-JU-Chips-2023-SG-CPL-2, as well as other projects undertaken in the frame of the European Chips Act (such as Important Project of Common European Interest[17] in microelectronics and communication technologies).

Functional requirements

The proposed product and technologies should meet the following functional requirements:

- The interface between chiplets should be compatible with different type of military applications (standardisation approach).
- The 2.5D or 3D integration should be based on EU capacities.
- The advanced packaging should be based on System-in-Package technology.
- The design should be made to optimise the power consumption of the system.

[17] https://competition-policy.ec.europa.eu/state-aid/ipcei_en

- The proposed design should be compatible with operations in harsh environment conditions of the targeted application.
- The design should be compliant with REACH and ROHS regulations.

Expected impact

The outcome should contribute to:

- Develop and share a common hardware library of chiplets building blocks.
- Identify EU based building blocks compatible with advanced architecture for defence components.
- Increase competitive advantage to the EDTIB in the domain of components development and integration.
- Increase flexibility of architectures to create multifunctional, systems, able to adapt to capability needs.

2.1.5. EDF-2025-RA-GROUND-CBC: Technologies for counter-battery capabilities

- **Indicative budget:** EUR 20 000 000 for this topic under the call EDF-2025-RA.
- **Number of actions to be funded:** Several proposals may be funded for this topic.

Objectives

General objective

Given that artillery is still responsible for the vast majority of losses suffered by armies facing each other on the battlefield, this call topic aims to explore and mature the technologies required to destroy or neutralise all enemies' artillery potential, thereby ensuring the survival of own forces and safeguarding their operational capacity.

Specific objective

In a changing geopolitical landscape, the armed forces of EU Member States and EDF Associated Countries face new and evolving threats. Artillery is responsible for 70% of combat losses. In this context, the ability to destroy or neutralise enemy artillery capabilities is vital to ensure the survival of land armies.

With the development of mobile manoeuvre concepts for field artillery ("shoot-and-scoot") effective counter-battery fire has become increasingly more challenging as the required time from detection of enemy firing to own effect delivered in the target area might often exceed the time required for enemy formations to leave their firing positions. This is particularly a challenge at longer ranges, the tactical depth and farther, as the time of flight of our own munitions may pose a limitation on timely delivery of effect. It is therefore necessary to be able to detect and identify critical components of enemy artillery systems also in other postures than when firing.

This research topic aims at research of counter-battery capabilities, including detecting, locating, identifying, and communicating of the made observations.

Furthermore, capabilities to detect, locate and identify other enemy capabilities such as HQs[18], SHORAD[19], HIMAD[20], EW[21], FARP[22], logistics, etc. could be studied by opportunity through the R&T process.

Scope and types of activities

Scope

The proposal must address:

- Research on new and innovative technologies useful for counter-battery capability.
- Possibilities for adaptation of existing state of the art technologies useful for counter-battery capabilities (to detect, to locate, to identify, to communicate).
- Research on passive and active sensors portfolio:
    - Acoustic and seismic.
    - Optical/optronics.
    - Radar/ESM23.
- Research on possible carrier systems for sensors, e.g., UxVs[24], balloons, vehicles, or stationary platforms.
- Research on new and innovative deploying mechanisms.

The proposed technological solutions should present an optimal compromise on cost/performance.

Depending on the maturity of the technologies, it may also address other targets in tactical and operational depth.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating**	Yes (mandatory)

[18] Head Quarters
[19] Short-Range Air Defence
[20] High to Medium Air Defence
[21] Electronic Warfare
[22] Forward Arming and Refuelling Point
[23] Electronic Support Measures
[24] Unmanned vehicles

Types of activities (art 10(3) EDF Regulation)		Eligible?
	knowledge)	
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (optional)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Generating knowledge:
    - Creating an overview of current and outdated methods for detection, locating and identification of critical components in enemy artillery systems.
    - Creating an overview of different scenarios for counter-battery capabilities based on current and historical scenarios.
- Integrating knowledge:
    - Assess potential of current active and passive sensors.
- Studies:
    - Integration of sensors into different platforms, e.g., UxV, etc.
    - Feasibility studies on deployment mechanisms, e.g., airdrop, firing by weapon systems, autonomous deployment, etc.

- Feasibility studies on acoustic and seismic sensors to identify indirect fire and ways to design an acoustic-seismic signature database.
- Feasibility studies on optical and optronics sensors to identify indirect fire and ways to design an optical and optronics signature database.
- Feasibility studies on active and passive radio frequency sensors and ways to design a radio frequency database.
- Feasibility studies on exploitation of illuminators of opportunity (e.g., 5G, DAB, etc.).
- Feasibility studies on GNSS25 and alternative positioning technologies for sensors.

In addition, the proposals should cover the following tasks, as part of the optional activities:

- Design:
  - Preliminary design studies of an automated (e.g., AI-supported) system that integrates the information from the various sensors.
  - Preliminary design of a (semi-)automated (e.g., AI-supported) target identification system using the signature databases.
  - Preliminary design of a sensor that allows the exploitation of illuminators of opportunity (e.g., 5G, DAB, etc.).

Functional requirements

The proposed product and technologies should meet the following functional requirements:

- Ability to timely detect, locate and identify different typologies of indirect enemy effectors (e.g., artillery, mortars, rockets, loitering munitions, etc.).
- Minimum range of at least 200 km (tactical depth).
- Operational in climate zones that are of interest to the EU Member States and EDF Associated Countries with a "one applies to all" way of usage[26].
- Operational in GNSS denied areas.
- Determine own position with a SEP[27] below 10 meters.
- Determine enemy firing positions with a SEP below 30 meters.
- Operational in a contested EW environment.
- Robust against jamming, spoofing and EMP[28].

[25] Global Navigation Satellite System

[26] At least A1-A3, B1-B3, C1-C3 and M1-M3 according STANAG 4370

[27] Spherical Error Probable (SEP is defined as the radius of a sphere centred on the true value that contains 50% of the actual measurements.)

- Low own energetic signature.
- Ability to identify various projectiles (e.g., missiles, rockets, shells, loitering munitions etc.).
- Compatible with relevant communication and information systems using relevant standards.

The proposed product and technologies may meet the following functional requirements:

- Ability to track detected targets, both artillery and other high-value assets, for subsequent engagement.
- Ability to identify various UAVs by their acoustic signatures (e.g., sound of rotor blades).
- Desired range of up to 500 km (operational depth).

Expected impact

The outcome should contribute to:

- Develop and increase maturity of innovative technologies specifically adapted to counter-battery systems for all armies of EU Member States and EDF Associated Countries .
- Develop low-cost and, if needed, expendable alternatives for high-risk missions.
- Opportunity to find commonalities for generic targeting in depth.
- Increase EU industry capability to produce counter-battery systems.
- Consolidate the offer of EU competitive solutions for the global market.
- Reduce dependencies on non-EU or non-EDF Associated countries suppliers by boosting the EDTIB and promoting the development of a EU solution.

2.1.6. EDF-2025-RA-UWW-SOASW: Stand-off anti-submarine warfare engagement

- **Indicative budget:** EUR 20 000 000 for this topic under the call EDF-2025-RA.
- **Number of actions to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

[28] Electro-Magnetic Pulse

Modern submarines are equipped with long-range heavy weight torpedoes (HWT) or sub launched anti-ship missiles. Both effectors normally exceed the range of surface ships organic underwater sensors and effectors. To be able to engage adversary submarines outside the torpedo danger zone, usually lightweight torpedoes (LWT) are deployed by aerial assets equipped with underwater (UW) sensors, such as organic anti-submarine warfare (ASW) Helicopters or Maritime Patrol Aircraft (MPA). Alternatively, torpedoes can be equipped with a booster rocket to engage submarines at range.

However, aerial assets are dependent on weather conditions and bound to deck-cycle times, limiting their availability. Additionally, current developments could lead to an air defence capability of submerged submarines, putting valuable manned airborne assets at risk.

It is essential for the survivability of a surface warship to be able to engage and neutralise an adversary submarine outside its effective weapon range when the mission dictates that evasion is not possible. The engagement capability must consequently be available at any time and within short notice, even outside of the deck cycles of the organic aircraft or availability of non-organic aircraft.

Specific objective

Market available rocket-launched torpedoes like the VL ASROC or MILAS are being launched from the Vertical Launch Systems (VLS) or upper deck surface-to-surface missile (SSM) containers, therefore consuming the very limited space and weight that could otherwise be used for air defence missiles or strike capabilities, increasingly required for present and future Anti-Access/Area Denial (A2/AD) threat environment, to achieve the Surface Warfare mission.

Current developments in the field of torpedo technology aim at developing very-lightweight torpedoes (VLWT) and ultra-lightweight torpedoes (ULWT). In combination with market available or tailored unmanned vehicles or rocket propulsion, these could provide a cost effective, flexible and lightweight, long-range stand-off ASW capability with a small footprint on the system “surface warship”. Furthermore, some of these technologies may offer cost-effective solutions to engage larger Unmanned Underwater Vehicles (UUV) as well. However, these new developments pose new challenges because of a reduced underwater effective range and the simultaneous requirement for extended range for transfer from the launching unit to the target area and with greater precision, delivering the effector at shorter range from its target, by suitable means to be determined. The surface warship requires an optimisation of its UW sensor suite for the prerequisite long-range detection and classification of targets with higher accuracy and update rates, which must be addressed before these new stand-off capabilities can develop their full potential.

Future multi-domain mission profiles require enhanced firepower distributed on board smaller size surface combatants, demanding for new and more flexible approach that delivers solutions able to be integrated in a multi-mission or multi- weapons bay, where both offboard and onboard sensors and effectors, can be loaded and integrated in a mission tailored configuration.

In addition, economical aspects are relevant factors. The aim of this activity is the identification of feasible common effector components, like V/ULW torpedoes or depth

charges, which can be deployed by systems, which are usable for other purposes or in other warfare areas or even other warfare domains as well, like Unmanned Aerial Vehicles (UAV)/ Unmanned Surface Vehicles (USV) for reconnaissance and surveillance, affordable precision strike capability, or deploying sensors like sonobuoys, in a configuration similar to the multiple launch rocket system. This approach may allow greater degree of flexibility for the procurement of systems and as well reduce individual integration, certification and storage footprints thus increasing their viability for navies of EU Member States and EDF Associated Countries.

Scope and types of activities

Scope

Proposals should cover the definition of a respective preliminary system design and plan for demonstration of a stand-off ASW engagement capability from sensor to effector.

Different combinations of sensor systems, delivery systems and effectors should be investigated, with the view of a concept of optimised solutions that enable engagements against submerged submarines and larger UUV at ranges exceeding 40nm.

The activities must aim at establishing a common understanding of the problem, a thorough investigation of different technologies and available products and simulation activities to conceptually define the most promising combination, eventually including one alternative for distinction with regard to effectivity, diversity of technological approaches, and economical aspects.

The activity must include a plan for a way forward towards a full-fledged capability solution. The proposal should seek for complementarity and avoid unnecessary duplication with other ongoing cooperation activities and projects in the same domain.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (mandatory)
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (optional)

Types of activities (art 10(3) EDF Regulation)		Eligible
(e)	System prototyping of a defence product, tangible or intangible component or technology (**prototype**)	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Generating Knowledge, Integrating Knowledge, and Studies:
    - Feasibility study on V/ULWT for long-range ASW engagement, assessing their performance (e.g., in terms of range, speed, accuracy, payload capacity), evaluating their integration on UxVs and rocket propulsion systems.
    - Feasibility study on UW sensor suites for long-range detection. The study must cover gaps and limitations in current sensor systems.
    - Explore the use of UAVs and USVs for deploying ASW effectors.
    - Evaluate the existing capabilities of legacy UAVs and USVs to carry and deploy V/ULWT.
    - Perform a cost-benefit analysis of various ASW engagement technologies and approaches.
    - Perform a market and technology analysis, providing a comprehensive picture of possible launch platforms for Stand-off ASW weapons and provide a technology roadmap for the development of the capability.

In addition, the following tasks should be performed:

- Studies:
    - Explore the use of UAVs and USVs for deploying ASW sensors and conduct reconnaissance operations.
- Design:

- Simulation activities should be performed in order to evaluate suitable combinations, optimal configurations and operational scenarios for further development.
- Simulate various sensor deployments scenarios to determine the most effective configurations (related with the optimisation of UW sensor suites).
- Provide a draft concept and architecture.

Functional requirements

The consortium should elaborate common requirements for stand-off ASW engagement capability in collaboration with the parent navies, including description of scenarios and SOPs[29].

Core functional requirements should include the following:

- The system should be deployable from several platforms, from frigate-sized warships to systems such as Large UxV (all-domain), and helicopters.
- The system should be installable on missile launching systems in accordance with relevant standards, such as applicable NATO standards.
- The systems should be deployable day and night, 24/7, and in non-favourable environmental conditions.
- The system should cover ranges exceeding the submarine's effective weapon range (>40nm).
- The system should be interoperable in a sensor-to-effector chain, including interface specifications with other system elements like Combat Management Systems or (secure and resilient) communication systems. VLS solution should enable use with current standards, but not be limited to these. Containerised solutions sharing commonality with other armed services or branches and requiring small deck space, up to 20-foot container size, on board should also be considered.
- The system should be accreditable according to NATO standards.

Expected impact

The outcomes should contribute to:

- Incentive EDTIB to invest in the development of innovative stand-off ASW engagement capabilities.
- Reduce development risk for EDTIB.
- Reduce time to market of the required capability.

[29] Standard Operating Procedure

2.1.7. EDF-2025-RA-SIMTRAIN-DAFAS: Multi-Disciplinary design and Analysis Framework for Aerial Systems

- **Indicative budget:** EUR 28 000 000 for this topic under the call EDF-2025-RA.
- **Number of actions to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

Digital Twins (DT) are defined as validated virtual models of physical entities and processes, with the capability to be (seamlessly) connected, in right time throughout their lifecycles, enabling simulation, performance optimisation, and informed decision-making.

A System of Systems (SoS) DT is a model that integrates multiple DTs of individual systems, subsystems, and components, providing a holistic, real-time view of the entire system behaviour, performance, and responses to various scenarios and conditions.

The development of advanced fully coupled DT simulation capabilities is necessary to support the design of complex, high-fidelity aerial systems, and to facilitate the generation of certification-relevant data.

This framework should comprise aerodynamic, structural, flight control system, general system, embedded software, and design capabilities from level zero to high fidelity modelling, offering the possibility to provide close and loosely coupled multi-disciplinary simulations, and provide full design gradients for multi-disciplinary numerical optimisation.

The multidisciplinary analysis and optimisation capability is a design methodology for fast and reliable design space exploration, trade-offs, and requirements sensitivity assessment, hence, a key technology for modern aircraft development.

DTs need to capture the complexity of the system being modelled and its surrounding environment, including the capabilities of Allied Nations.

Potential benefits of DTs for military applications include:

- Increase fleet availability and reliability by enabling better maintenance planning and reducing the occurrence of unanticipated damage findings.
- Improve product development and reduce lead time for the new military systems.
- Ensure fleet safety by providing better information on the condition of each individual asset.
- Incorporate added capabilities to provide operational superiority.
- Reduce maintenance costs by increasing maintenance interval, reducing inspections and maintenance labour.

A key objective of this call topic is to explore the benefits of applying DT technologies across the entire lifecycle of military systems, from design and development to operation and maintenance. This includes investigating how DTs can improve the efficiency, effectiveness, and interoperability of systems throughout their lifespan.

The research also aims to examine the flow of digital data across different stages of the lifecycle, as well as between various domains, such as:

- Lifecycle phases: How digital data can be seamlessly shared and utilised across different stages, e.g., from design to software development to mechanical engineering.

- Application domains: How digital data can be integrated and leveraged across different areas, such as system operation, logistics, and maintenance.

- Information spaces: How digital data can be shared and utilised across different information systems and platforms, ensuring interoperability, and reducing silos.

Specific objective

To address the interoperability challenges of DTs in a global context, it is essential to develop a robust reference architecture that can handle the complexities of exchanging, sharing, and reusing information across diverse systems and nations. The key issues to be addressed are the following:

- Effective Information Exchange is challenging because of use of diverse data formats and standards, variations in modelling techniques and simulations tools (esp. considering sensor networks). This should be addressed through improvement of standardisations, implementation of middleware solutions and data catalogues.

- Coordination and Enrichment of Simulations: the main challenge is the need for faster than real time data integration from multiple sources and ensuring data consistency. These should be addressed through the creation of a federated architecture, data orchestration and cross-domain ontologies.

- Security of Information Exchange to protect against cyber threats. Data should be secured both during transfer and storage. Therefore, following technologies must be considered: encryption, access control, Intrusion Detection Systems or use of block chain technologies.

- Coherent Data Analysis, Storage, and Discovery where the main issues are about managing large volumes of heterogeneous data, handling high-resolution sensor data from multiple sources, and ensuring its quality and consistency. The proposals must address the use of cloud storage for raw data, structured data as well as big data analysis, metadata management, and use of AI and Machine Learning for data cleaning, integration and predictive analytics.

- Development and Validation of Models where the main challenges lie in ensuring accuracy, reliability of physics based and data-driven models and calibration with real-world data. The following technologies and approaches should be considered: Hybrid modelling approaches, model validation frameworks, continuous learning, and collaborative platforms.

- Explore the DT potential in non-technical areas, such as managing cost overruns, reporting progress, and coordinating multi-national capabilities. A common model database, featuring constructive entities and terrain data, can facilitate data sharing and reuse, enhance collaboration, and boost efficiency. This requires understanding data ownership, sovereignty, and sharing concepts to ensure effective management and protection of critical data assets.

The final outcome of this proposal should be a demonstration of a system of system DT that showcases the functional requirements listed further below on one or a few fully described use case(s) for which the consortium can demonstrate to have access to all the necessary data.

Scope and types of activities

Scope

The proposals must address the study and design of a SoS DT, in a modular way (sub-systems level), in order to enable a gradual and progressive development.

Priority should be the development of modules related to the modelling of aerial systems and their integration in a digital rig, with a view to certifying these integrations of systems and subsystems. Further modules should be developed and coupled towards reaching the goal of obtaining a DT at the aerial system level. This modular building up could benefit complementary developments for other weapons systems.

Different levels of interdisciplinary coupling strategies are required depending on the relevant involved disciplines. Depending on the aerial system type, exploiting the interaction between aerodynamics, structure, control laws, general systems, control software, manufacturing and performance analysis (mission and point performance) is crucial, in order to achieve an optimal design and significantly de-risk the programme overall.

The DT should be able to couple with physical tests and easily integrate derived data-driven models. Furthermore, the DT should be able to estimate platform behaviour when stimulated in a virtual environment, as to forecast possible integration issues and evaluate different architecture and solutions to de-risk development of system-details and physical testing.

Simulation data management must ensure data consistency across the design cycle. Any needed High-Performance Computing (HPC) architectures should be accessible.

In order to achieve a DT that is highly realistic and has a robust predictive capability, the underlying modelling and computational technologies must be developed, tested and validated against representative data.

The focus of this activity should encompass the entire spectrum of the systems development life cycle. Therefore, a demonstration of a concept for real-time interconnection of individual DTs of military assets with a monitoring and diagnostic dashboard is essential. This should include a framework for data transfer and feedback loops.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (optional)

Types of activities (art 10(3) EDF Regulation)		Eligible?
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Studies:
    - Creating a concept of operations (CONOPS) for a fully coupled DT system for a multi-functional and high-fidelity aerial system design, consider the following aspects:
        - System Architecture.
        - Modelling and Simulation.
        - Data Management.
        - Cybersecurity.
        - Information Exchange.
        - Virtual Environment.
        - User interfaces.
        - Certification and Validation.

        - Interdisciplinary Collaboration.
        - Scalability and Extensibility accommodating new generation assets (manned or unmanned) and technological novelties.
        - Non-technical Applications: Investigate the DT's usefulness for non-technical aspects, such as cost-overrun and progress reporting, and consider the benefits of a common model database for constructive entities, terrain data, and addressing data ownership, sovereignty, and sharing concerns.
    - Exploring use cases beyond those identified in the proposal covering the lifecycle of weapon systems, such as Product Development, Acceptance Test, Supply Chain, Maintenance (PLM), Training, Fleet Supervision, Operational Support, Mission Planning, Product Improvement, Lifetime Evaluations and Extensions, Retrofits, and the benefits of these use cases, while overcoming current challenges in implementing DTs in the military air domain, and issues related to accessibility of information, such as data ownership, intellectual property rights (IPR), concurrency, and synchronisation between subsystems.

- Design:
    - The architecture of the digital and fully coupled DT system for a multi-functional and high-fidelity aerial system design must focus on the following aspects:
        - Common Assets: Implement a SoS DT with a modular, scalable, and standardised approach to ensure interoperability across various aerial system components and subsystems.
        - Modularity: Design the DT system to be modular, enabling gradual and progressive development, focusing on the modelling of aerial systems and their integration.
        - Scalability: Ensure the DT system can accommodate new generation assets (manned or unmanned) and technological novelties like Big Data, AI, and XR, cloud architecture solutions, tactical data links, and LVC interoperability solutions.
        - Standardisation: Establish standardised information exchange, data formats, and ontologies to facilitate faster-than-real-time data integration from multiple sources and ensure data consistency.
        - Communications Backbone System: Develop a communications backbone system model that supports real-time data transfer between the DT and other system components.
    - A comprehensive data storage and transfer concept addressing:

        - Data Compression: Establish a data compression system that supports various data formats, resolutions, and compression concepts based on sensor accuracy and use case.
        - Data Model Definition: Define a data model that covers not only metadata but also data governance, including capturing, logging, and datatype (e.g., type: Date) to enable big data fleet analytics.
        - Data toolsets: such as data recorders, data players, application launchers, and scripting interpreters.
    - An initial demonstrator of the system of system DT which includes:
        - A simulation communications backbone system demonstrator, serving as the basis for a European Defence Standard of communications systems.
        - A set of high-fidelity generic models that demonstrate the feasibility and benefits of a generic DT concept, across the systems development life cycle and for users in operation and lifecycle evaluation.
        - The ability to work across the systems development life cycle and provides benefits for users in operation and lifecycle evaluation.
        - 2 independent tests of the demonstrator using real operation data from military assets, focusing on its effectiveness and performance.

In addition, the proposals should cover the following tasks:

- Studies:
    - Development of a technology maturation roadmap for DTs in Aerial Systems, investigating cost-saving potentials due to Model-Based System Engineering (MBSE) approach and DT technologies. This should include future mission scenarios of the lifecycle military assets.
- Design:
    - Elaboration of a proposal for DT standards:
        - Standardise event lists (log files).
        - Standardise data formats.
    - A concept for design evaluation based on data production, covering a design model for lifecycle evaluation/lifetime evaluation of a component.
    - A concept to evaluate the required numbers of measurements and locations for operation supervision and lifetime evaluation of Aerial Systems.

- A complete list of components and sub-components, a measurement list and Process & Instrumentation Diagram for the use case of the proposal, including all sensors.
- Develop a comprehensive data catalogue structure for aerial systems, aligned with international standards ISO/TS 16952, EN 61346-2 and EN 81346-2, which covers:
  - A hierarchical structure with multiple aggregation levels, including:
    - Nation level.
    - Fleet level.
    - System level.
    - Functional overall system level.
    - Sub-system level.
    - Signal identification level.
  - A unique measurement identification system for each sensor or tag at the nation level, ensuring precise tracking and organisation of data from individual sensors/tags to the national level.
- a concept for DT models that integrate multiple approaches, including:
  - Maths and Physics-Based Models
  - Data-Driven and Calibrated Models

  The concept should also include a validation strategy to ensure the reliability and effectiveness of both types of models in operational environments.

In addition, the proposal may cover:

- Studies:
  - Elaboration of recommendations for a European Defence (Aircraft Simulation) DT Model Office in order to share generic models which are not subject to security or export control but improve the speed of development new simulators/prototypes or DT creation. This should include the definition of functional requirements of a number of high-fidelity generic models that could be reused by the defence industries in order to be cost effective and improve the interoperability.
  - Guidelines for:
    - Architecture of DT and the designation of all measurements on fleet perspective.

- DTaaS concept (DT as a Service).

The proposals must substantiate synergies and complementarity with foreseen, ongoing or completed activities in the field of simulation, notably those described in the call topic EDF-2022-DA-SIMTRAIN-MSSI related to *Modelling, simulation and simulator integration contributing to decision-making and training*.

Functional requirements

The proposed product and technologies should meet the following functional requirements:

- Detect and assess damage and optimise aerial systems capabilities by
  - Identifying key features in data.
  - Integrating on-board diagnostic, prognostic, and early-warning functions to ensure reliable performance in various operational, loading and environmental conditions.
  - Achieving high accuracy and low false alarm rates.
- Consider human factors in multi-level data analysis for various users, including:
  - Aerial Systems or crew.
  - Onshore/Air Force base maintenance services.
  - Fleet management teams.
- Use Model-Based Systems Engineering (MBSE) to:
  - Simulate system behaviour.
  - Analyse the impact on:
    - Requirements.
    - Functional domain.
    - Logical domain.
    - Physical domain.
- The system should integrate the following components and capabilities to enable real-time platform health monitoring and predictive maintenance:
  - Industrial IoT Technologies.
  - Sensor Integration.
  - Operator interfaces.
  - Data Lake/Cloud infrastructure.
  - AI-Based Analysis Capabilities.
  - Condition Monitoring.
  - Component/System Failure Modelling.

- The system should be upgradable and flexible, demonstrated through:
    - Modular Design and DTs: Showcase the ability to upgrade and modify the system using DT technology and modular design principles, ensuring that changes can be made quickly and efficiently.
    - Continuous Deployment: Demonstrate the capability to continuously deploy software systems in both the DT environment and on-board, ensuring that updates and new features can be added seamlessly.
    - Easy Integration of New Functionalities: Show that new digital capabilities and functionalities can be easily added to the system without disrupting existing operations, thanks to the use of shared standards for data and interfaces.

- The system should provide a collaborative environment that enables the following data management capabilities:
    - Comprehensive Data Storage: Store all-time series data from the deployment system, including operational data such as raw and processed measurement data, high-frequency data (>1000 Hz).
    - User-Adaptable Data Management covering prioritisation, resolution and adaptation to changing requirements.
    - Time Series Data Storage: Store data in time series format, taking into account physical constraints up to measurement accuracy.
    - Data Compression: Enable data compression for efficient storage.
    - Unified Data Backbone: Transfer all-time series data on a single, unified data backbone.
    - Big Data Analytics and DT Enablement: Store all data, including raw time series data, from Aerial Systems to enable:
        - Big data analytics.
        - Future DT technologies.
    - Data Transfer to Global Storage Centre: Enable the transfer of all stored data from the deployment system to a global data storage centre, such as a Cloud or Data lake.
    - Real-Time Data Transfer: Enable the state-of-the-science transfer of real-time data from the deployment system to a global data storage centre.
- The digital architecture of the DT solutions should meet the following functional requirements:
    - Design
        - Modular design principle to ensure flexibility and scalability.
        - Use open standards for:
            - Hardware.

        - Software.
        - Infrastructure.
    - Implement modern Service-Oriented Architecture (SOA) principles.
    - Employ Modelling and Simulation as a Service (MSaaS) standards.
    - Adopt DT as a Service (DTaaS) approach.
    - Ensure open standards for interoperability with NATO and national systems (e.g., HLA/DIS/BOM), both military and civilian.
    - Provide state-of-the-art, intuitive graphical user interfaces (GUI) to support:
        - Analytics.
        - Operational needs.
        - Training.
        - Decision-making.
- Resilience
    - Identify architectural principles to mitigate the impact of undesirable events (e.g., combat damage, loss of power, cyber-attacks) and ensure:
        - Fast recovery.
        - Core functions in degraded mode.
        - Minimal disruption to operations.
- Security
    - Define and select common architectural principles to maximise security against:
        - Cyber threats.
        - Physical threats.
    - Ensure the safety of the infrastructure for the asset itself.
- Sustainability
    - Operational Availability: Maintain the architecture's operational availability at reasonable costs through:
        - Maintainability.
        - Obsolescence management.
    - Resource Optimisation: Optimise resource usage through:
        - Lean architecture.
        - Energy optimisation.

        - Ensure the architecture can evolve and integrate future technologies and architectural patterns.
- To ensure the quality and reliability of the DT solutions, incorporate the Verification and Validation (V&V) concept to:
    - Define the V&V process and quality standards at the proposal outset.
    - Standardise the V&V process and documentation across industry members.
    - Conduct the V&V process independently of developers.
    - Ensure transparent and comprehensive documentation of model validation.
- Artificial Intelligence (AI) Requirements
    - Artificial Intelligence (AI) capabilities that enhance decision-making speed, develop behavioural models, and analyse time series data:
        - AI-enhanced Decision-Making.
        - AI-based Behavioural Models (civilian and military).
        - AI-based Time Series Data Analysis:
            - Leverage modern AI analytics to analyse the complete history of time series data.

      These AI-based capabilities are to extend the surveillance and operational capabilities of each individual system, allowing for:
        - Sub-component specific analytics: Analyse the performance of individual components within a system.
        - Fleet-specific analytics: Analyse the performance of entire fleets of systems.

Expected impact

The outcome should contribute to:

- Enhance operational superiority and lifecycle management.
- Enable breakthroughs such as integrated mission management and systems diagnosis, predictive maintenance facilitating mission planning and mission planning adaptation, simulation and training scenarios, reduced manning and/or autonomous operations.
- Ensure safer platforms, increased equipment reliability, endurance, and reduced maintenance costs.
- Facilitate the validation and incorporation of new technologies throughout the platform lifecycle.
- Enable early risk reduction and digital system maturation to minimise development time and costs.
- Enhance the effectiveness of coordination with Military Airworthiness Authorities.

- Allow the air forces of EU Member States and EDF Associated Countries to remotely configure customised platforms and assess operational effect.

- Revolutionise aerial system design and certification, enabling multi-functional and high-fidelity system design coupled to physical testing infrastructure, leading to improved system efficiency and reduced costs.

2.1.8. EDF-2025-RA-SIMTRAIN-LVC-STEP: Live, Virtual, Constructive training interoperability – Joint operations and service-specific solutions

- **Indicative budget:** EUR 15 000 000 for this topic under the call EDF-2025-RA.

- **Number of actions to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

Live training is paramount to conduct realistic multi-domain operations (MDO) training in a multi-national context. Creating a realistic joint training environment is however challenging due to aspects such as limitations in access to training areas, the number of available real assets and the need to protect information regarding tactics and system capabilities.

Live, Virtual and Constructive (LVC) technology has a clear potential to be important to perform cost-efficient Multi Domain training by alleviating some of the above limitations. An integrated blend of real platforms (Live), simulators (Virtual) and computer-generated players and targets (Constructive) is developing rapidly. Various recent technologies such as modern communication systems, security solutions and eXtended Reality (XR) also show potential for further enhancing Live as well as Virtual solutions, facilitating flexible use of LVC for training participants. Using LVC in Multi Domain Education and Training reduces operational risks and enhances decision support.

Specific objective

A major challenge is to design and evaluate LVC-training to ascertain training value to both Live and Virtual participants.

While there are many efforts in the development of LVC technology in different domains (e.g., UCATT for land, Distributed Synthetic Training (DST) and Tactical Data Links for the air domain) there is a need to address interoperability in a MDO context and the implications they pose on the current virtual and constructive simulations and the need for common services (Modelling and Simulation As A Service MSaaS). The maturity of standards varies across the different domains (i.e., land, maritime, air, cyber and space), challenges remain to achieve a mature level of interoperability of different Live, Virtual and Constructive entities across EU Member States and EDF Associated Countries and industries.

There is an urgent need to investigate how to develop a continuous, scalable and flexible learning environment that integrates LVC capabilities seamlessly for persistent training, exercises, and rehearsal in a cost-effective way. This is to be realised through:

- Development of a roadmap for an interoperable, flexible, and cost-effective Multi Domain Operations LVC training capability by exploiting current training environments and ongoing LVC activities.

- An LVC Reference Architecture, which is needed to incorporate the Virtual and Constructive simulated world into the live assets. Interoperability standards for LVC systems (e.g., communication, dissemination, service sharing, cyber security) are essential. Therefore, an Open System Architectural approach and standardisation of data exchange is needed to enable multi-domain combat simulation and provide a common entry point and common processes for proprietary systems.

- Scalable and extendable to integrate new generation assets (manned or unmanned) to implement and enhance several mission management functions. Tightly integrated operation of manned and unmanned assets or intelligent integration of heterogeneous data, improving the overall operational performance of each asset and its perception of the rapidly evolving tactical environment.

- Executing training and operating in a more distributing environment, in various more integrated tactical scenarios, including advanced cooperative crewed and un-crewed platforms operations

This call topic contributes to the STEP objectives, as defined in STEP Regulation[30], in the target investment area of deep and digital technologies.

Scope and types of activities

Scope

Proposals must investigate solutions in the training and simulation area.

Proposals must identify current challenges in Multi-Domain Operations (MDO) Integrated LVC in a multi-national context, and more specifically identify state of the art, research gaps, needs and requirements.

Proposals must aim to further research a subset of those challenges found, for a chosen specific use case(s) by achieving an increment in the maturity of the LVC training paradigm and assessing its training value focusing on MDO in a multi-national context.

Proposals should consider concepts and manned and unmanned combat platform to be operated by the EU Member States and EDF Associated Countries, from current or emerging to next generation combat systems in Europe.

Proposals should take into account the foreseeable evolution of mission systems, aiming at standardised effector interfaces and consolidating common and harmonised processes for the operation of relevant simulation technologies at EU level.

In addition, proposals must ensure compliance with NATO standards and other possible coalition situations.

[30] Regulation (EU) 2024/795

This should allow for extended interaction between a variety of collaborative assets used in different operational domains.

Finally, the proposals should demonstrate LVC growth capabilities integrating new generation assets, technological novelties like Big Data, AI and XR, cloud architecture solutions, tactical data links and LVC interoperability solutions.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (optional)
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (optional)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Design:
    - Design and demonstrate technological novelties aiming at improving the training realism and efficiency.

- Design and demonstrate examples of customised solutions to enhance the current training systems capabilities considering the operational needs and the outcome of above activities.

- Demonstration and evaluation of a representative MDO combat training scenario in a multi-national context.

In addition, the proposals should cover the following tasks:

- Studies:

  - Identify state of the art, research gaps, needs and requirements of MDO Integrated LVC in a multi-national context, including:

    - Identification of gaps in LVC training technologies, technological enablers, and standardisation.

    - Identification and analysis of the state-of-the-art LVC system architectures in the different domains across EU Member States and EDF Associated Countries. Identify security (cyber security and cyber defence) and technological gaps, which preclude the interoperability of live tactical data links (e.g., Link 16, Link 22, ADS-B, AIS) in the LVC training network.

    - Survey on potential application of disruptive technologies (such as Extended-Augmented Reality, Big Data Analysis and Artificial Intelligence).

    - Identification of the specific interoperability challenges in live systems integration in a MDO multi-national context. Considerations must be given to evolve or integrate legacy solutions.

    - Identification of how current Distributed Synthetic Training (DST) capabilities and Virtual and Constructive assets need to evolve in order to meet the fidelity requirements posed by integration with live assets/platforms.

    - Identify how future LVC capabilities may benefit from using an Modelling and Simulation as a Service (MSaaS) approach in order to implement common services such as terrain and weather services, damages services as well as system initialisation services.

  - Achieve an increment in the maturity of the LVC training paradigm and assessing its training value focusing on MDO in a multi-national context, including:

    - Integration of LVC training on operational, strategic, and tactical level. Technologies and interoperability standards for Multi Domain Operations Combination of LVC entities to give efficient and effective training effects.

        - Design of training scenarios and approaches, including preparation, execution and management, and evaluation.
        - Methods for measurement and evaluation of training value and performance
    - Survey on the potential of live training areas in EU to integrate LVC technologies and migrate to a future integrated LVC training area which should ultimately lead to a future common EU training facility.

The proposals should substantiate synergies and complementarity with foreseen, ongoing or completed activities in the field of simulation, notably NATO and EDF simulation activities.

Functional requirements

The proposed product and technologies should meet the following functional requirements:

- Interoperability of heterogeneous systems (from existing to next generation systems, manned and unmanned), including when in coalition situations with EU Member States' and EDF Associated Countries' forces and NATO forces, allowing to perform different missions with System of Systems approach.
- Common scenario synchronisation protocol and communication service are to be used.
- Interoperability with maritime on-board training systems, air embedded training systems and instrumented live training systems for the land domain as well as Distributed Synthetic Training (DST).
- Be applicable for the design of mission system for next generation combat assets and the upgrades of legacy combat systems.
- Enhanced visual capabilities with eXtended Reality to improve trainees' immersion (e.g., visual, stimulated onboard subsystems)
- Enhanced training capabilities including adaptive training using new technologies (e.g., big data analysis and AI).
- Increase connectivity between live and virtual platforms and interconnection of tactical Data Links with Live dedicated training platforms.

Expected impact

The outcome should contribute to:

- Structure and develop a European ecosystem to support simulation technology for military usages.
- Establish an EU roadmap for MDO LVC in a multi-national context.
- Identify and address specific LVC interoperability challenges and gaps in order to establish a cost-efficient LVC training capability for MDO in a multi-national context.

- Incrementally increase the interoperability of LVC training systems - current and future – to enable the EU Member States' and EDF Associated Countries' armed to "plug and train" efficiently.
- Improve the capabilities and effectiveness of On-Board and Ground Training systems by identifying specific LVC challenges and addressing the gaps of federated LVC solutions to promote interoperability, integration and MDO in a multi-national context.
- Integrate and develop advanced training concepts by adopting novel technologies allowing a proper coverage of emerging needs of a MDO in a multi-national context.
- Promote convergence on training standards and certifications to foster interoperability of EU Member States and EDF Associated Countries.
- Better use of resources (single and multiple domains and assets).
- Harmonise the EDTIB processes and methods for the development of LVC simulation capabilities.
- A more effective, efficient, cost-effective, and sustainable Multi Domain Operations combat training and mission rehearsal.
- Increase the multinational and multi-domain training activities while at the same time improving the corresponding lessons-learned process.

2.2. Call EDF-2025-LS-RA-SI

- **Targeted type of actions:** Research actions
- **Form of funding:** Lump sum grants following the call for proposals
- **Targeted type of applicants:** Any eligible consortium as defined in Articles 9 and 10(4) of the EDF Regulation.
- **Specific provisions for the call:** The proposals must build upon or integrate results that have been achieved within one or several projects that had been funded under an EU programme call with a focus on civil applications. This previous project(s) may be completed or may still be active. The submitting consortium does not need to be constituted or even to include a participant or result owner of the previous project(s). However, applicants must provide a confirmation that they have or will have the necessary rights to use and commercialise the results of the previous project(s).
- **Indicative budget for the call:** EUR 40 000 000 for two call topics addressing two categories of actions.

2.2.1. EDF-2025-LS-RA-SI-CYBER-3RAV-STEP: Risk, robustness and resilience for autonomous vehicles in military operations

- **Indicative budget:** EUR 20 000 000 for this topic under the call EDF-2025-LS-RA-SI.
- **Indicative number of proposals to be funded:** Several proposals may be funded for this topic.

Objectives

General objective

Unmanned vehicles (UxV) such as drones, ground vehicles, and surface/underwater vessels are bound to become an integral part of military operations. Advanced autonomous capabilities are being developed for these systems to enable them to carry out different missions, both with and without human intervention, thus increasing efficiency and minimising risk. From a security perspective, this poses various new challenges that need to be properly resolved to deploy these vehicles in real missions and exploit their full potential.

The cyber-physical nature of UxVs affects security in various way. It brings the attack surface of a typical computer (network) into a new context where successful cyber-attacks can have serious consequences in the physical world, while imposing new physical and operational constraints on available and well-established cyber security controls. New attack vectors emerge, and threat models need to be revised. If autonomous capabilities that rely heavily on sensor data to make their decisions are employed, the environment itself can become a new attack vector, as it can be manipulated to exploit vulnerabilities in these new capabilities. Sensors themselves become a new part of the threat model, and the protection of confidentiality of data on the vehicles needs to be weighed against the protection of the availability of effectors and actuators and the integrity of control information.

Specific objective

Designing appropriate security controls for UxVs requires capabilities to identify and evaluate complex trade-offs between data protection, cybersecurity and assured autonomy to best support a mission. Automating parts of the analysis process is necessary to handle the complexity of this task, including processing large amount of data, reducing costs and risks associated with testing physical systems, and producing structured and traceable documentation.

Existing security and safety approaches may be tailored to suit UxVs so that they can be made both secure and robust against well-known deliberate and accidental threats, however new solutions are expected. An additional challenge is whether UxVs can be made resilient in the sense that they can still react in a way that minimises the consequences, and possibly allows for alternative ways to complete the mission autonomously, in the presence of a successful cyber-attack.

This call topic contributes to the STEP objectives, as defined in STEP Regulation[31], in the target investment area of deep and digital technologies.

Scope and types of activities

Scope

The capability of UxVs to be resilient so that they can minimise the consequences of an cyber-attack, and allowing for alternative ways to complete the mission autonomously, is called in this context *autonomous cyber defence*, which is consisting of four main components: monitoring, detecting, reacting, and reconfiguring (or learn). A central part of this capability is the ability to monitor the system and detect potentially harmful anomalies, but also to understand the risk associated with both their impact and possible responses. For instance, if a malware was detected on a UxV trying to exfiltrate classified data, and the source was a malicious component critical for flight, the system might have to evaluate the risk and feasibility associated to either: preventing a breach of confidentiality by shutting down the malicious component and crash onto the ground, thus possibly damaging people or infrastructure; accepting the loss of data to prevent the UxV from crashing; or reconfiguring itself to perform an emergency landing while gradually shutting down the rotors in time to prevent significant data leakage.

A "risk-evaluation engine" is central to this capability to generate risk-based courses of actions (CoA) that take into consideration the effect of each action on the various assets connected to the UxV that need to be protected. This includes the mission goals the UxV supports, the confidential information on the UxV and the safety of the UxV itself and its surroundings. This presupposes a sufficient understanding of the UxV´s systems, its interactions, the environment and the dependencies between the UxV´s capabilities and the mission. Additionally, the anomalies should be detected with a high degree of precision to estimate their potential effect before they compromise the UxV beyond repair.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (mandatory)
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)

[31] Regulation (EU) 2024/795

Types of activities (art 10(3) EDF Regulation)		Eligible
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	System prototyping of a defence product, tangible or intangible component or technology (**prototype**)	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

The following tasks must be performed as part of the mandatory activities of the proposals:

- Generating knowledge:
    - Develop suitable military scenarios where autonomous vehicles are applied, including mission objectives and mission risks.
    - Attack modelling and catalogue of threats/attacks suitable for both the vehicles and given scenarios.
    - Catalogues of assets/functionality/capabilities required to perform the mission/scenario.
    - Catalogue of security controls and measures; both to prevent attacks and to detect and respond. These are to be cyber-physical and may be both in the cyber and physical domain.
- Integrating knowledge:
    - Develop and/or enhance simulation environments (digital twins) in order to simulate scenarios, including applying attacks and defensive measures (both in cyber and physical domain).
    - Development, adaption and/or enhancement of suitable preventive security measures/controls for autonomous cyber defence.

- Development of monitoring and detection capabilities, possibly based on AI, for autonomous cyber defence.
- Development of capabilities to understand and contextualise detected incidents, events and produce suitable response based on risk and mission goal, which can be autonomously applied to environment.

- Studies
  - Ethical and legal considerations for autonomous cyber defence in such cyber-physical domain.
  - Understand effect and limitation of preventive security measures.
- Design
  - Proof of concept implementation of autonomous cyber defence with both preventive measures and abilities to detect and respond to cyber-attacks.
  - Test of implementation in realistic military operational scenarios and/or military exercises.

Functional requirements

The proposals should meet the following functional requirements:

- Improve robustness and resilience of UxVs against threats and attacks in the cyber domain.
- Improve knowledge of the effects and limitations of both preventive security measures and capabilities to detect and respond autonomously to attacks in the cyber domain.

Expected impact

The outcomes should contribute to:

- A stronger, more competitive, and technologically independent European Defence Technological and Industrial Base (EDTIB) when it comes to solutions for cybersecurity penetration test automatisation and capability to test the security posture of operational computer networks and emulate threat agents during training, exercises, and system tests.
- Enhanced security for EU Member States and EDF Associated Countries and more capable and interoperable forces performing cyber defence operations,
- Promote cooperative efforts in this area leveraging the implementation of EU Policy on Cyber Defence (EPCD)

2.2.2. EDF-2025-LS-RA-SI-ENERENV-NH2PS-STEP: Naval hybrid propulsion and power systems

- **Indicative budget:** EUR 20 000 000 for this topic under the call EDF-2025-LS-RA-SI.

- **Number of actions to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

The EU has set the ambition to be carbon neutral by 2050. This objective also affects military naval vessels. Most efficiently produced carbon-neutral fuels such as hydrogen and ammonia have an energy density, safety and toxicity that does not allow its application on frontline naval vessels, such as frigates and corvettes, as it would affect their ability to operate autonomously, with minimal logistic supply lines and impede the resilience against damage due to the explosivity or toxicity of the fuel. Fluid fuels, such as methanol, could be applicable to certain types of naval vessels with limited autonomy requirements or during peacetime operations, while frontline operations would be best sustained with a zero-emission long-chain synthetically produced fuel, such as sustainable aviation fuel. This drives the need to reduce the impact of sustainable fuels on naval propulsion and electrical power systems. The use of expensive long chain e-fuels and less energy-dense e-fuels, such as methanol, urgently requires an increased energy efficiency of the propulsion and power plant. Moreover, commercially developed technology, such as electrical propulsion systems, novel SiC based power-dense power electronics, DC power systems, fuel cells and energy-dense storage devices (e.g., Li-ion batteries, super-capacitors, flywheels, etc.) with higher capacity provide an opportunity to increase the efficiency, range and life cycle cost of propulsion and power systems, and to improve its military performance criteria, such as noise, infrared and electromagnetic signatures, power density, power system resilience against shock and battle damage. However, to achieve this, these systems need to be developed for military application and integrated in a naval vessel and its propulsion and power system.

This call topic aims to address the design of a prototype, the testbed and general architecture for a future modular and hybrid propulsion systems, hybrid DC power systems and their components for military application, while performing its system integration in a combined digital and physical development environment. These novel propulsion and power systems can achieve reduced Green House Gas (GHG) and hazardous emissions from well-to-wake in peacetime and can power wartime missions effectively with maximum autonomy at sea, survivability and minimal and controllable noise, infrared, electromagnetic and radar-cross-section signatures. To achieve these benefits, mostly civilian developed technology needs to be navalised and effectively integrated in the naval propulsion and power system. These naval propulsion and power systems aim to serve a wide spectrum of naval vessels ranging from small and lightweight high-speed combat vessels, slow speed manhunting vessels and motherships, medium- and high-speed frigates, through to high-speed air-defence destroyers. These vessels have in common that they serve a wide range of propulsion systems, diverse variable speed drives and many DC combat system loads and therefore could all benefit from modular and scalable hybrid propulsion systems and hybrid DC power systems.

Specific objective

In many commercial applications, continually increased power density of electrical motors, generator units and power electronic converters is achieved. Due to the enormous diversity of naval vessels, these novel technologies for propulsion and power generation are only very slowly implemented on naval vessels, while its urgent need increases rapidly. Novel technologies in modelling and simulation of these systems, including data-driven methods as developed in the civilian sector, allow the systematic development, testing and demonstration of these technologies for integrated hybrid propulsion and hybrid power system. Moreover, various components developed and tested at dislocated physical test-facilities at various scales can be tested, demonstrated, and validated in a combined digital twin and physical power hardware in the loop environment. This can provide the necessary steps towards implementation of the technology researched in the innovative propulsion call, for which industry currently prepare their proposals.

This approach allows to more rapidly pull-through commercially developed technology to military application for the following specific naval challenges:

- DC electrical power systems can be applied to reduce the number of conversion stages in electrical systems with increasing amounts of variable speed drives and high-power DC sensor and weapon systems. The growing need for electrical power requires a technological effort to increase the working voltage for DC shipboard grids. Moreover, novel DC power systems can increase the power system resilience by the application of fast acting power electronic based or hybrid switches and novel fault protection strategies.

- A modular, scalable hybrid propulsion and power system can enable the integration of diverse power sources such as dual fuel engines, gas turbines, fuel cells and batteries.

- For low and medium speed engine, technology is available for diesel methanol dual-fuel combustion engines. However, for power dense and silent high-speed engines dual-fuel combustion engines still need to be developed, tested, and integrated, with a specific focus on establishing the optimal operating point for efficiency, signatures, and its response to dynamic loads.

- While fuel cells are introduced in special maritime applications, like submarines or Autonomous Unmanned Vehicle demonstrators, the harsh dynamic loading, necessary reformer and shock requirements of surface vessels require specific design and integration changes for military applications and test and demonstration in an integrated hybrid power system.

- The integration of batteries can provide an energy source to provide power to highly dynamic loads, provide a back-up power source for power source failures and achieve a very silent low speed purely battery-electric operation.

- The integration of both low-flash-point fuels and energy dense battery systems requires specific integrated safety solutions to prevent fires and limit the impact of potential incidents, with a specific focus on military application.

This call topic contributes to the STEP objectives, as defined in STEP Regulation[32], in the target investment area of clean technologies.

Scope and types of activities

Scope

Proposals must develop of a joint digital simulation environment using the knowledge gained from *the civilian sector* and several commercial national and EU research programmes. In addition, the proposal must develop a methodology to utilise various dislocated test facilities across Europa to evaluate the component behaviour (subsystems/components de-risking) and improve its system integration and control with a specific focus on military performance criteria such as autonomy at sea, survivability and minimal noise, infrared, electromagnetic and radar-cross-section signatures.

Moreover, the proposal must develop, prototype and demonstrate an integrated DC power system architecture with its fault protection, control strategies and components, with a focus on energy efficiency and military signature requirements. Furthermore, the proposal must also develop, prototype and demonstrate power sources, such as high-speed dual-fuel combustion engines, gas turbines on sustainable fuels, fuel cells and batteries.

In addition, proposals may address the development of AI controllers based on physical models to optimise the behaviour of the DC architecture in terms of energy and fuel consumption and GHG emissions reduction, with the focus on military requirements on safety and operation.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (optional)
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)

[32] Regulation (EU) 2024/795

Types of activities (art 10(3) EDF Regulation)		Eligible?
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No (mandatory)
(f)	**Testing** of a defence product, tangible or intangible component or technology	No (mandatory)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No (mandatory)
(h)	**Certification** of a defence product, tangible or intangible component or technology	No (mandatory)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No (mandatory)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Studies:
    - Conduct research studies on novel concepts for propulsion and energy systems in future military vessels, with a focus on improving all functional requirements. In addition, the proposed studies should be justified and benchmarked against established functional requirements for military ships of similar size and mission profile.
    - Study, investigate and recommend possible standardised DC-grid Low Voltage (LV) and High Voltage (HV) power quality requirements that should facilitate the use of commercial and military equipment (HV and LV as defined by IEC).
    - Study and simulate the DC-grid behaviour in various fault conditions in order to establish the system power quality envelope, such as arc flash, selectivity, grounding faults.
    - Study and investigate possible LV-/HV- shore connection system, DC-AC and DC-DC.
    - Studies on the Low Voltage (LV) and High Voltage (HV)-DC-grid response to peak energy demands caused by e.g., direct energy weapons, high energy lasers.
    - Studies on the power quality and fluctuations in the Low Voltage (LV) and High Voltage (HV)-DC-grid during peaks of energy demands.

- Study and demonstrate the various concept for alternative fuels / energy systems for Navy vessels, taking into account multinational operations including replenishment at sea operations.
- Simulate and demonstrate the different energy conversion methods.
- Simulate and demonstrate the difference in the energy conversion methods taking into account signatures, ramping up speed, exhaust gasses and fuel consumption.
- Study and analyse the logistic support chain of alternative fuel / energy system challenges.
- Analyse the environmental impact/possible benefits via a (comparative) Life Cycle Assessment.
- Study and investigate new strategies and technology for energy monitoring and energy optimisation onboard military ships.
- Study the integration of a robust and silence gearbox in the hybrid propulsion system taking into account increased military performance, energy density of the complete system and optimal speed selection.

- Design:
  - Adapt and demonstrate power sources for military purposes.
  - Develop innovative designs for complete propulsion and energy systems tailored to military vessels with different mission profiles, focusing on improving all functional requirements for future naval vessels of different sizes. In addition, the proposed designs should be fully justified and benchmarked against established functional requirements for military ships of similar size and mission profile, to ensure a robust and optimised solution.
  - Investigate dual/multi fuel high speed diesel engines utilising alternate sustainable fuels.
  - Design and demonstrate novel power dense converter technology, based on novel SiC based electronic components.
  - Design and demonstrate novel DC system architectures (MW-scale) and its fault protection strategy using both converter based and hybrid mechanical and power electronic switches.
  - Design and demonstrate advanced control strategies for fuel, emission, and signature optimisation.
  - Design and demonstrate integrated power system architectures and its power hardware in the loop development and testing strategy.

- Design and demonstrate a redundant architecture LV/HV DC-grid systems based upon novel technologies.
- Design, validate and demonstrate digital twins for propulsion and power systems with validation from test facilities and real vessels.
- Design of a testbed for systems that have large HV DC request, such as direct energy weapons, etc.., which allows obtaining information about the DC-grid response and the elasticity of the grid.

In addition, the proposals should cover the following tasks:

- Generating knowledge:
  - For all components, identify criticalities regarding materials' supply and study mitigation measures (including but not limited to substitutes – explaining potential limitations, circular management of components and recycling).
  - Investigate DC LV/HV ground faults, and their effects on ship corrosion including the impressed current cathodic protection system.
  - Investigate and recommend philosophy and "best practice" design for monitoring of DC LV/HV ground faults.
  - Investigate "best practise" philosophy, design and trade-offs with ground faults, EMC filters and ship corrosion for DC grid systems.
  - Investigate personnel safety for LV/HV DC grid.
  - Investigate the hazards imposed by the proposed alternative fuels and give the best practise design for a navy ship.
  - Investigate the possibility to define the DC-grid fault condition using a dependable design based on dynamic modelling (fault-forecasting based on dynamic simulations)
- Integrating knowledge:
  - Gain knowledge of the power layer and data layer integration in complex onboard DC power systems and control architectures in order to increase resilience.

The **proposals may also cover the following tasks:**

- Generating knowledge:
  - Develop, prototype and demonstrate for study purposes the integration of super-capacitors and/or flywheels, in combination with batteries, in order to combine the advantages of each of the technologies and improve the global power system efficiency.
- Integrating knowledge:

- Gain knowledge of the risks in the cyber domain (cyber-security tests) in order to define the vulnerability of the system architecture.

Proposals must substantiate synergies and complementarity with foreseen, ongoing or completed activities performed in the civilian sector and several commercial national and EU research programmes.

Functional requirements

The proposed product and technologies should meet the following functional requirements:

The technologies to be developed should focus on the following environmental and military requirements and its trade-off for both peacetime and wartime operating scenarios:

- Impact on all performance criteria listed below for top speed, cruise speed, and several peacetime and wartime typical mission profiles.
- Acceleration and deceleration behaviour of the propulsion plant in various mechanical, electrical, and combined operating modes.
- Weight and volume reduction of components and the integrated propulsion and power system.
- Noise signatures at various operating modes and for several peacetime and wartime mission profiles.
- Infrared signatures at various operating modes and for several peacetime and wartime mission profiles.
- Electromagnetic signatures at various operating modes and for several peacetime and wartime mission profiles.
- Radar Cross Section, which is directly related to size and displacement.
- Safety of alternative fuels, fuel cells and batteries, whether integrated alone or combined in a vessel, and the response to calamities caused either by internal failure or external damage.
- Range and autonomy (sea endurance).
- All exhaust gasses at all mission profiles (e.g., top speed, cruise speed in various operating modes and during several peace- and wartime typical scenarios).
- Integration of energy conversion system in combination with selective catalytic reduction systems.
- Energy efficiency at all mission profiles (e.g., top speed, cruise speed in various operating modes and during several peace- and wartime typical scenarios).
- Life Cycle Cost based on maintenance, fuel cost and manning for several peacetime and wartime typical mission profiles.

- Shock resistance, propulsion and power system robustness and resilience.
- Manning requirement for operation and maintenance.
- Modularity to enable both the application of the developed technology to a wide range of different platforms and future upgrades to further increase energy efficiency and improve military performance.
- Expected life limit for components and systems.
- Expected removal from ship / main overhaul for components and systems.
- Expected failure rates of components and systems (Mean Time Between Failure (MTBF) and Mean Time To Repair (MTTR)).

Expected impact

The outcome should contribute to:

- Accelerate the adoption of commercial high-tech propulsion and power system components.
- Technology implementation on naval vessels and the accelerated development, prototyping and demonstration of a number of crucial propulsion and power system technology building blocks.
- Accelerate the future research and development programmes of on energy conversion systems.

2.3. Call EDF-2025-LS-RA-CHALLENGE

- **Targeted type of actions:** Research actions (technological challenges)
- **Form of funding:** Lump sum grants following the call for proposals
- **Targeted type of applicants:** Any eligible consortium as defined in Articles 9 and 10(4) of the EDF Regulation
- **Indicative budget for the call:** EUR 27 000 000 for two call topics addressing one category of actions.

This call aims at progressing human-AI dialogue systems for defence applications. In order to foster and steer progress, the research activities will be organised as a technological challenge, whereby different research teams submit their systems to blind testing using common evaluation protocols and datasets, with the support of an organising third party. This scheme is needed to evaluate systems involving machine learning in an objective and reproducible way. This leads to two call topics, one to support the research teams participating in the challenge (HAIDP), and one to support the challenge organisers (HAIDO). A preliminary evaluation plan common to the two topics is provided as part of the call document (cf. Annex 4). It is an integral part of the topic description for each of the two topics.

The technological challenge organised through this call addresses several features of dialogue systems for which significant progress is needed. In addition, the call covers the production of complete demonstrators that can be tested by representative defence users.

A proposal submission may address only one topic. However, it is highly recommended that applicants read both topics and the preliminary evaluation plan related to a given technological challenge before preparing their application in order to fully understand the overall set-up.

The two topics of a technological challenge are linked. Actions selected for the participation in a challenge will be linked to the action selected for its organisation, via the "linked action" mechanism described in the Model Grant Agreement.

2.3.1. EDF-2025-LS-RA-CHALLENGE-DIGIT-HAIDP-STEP: Privacy-preserving human-AI dialogue systems – Participation in a technological challenge

- **Indicative budget:** EUR 20 000 000 for this topic under the call EDF-2025-LS-RA-CHALLENGE.
- **Number of actions to be funded:** Several proposals may be funded for this topic.
- **Range of financial contribution of the EU per proposal:** The requested funding cannot exceed EUR 5 000 000.

Objectives

The fast progress of generative artificial intelligence (AI), large language models and dialogue systems (chatbots) paves the way towards high-impact defence applications in various domains such as intelligence, strategic planning, tactical operations, and life-cycle support. However, these technologies are still prone to errors, leading them in particular to present false or misleading information as fact (hallucinations). They should also be adapted to defence-specific needs. There is therefore a need for further research to develop high-performance human-AI dialogue systems for defence.

In order to ensure trust and steer progress, these systems should be evaluated in an objective and comparative way. For that purpose, each consortium supported through this call topic will benefit from a common testing environment set up by a third-party consortium (selected under topic EDF-2025-LS-RA-CHALLENGE-DIGIT-HAIDO) in the framework of a technological challenge and will have to participate in the evaluation campaigns organised in this framework.

To further ensure trust and usability by all EU Member States' and Associated Countries' forces in a wide range of military contexts, the following features should also be developed and evaluated:

- The systems should be able to justify their answers (explainable AI).
- The systems should be able to properly handle and protect sensitive or classified information. This requires a form of learning taking into account that different sets of information are restricted to different user groups, so that the systems can adapt their answers depending on the users they interact with.

- The systems should be able to continuously learn from user supervision without intervention from the developers and without regression.
- The systems should be able to interact both in writing and by voice.
- The systems should cover all EU official languages.

Systems should be integrated into demonstrators that can be tested by defence users. This is important not only to validate results, but also to generate realistic data which can be used to further develop the systems.

This call topic contributes to the STEP objectives, as defined in STEP Regulation[33], in the target investment area of deep and digital technologies.

Scope and types of activities

Scope

The proposals must address multilingual written and spoken human-AI dialogue systems that can manage the need-to-know associated to classified information, learn from users, and explain their answers. These systems must be evaluated in the framework of the technological challenge organised under this call. They must be integrated into demonstrators with user-friendly interfaces.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (mandatory)
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (optional)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (optional)

Types of activities (art 10(3) EDF Regulation)		Eligible?
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

The proposals must cover at least the following tasks as part of mandatory activities:

- Generating knowledge:
    - Research on dialogue systems.
    - Participation to the evaluation campaigns organised in the framework of the technological challenge, including:
        - exchanging with other stakeholders on the evaluation plans.
        - submission of systems to experimental performance measurements during the test campaigns managed by the challenge organisers.
        - participation to debriefing workshops.
- Integrating knowledge:
    - Integration of technological modules into demonstrators that can be tested by representative defence users.

The proposals should include descriptions of work packages, tasks and deliverables that enable a clear assessment of work package completion. These should include the participation to the test campaigns organised in the framework of the technological challenge, and the delivery of descriptions of the systems submitted to the tests.

Functional requirements

The proposed solutions should meet the following requirements:

- Systems should offer state-of-the-art performances. Applicants should describe in their proposals the systems they plan to build upon and provide quantitative information on their performances (including information on the data and metrics used for the measurements, and if applicable on the evaluation campaign in the framework of

which the measurements where made), along with references to public information backing this information.

- Software components corresponding to tasks covered by the technological challenge should be submitted for evaluation therein. Applicants should describe in their proposals how the proposed approaches and systems will address the tasks outlined in the preliminary evaluation plan (cf. Annex 4).

- Software components should be integrated into demonstrators with user-friendly interfaces and run in near real-time with no perceived lag for the users. Any difference between the version of components evaluated through the technological challenge and a version integrated in the demonstrator should be documented.

- Demonstrators should be able to run locally, without a connection to a wide area network, except for specific functions for which this can be duly justified and is compatible with operational missions (e.g., to achieve higher performances when adapting under user supervision).

Expected impact

The outcome should contribute to:

- A strengthened EDTIB (European Defence Technological and Industrial Base) and enhanced technological autonomy for defence-oriented Human-AI dialogue systems.

- Broader, trusted usage of generative AI, large language models and chatbots in defence systems.

- Data sovereignty and security of information when using generative AI.

- Better and faster decision-making in complex operational scenarios.

2.3.2. EDF-2025-LS-RA-CHALLENGE-DIGIT-HAIDO: Privacy-preserving human-AI dialogue systems – Organisation of a technological challenge

- **Indicative budget:** EUR 7 000 000 for this topic under the call EDF-2025-LS-RA-CHALLENGE.

- **Number of actions to be funded:** One proposal is to be funded for this topic.

Objectives

Human-AI dialogue systems offer impressive results but are still prone to errors of various types. Moreover, there is no established metric to measure system performances. In order to ensure trustworthiness and steer progress, these systems should be submitted to common tests using shared data and clear metrics and protocols.

The goal of this call topic is thus to set up a testing environment and organise a technological challenge to evaluate the performances of such systems for defence use cases, including their abilities to manage classified information and to justify their answers. The challenge should be open to research teams supported through another call topic (EDF-2025-LS-RA-

CHALLENGE-DIGIT-HAIDP) and possibly by other sources of funding. Representative defence users should be involved to contribute to the definition of the use cases and associated data, to test the demonstrators produced by the participating teams, and to provide feedback.

Scope and types of activities

Scope

The proposals should address the organisation of a technological challenge on human-AI dialogue based on the preliminary evaluation plan provided as part of the call document (cf. Annex 4). This includes the collection, annotation and distribution of data, the elaboration of evaluation plans and metrics, the measurement of system performances, and the organisation of debriefing workshops.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (optional)
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (optional)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (optional)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

The proposals must cover at least the following tasks as part of mandatory activities:

- Integrating knowledge:
    - Setting-up of the infrastructure for testing human-AI dialogue systems in the framework of the technological challenge.
    - Elaboration of data annotation guidelines, collection and annotation of data, quality assessment, distribution and curation of databases.
    - Organisation of the evaluation campaigns, and in particular.
        - coordination of the exchanges with the participating teams and any other relevant stakeholders on the evaluation plans and elaboration of these plans.
        - management of the experimental test campaigns and of the objective measurements of the performances of the systems submitted to the tests by the participating teams according to the protocols and metrics described in the evaluation plans.
        - organisation of the debriefing workshops.

The proposals should include descriptions of work packages, tasks and deliverables that enable a clear assessment of work package completion. These should include the production of detailed evaluation plans agreed upon by all stakeholders, the production of the annotated databases needed for the evaluations, the production of measurements for all systems submitted to the tests by the participating teams following these plans, and the organisation of the needed events.

Functional requirements

The proposed solutions should enable the measurement of the performances of dialogue systems according to detailed evaluation plans based on the preliminary evaluation plan provided as part of the call document (cf. Annex 4). Key aspects of the foreseen detailed evaluation plans and associated data management should be described in the proposals. The proposals should in particular describe:

- the scenarios considered.
- the languages that can be covered for each evaluation campaign.
- the nature and volume of data annotation to be produced, and in particular how the data is representative of defence use cases.
- a detailed plan of the test campaigns and an overall timeline/Gantt chart of the technological challenge.
- the evaluation procedures (rules and tools to implement the metrics) and significance tests to be performed on measurements.

A user board consisting of representative defence users should be set up and involved in live tests. The proposals should describe the foreseen efforts from users to test demonstrators and provide feedback.

During the challenge, detailed evaluation plans should be prepared for each evaluation campaign. Drafts of these detailed evaluation plans should be submitted for discussion to the participating teams, early enough to take into account the feedback for the actual evaluation campaigns. Any evolution of the evaluation plans should take into account several factors: technical possibilities and cost, scientific relevance of the measurement, and representativeness of the metrics and protocols with respect to military needs.

More generally, the user board and the participating teams should be involved in the steering of the technological challenge. The proposals should include a clear description of the foreseen governance and decision-making processes at the technological challenge level.

Expected impact

The outcome should contribute to:

- Standardisation of testing for dialogue systems.
- Enhanced clarity on the performances of dialogue systems for all stakeholders, including system developers, funders, and users.
- Community building at the European defence level.
- Trustworthy dialogue systems that enhance operational decision-making.
- Availability of databases to further develop dialogue systems.

2.4. Call EDF-2025-LS-RA-DIS

- **Targeted type of actions:** Research actions (dedicated to disruptive technologies for defence)
- **Form of funding:** Lump sum grants following the call for proposals
- **Targeted type of applicants:** Any consortium of eligible entities as defined in Article 9 of the EDF Regulation and involving at least two legal entities established in at least two different EU Member States or EDF Associated Countries. At least two of the eligible legal entities established in at least two EU Member States or EDF Associated Countries shall not, during the entire period in which the action is carried out, be controlled, directly or indirectly, by the same legal entity, and shall not control each other.
- **Indicative budget for the call:** EUR 43 000 000 for two call topics addressing one category of actions.

2.4.1. EDF-2025-LS-RA-DIS-GDET: Great-depth enabling technologies

- **Indicative budget:** EUR 23 000 000 for this topic under the call EDF-2025-LS-RA.

- **Number of actions to be funded:** Several proposals may be funded for this topic.

Objectives

General objective

Following the emergence of geopolitical instability in Europe and recent acts of sabotage on underwater critical infrastructures, it is evident that the vulnerability of assets such as underwater strategic pipelines, cables, communication backbones and offshore infrastructures, requires resolute measures to ensure their safety and resilience with a specific focus on Seabed Warfare (SBW).

Next generation silent submarines are an example of new forms of threats that need to be countered by effective response capabilities supporting the various defensive missions. Other examples of threats are unmanned vehicle (UxV) carriers that can target energy pipelines, spoofing data from the submerged communication backbones and cutting power energy cables.

International cooperation projects under the auspices of the EU (PESCO, EDF) and NATO (JCG MUS, Smart Defence) have already been initiated to counter these emerging threats.

However, further dedicated research focusing on the evaluation of potential technologies to cope with the above needs is necessary. In particular, this research must prioritise on delivering of technologies to EU defence capabilities that are expected to enable solutions for monitoring and defending underwater critical assets as well as responding to threats in deep waters[34] (water having a depth greater than 200 metres) up to 6000 meters (m) in depth.

Specific objective

Due to a growing number of sabotage acts on critical underwater infrastructure, SBW has gained a very high level of interest for many EU navies. It is therefore necessary to be able to counter the various threat types operating in deep waters up to 6000 m in depth. Most of today's surveillance and reaction systems currently in service in Western navies have been developed to operate at limited depths, and not in the immediate proximity of the seabed. For many of these systems, extension to new operational requirements is hampered by several technological barriers. For example, with existing technologies the maximum operating depth of vehicles based on a pressure-resistant hull (such as traditional torpedoes) is insufficient for new and emerging operational scenarios.

An extensive and precise research activity, focused on "great-depth enabling technologies", could represent an important intermediate step towards an optimised and more efficient future SBW. The results of the research activity could facilitate and speed up the design of new systems specifically conceived and optimised for the operation in the new operational scenarios. At the same time, these new great-depth technologies could facilitate the adaptation of current systems to new operational requirements.

Proposals are expected to reach technology readiness level (TRL) 5.

Scope and types of activities

[34] NATO AAP-06(2021)

Scope

The aim is to progress in undersea operations (e.g., SBW) in deep waters up to a depth of 6000 m, with a concept phase to study and evaluate technologies suitable for platforms and payloads to allow unmanned underwater vehicles (UUV), detection systems, warning systems, communication systems, and weapon systems to perform deep water undersea missions (e.g., SBW missions), or even to be applied on fixed elements such as monitoring systems.

The proposals must identify defence use cases and justify the relevance of the proposed technologies to be addressed with respect to these use cases, taking into account the wider landscape of potential solutions for these use cases and the deployment costs.

Layered defensive depth must be formed and critical areas must be identified where monitoring and protection of the critical undersea infrastructure must be extended.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes (mandatory)
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (optional)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No

Types of activities (art 10(3) EDF Regulation)		Eligible?
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Generating Knowledge:
    - Creation of numeric models and simulation of components that embody new or improved technologies, which can demonstrate the element's performance in an operational environment.
    - Investigate and improve next-generation sensor technologies capable of high-resolution data collection in deep waters up to depths of 6000 m.
    - Generate knowledge of multi-layered intelligence, surveillance and reconnaissance of underwater threats.
    - Investigate intelligent underwater sensor systems able to ad-hoc networking and contributing to shared situational awareness.
    - Generate knowledge of neutralisation solutions for emerging underwater threats, such as UUVs (autonomous underwater vehicles (AUV) and remotely operated vehicles (ROV)), including hard vs soft kill effectiveness analysis, preventing damage to the infrastructure itself.
- Studies:
    - Study to explore new or improved technologies specific for SBW and their application to products, including scouting of present technologies from the civilian market.
    - Feasibility studies to identify and evaluate technologies suitable for deep water (up to a depth of 6000 m) operations, which should include a literature review and market analysis of existing technologies and their applications in underwater missions. The studies should define and analyse defence use cases relevant to deep water operations and evaluate the performance requirements for platforms and payloads operating at deep water depths. Additionally, the compatibility of existing UUVs with new technologies should be assessed.
    - Methods and technologies for deep water launch and recovery from surface, in nominal and degraded/emergency conditions, including deep water installation and mooring.
    - Methods and technologies of exploiting underwater fixed and/or deployable surveillance assets in conjunction with autonomous systems.

- Study of the dynamics of underwater explosion for the effectiveness of an explosive charge at deep water depths (up to 6000 m).

In addition, the proposals should cover the following tasks:

- Integrating Knowledge:
  - Energy storage and generation/harvesting at the sea surface and on the seabed, including study of the market and of possible deployment and installation methods, to enable persistent operation in the sea floor and water column, and to minimise maintenance requirements.
  - Use of critical infrastructure self-diagnostics as part of surveillance.
  - Enrich underwater situational awareness utilising data fusion of various sources, including open-source data repositories.
- Design:
  - Partial tests for risk reduction on specimens and/or demonstrators of technology in an industrial or representative environment.
  - Conduct experimental research to partially test and reduce risks relevant to new materials and technologies designed to withstand high pressure and harsh underwater environments.
  - Conduct research on finding novel approaches to utilise existing technologies in the critical underwater infrastructure as a source of surveillance information.
  - Create and refine autonomous navigation algorithms for UUVs operating in deep waters (up to a depth of 6000 m).
  - UxV energy autonomy solutions for improved performance in deep water operations, including selection of suitable cell technologies starting from Lithium Polymer (Li-Po) available on the market, test of long-term pressure effects on cell structure and electro-chemical characteristics, simulation models for cell degradation over time.
  - Design of high demanding command and control (C2) requirements to manage surface dependency problems including connectivity, power generation, computational power, deployability and level of decisional autonomy of systems.
  - Design an advanced Underwater IFF (Identification Friend or Foe) system for unmanned vehicles (UUVs and USVs) that accurately distinguishes, recognises and classifies between friendly, neutral, and hostile underwater entities to enhance situational awareness in all volume of water.

The proposals may also cover the following tasks:

- Generating Knowledge:

    - Explore and integrate state-of-the-art acoustic and non-acoustic sensors capable of underwater identification for IFF application.

- Design:

    - Conduct rigorous simulation and field testing in diverse deep-water environments (up to a depth of 6000m) to validate the IFF accuracy and reliability.

The proposals should substantiate synergies and complementarity with foreseen, ongoing or completed activities in the field of underwater warfare, notably those described in the call topic EDF-2023-DA-UWW-ASW on *Unmanned Anti-Submarine and Seabed Warfare*.

Functional requirements

The proposed product and technologies should meet the following functional requirements where applicable for the domains addressed:

- Marinisation and miniaturisation of critical components, including pressure-tolerant solutions.

- Autonomous accurate underwater navigation with poor or no positioning aid.

- Materials and solutions for underwater persistency over a long period of time, including underwater garages and integrated equipment/sensors for UUVs continuous health monitoring and preservation.

- Enhanced underwater communication in deep waters (up to a depth of 6000 m): spanning from the analysis of applicability of fibre optic link and sensors, seabed-to-seabed and seabed-to-surface networked data exchange, to ultra-low frequency acoustic propagation.

Expected impact

The outcome should contribute to:

- Improvement in detection capabilities in SBW scenarios.

- Improvement of reaction capabilities in SBW scenarios.

- Improvement in EU technological autonomy for critical seabed infrastructure protection.

- Improvement of design of integrated defence systems for SBW scenarios operating at deep water depths.

2.4.2. EDF-2025-LS-RA-DIS-NT: Non-thematic research actions targeting disruptive technologies for defence

- **Indicative budget:** EUR 20 000 000 for this topic under the call EDF-2022-LS-RA-DIS.

- **Number of proposals to be funded:** Several proposals may be funded for this topic.
- **Range of EU financial contribution per proposal:** The requested funding should match the ambition of the proposed action and be duly justified. In any case, the requested funding cannot exceed EUR 4 000 000.

Objectives

The specific challenge is 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 researchers, ambitious high-tech SMEs and visionary research centres of big companies, universities or research and technology organisations.

Scope and types of activities

Scope

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

- A disruptive impact in a defence context: the proposals need to clearly address how the proposed solutions would create a disruptive effect when integrated in a realistic military operation;
- Radical vision: the proposals 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 proposals must target novel and ambitious scientific or technological breakthroughs that can be experimentally assessed, and the suitability of the concept for new defence applications must be duly demonstrated. Basic research without a clear technological objective targeting defence applications will not be funded.

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

The proposals must address disruptive technologies and should include clear descriptions of the proposed criteria to assess work package completion.

The proposals may address any area of interest for defence.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which	Yes

Types of activities (art 10(3) EDF Regulation)		Eligible?
	can achieve significant effects in the area of defence (**generating knowledge**)	(mandatory)
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (optional)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (optional)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

Functional requirements

This call topic is open to any technology with a high disruption potential. The proposals should describe the targeted functionalities and the foreseen means to measure progress toward the achievements of these functionalities.

Expected impact

- Scientific and technological contributions to the foundation of a future technology with disruptive applications in the area of defence.
- Enhanced innovation capacity of the EDTIB by identifying and exploring ground-breaking concepts and approaches or by applying technologies and concepts previously not applied in the defence sector.
- Enhanced competitiveness of the EDTIB and creation of new defence markets.
- Enhanced defence research and innovation capacity across Europe by involvement of actors that can make a difference in the future, such as excellent researchers, ambitious high-tech SMEs or visionary departments of large companies, universities or research and technology organisations.

2.5. Call EDF-2025-LS-RA-SMERO

- **Targeted type of actions:** Research actions (dedicated to SMEs and research organisations).
- **Form of funding:** lump sum grants following the call for proposals.
- **Targeted type of applicants:** any eligible consortium as defined in Articles 9 and 10(4) of the EDF Regulation. Members of the consortium must be SMEs (as self-declared according to Commission Recommendation 2003/361/EC) or research organisations (as self-declared according to European Commission Rules for Legal Entity Validation[35]). However, the coordinator of the consortium must be an SME. The budget allocated to research organisations cannot exceed 40% of the total requested grant amount.
- **Indicative budget for the call:** Up to EUR 36 000 000 to support one call topic:

2.5.1. EDF-2025-LS-RA-SMERO-NT: Non-thematic research actions by SMEs and research organisations

- **Number of proposals to be funded:** several proposals may be funded for this topic.
- **Range of EU financial contribution per proposal:** The requested funding cannot exceed EUR 4 000 000.

Objectives

This call topic encourages the driving role of innovative SMEs and Research Organisations (RO) in bringing forward innovation defence research, possibly by adapting technologies from civil applications or addressing hybrid warfare.

Scope and types of activities

Scope

The proposals must address innovative technologies and solutions for defence, including those that can improve readiness, deployability, reliability, safety and sustainability of forces in defence tasks and missions, for example in terms of operations, equipment, infrastructure, energy solutions, surveillance systems or digital solutions.

The proposals must address any area of interest for defence.

In addition, to best complement R&D efforts already targeting civil applications and to encourage the efficient spinning-in of knowledge, innovation and technological development to the defence sector, this topic also welcomes proposals for add-on research actions to adapt solutions originally developed for civil applications and previously not applied in defence sector. The proposals should drive forward or integrate results of projects funded under EU funded programme calls with a focus on civil applications and under the provision that the applicants have the necessary rights to access and commercialise the results of the precursor projects.

Types of activities

[35] European Commission, *Rules for Legal Entity Validation, LEAR Appointment and Financial Capacity Assessment*, rules-lev-lear-fca_en.pdf (europa.eu)

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	Yes
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	No
(f)	**Testing** of a defence product, tangible or intangible component or technology	No
(g)	**Qualification** of a defence product, tangible or intangible component or technology	No
(h)	**Certification** of a defence product, tangible or intangible component or technology	No
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	No

The proposals must not cover studies only.

The proposals must describe a clear work breakdown structure and link the proposed tasks to eligible activities.

The proposals should include clear descriptions of the proposed criteria to assess work package completion.

Functional requirements

This call topic is open to any technological research for defence. The proposals should describe the targeted functionalities and the foreseen means to measure progress toward the achievements of these functionalities.

Expected impact

The outcome should contribute to:

- Innovative and cost-effective solutions for defence applications.

- Ground-breaking or novel concepts and approaches, new promising future technological improvements or the application of technologies or concepts previously not applied in the defence sector.
- Enhanced innovation capacity across Europe by involvement of SMEs that can make a difference in the future.
- Potential for future market creation for SMEs, especially by facilitating access of SMEs to defence markets and supply chains.
- Development of European research and technology ecosystems and to the strengthening of EU Member States' and EDF Associated Countries' defence supply chains.

2.6. Call EDF-2025-DA

- **Targeted type of actions:** Development actions
- **Form of funding:** Actual costs grants following the call for proposals
- **Targeted type of applicants:** Any eligible consortium as defined in Articles 9 and 10(4) of the EDF Regulation
- **Indicative budget for the call:** EUR 546 500 000 for 12 topics addressing 9 categories of actions

2.6.1. EDF-2025-DA-SENS-MB4DR-STEP: Multiband 4D Radar

- **Indicative budget:** EUR 29 500 000 for this topic under the call EDF-2025-DA.
- **Number of actions to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

In the context of the maritime domain becoming increasingly contested, the state of the art of naval capabilities and interoperability are key to protect the EU interests. Evolving operational scenarios demand increased sensor capabilities. The radar sensor technology is also concerned with this capability upward trend, under challenging multi-domain threat conditions (land, sea, air, space and cyber).

Over the past decade, significant advancements have been made in fundamental technologies that influence both hardware and software aspects of radar systems. These advancements include among others the evolution of Radiofrequency (RF) electronics, digital technology, photonics, and smart antennas in the hardware domain, as well as the integration of machine learning, multiplatform virtualisation, and cloud/edge computing in the software domain. The

integration of these cutting-edge technologies has led to an enhanced capability that enables a shift from a multiple-radar sensor approach to a multifunction radar netted approach, thereby optimising sensor strategy and overall system performance.

At the same time, the use of the electromagnetic spectrum has quickly increased in civil applications as well as military operations, originating a congested electromagnetic scenario, with a fast evolution of electronic warfare (EW) equipment with effective jamming techniques. This scenario demands radar sensors with more robust capabilities to accomplish their missions. The next generation of radar systems could benefit from extending their bandwidth for increased resolution to address strong clutter, low Radar Cross Section (RCS), stealth targets, and robustness against electronic counter measures (ECM).

The objective of this call topic is to demonstrate the enhanced capability of the integration of these technologies in a multiband 4D radar demonstrator to be developed as the basis of EU integrated systems for future naval platforms and further application to ground/air surveillance systems. It should allow EU to remain at the forefront of technology and maximise interoperability by design to operate with technological superiority and to increase the EU strategic autonomy.

A 4D radar is an advanced radar system used in defence applications combining 3D radar capabilities measuring range, azimuth, and elevation of the target, with time or velocity as an additional dimension. This allows a more accurate track of the targets, providing information on their position, speed, and direction in real-time, and improving situational awareness, target identification, and engagement capabilities for defence systems (e.g., missile defence or air defence).

Specific objective

The specific challenge of this topic is to propose a technology integration demonstrator, as the basis for a future multiband 4D radar system that performs simultaneous sea, land, air and space warfare capabilities, and that is suitable to be integrated into a naval platform self/area-defence and combat management system within an air surveillance command and control system.

The development of a multiband demonstrator including a multifunction capability with radar and communications should improve situational awareness and enhance interoperability.

Regarding radar, it aims to show enhanced detection of conventional air/surface and Tactical Ballistic Missiles (TBM) targets as well as new threats including tactical and strategical hypersonic targets and Low Earth Orbit (LEO) objects. The system should be able to be integrated in a cooperative capability network with other platform sensors providing multi-static operation with cooperative remote assets. It should present simultaneous operation in multiple frequency bands, aiming at ensuring the coverage of at least one decade and providing hybrid active-passive radar operation.

Regarding communications, it should provide the capabilities for management of bidirectional weapon datalinks.

The objective of the final system is to be seamlessly integrated within the combat management system and the fire control loop, being able to provide a multistatic capability (the radar being an illuminator or a receiver) and being multifunctional enabling communications to establish datalinks within collaborative signals/carriers. Additionally, the final system should consider the inclusion of innovative collaborative capabilities to augment the efficiency of EU Member States' and EDF Associated Countries' forces.

This call topic contributes to the STEP objectives, as defined in STEP Regulation[36], in the target investment area of deep and digital technologies.

Scope and types of activities

Scope

Proposals must address the demonstration of essential elements for future EU naval radar systems with future application to ground systems for air surveillance, covering four main areas:

- Intelligent electromagnetic spectrum management. Using multiple radar bands adapted to the operation and functionality required in a condensed jammed electromagnetic spectrum of operation.
- Communication links for multiple bidirectional links to weapons, effectors and possibly remote assets (e.g., unmanned air systems).
- Full integration of the future final system in a combat management system, with enhanced collaboration with multiple platforms.
- Autonomous system based on optimised cognitive capabilities designed for limited human interaction dependencies to facilitate efficient and safe operations in multiple complex scenarios.

They must include detection of challenging targets, multiband operation, interoperability, interchangeability, scalability, integration in maritime platforms, modelling, simulation, and functional tests among other characteristics indicated below.

Types of activities

The following types of activities are eligible for this topic:

[36] Regulation (EU) 2024/795

Types of activities (art 10(3) EDF Regulation)		Eligible?
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes (optional)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (optional)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Integrating knowledge:
    - Describe interface requirements to assure interoperability between different technological solutions.
    - Define and be based on design standards to obtain interoperability and scalability of the system.
    - Elaborate a roadmap, identifying the technology needs and perspective to de-risk product feasibility.

- Studies:

- Define operationally realistic use cases (vignettes) and performance indicators defining the Measures of Effectiveness (MoEs) to be used in the evaluation process.
- Define and model tasks to determine multiband operation of the system.
- Define the integration into different naval platforms and the expected performance in naval operative applications.
- Perform simulations to evaluate the potentiality of the multiband approach to the selected scenarios.

- Design:
  - Describe the detailed design architecture and interfaces.
  - Define in details the hardware to perform multiband 4D operation.
  - Design the multiband and multifunction AESA antenna to demonstrate the concept through a demonstrator.
  - Develop a software model of the system to simulate performance and assess its capabilities (initial Digital Twin of the demonstrator).
  - Define the software processes needed to optimise spectrum management in congested scenarios (interferences and jamming) and complex environments.
  - Identify algorithms to optimise performance based on the multiband radar capabilities and address the following specified targets, including necessarily but not limited to:
    - Very low Radar Cross Section (RCS) (latest generation and stealth fighters and missiles)
    - Hypersonic vehicle threats
    - Low Earth Orbit (LEO) objects
    - Small and manoeuvring unmanned targets (land, sea & air).
  - The proposal should develop a multiband AESA integrated demonstrator as a proof-of-concept for the principal AESA operational capabilities (beamforming, synchronisation and calibration), demonstrating it at least in a controlled environment (e.g., anechoic chamber) but preferably in a relevant environment.
  - The multiband AESA demonstrator should include the necessary hardware and software to demonstrate the multiband AESA technology integration and the capability to fulfil the spectrum management for future operational capabilities.
  - Perform functional test on the multiband integrated model to demonstrate its capabilities and smart management of the spectrum.

- Analyse the results in terms of the defined performance indicators and Measures of Effectiveness (MoEs).
- Extrapolate results using the developed system model to practical scenarios where algorithms to increase performance based on the multiband capability should be applied.
- Improve the software model with the results of the testing for further refinement of the results.

The proposals should substantiate synergies and complementarity with foreseen, ongoing or completed activities in the field of advance active and passive sensors, notably those described in the call topics PADR-EMS-03-2019 on *European active electronically scanned array with combined Radar, communications, and electronic warfare functions for military applications*; EDF-2021-SENS-R-RADAR and EDF-2022-RA-SENS-ART on *Advanced Radar Technologies*; EDF-2022-RA-SENS-CSENS on *Covert Sensing*, EDF-2022-DA-NAVAL-NCS on *Naval Collaborative Surveillance*; and EDF-2023-DA-SENS-GRID on *Sensor grid*.

Functional requirements

The proposed product and technologies should be a 4D Radar which meets the following functional requirements:

- Operation concept definition focused on challenging scenarios considering threats in sea, land, air and space, interference and jamming and special environment situations.
- Multiband approach, including simultaneous multiband radar operation, aiming at ensuring the coverage of at least a decade from L to X bands and at including smart management of the spectrum.
- Communications functionalities, including bidirectional datalinks to weapon and effector systems and other remote cooperative signal/carriers, ensuring the integrity and security of data.
- Usage of a scalable AESA design to be adapted to multiple naval platforms or in the future ground-air surveillance systems.
- Incorporation of the objective of minimal size, weight, and power (SWAP) adapted to the needs of the selected platform.
- Minimisation of RF emissions without compromising the quality of the functions required (e.g., by reducing the number of antennas on ship decks).
- Conceptual design of the complete Multiband 4D Radar in accordance with the following architectural concepts, to allow for further integration between technologies and EU industries:
    - Integrated modular and scalable architecture (IMOSA), with high modularity and scalability to adapt to multiple platforms.

- Software multiplatform virtualisation.
- Use of fully digital AESA in transmission and reception modes.
- Resilient cyber-physical system, preventing malware and gaps in the cyber, cyber-physical and physical dimensions of the system.
- A network-enabled radar that explores the sustainability challenges facing digitalisation and military data centres.

Expected impact

The outcome should contribute to:

- The proper coverage of use cases integrating technologies established through the EU industries.
- The improvement of operation capabilities and resilience to future scenarios of EU Member States' and EDF Associated Countries' defence forces, in line with their strategic needs and trends.
- Increasing the interoperability and interchangeability between participating EU Member States and EDF Associated Countries and industry.
- The development of innovative systems, which should be more efficient, scalable, and adaptable to different platforms (initially naval but also e.g., in the future ground, air).
- Reducing the cost of the future systems development and their maintenance throughout life cycle.

2.6.2. EDF-2025-DA-SENS-IRD-STEP: Technologies for optronic detectors

- **Indicative budget:** EUR 29 000 000 for this topic under the call EDF-2025-DA
- **Number of actions to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

The domain of Infrared (IR) detectors encompasses a variety of technologies that detect in different spectral bands, for a variety of applications such as land, air, naval, space, missile guidance and drones. IR detectors are key drivers to increase detection, recognition, and identification (DRI) ranges and thus to improve the global efficiency of the system in terms of situation awareness and targeting. IR technology is an important element of the EU technological sovereignty in key value chains. In this regard, the European Defence Technological and Industrial Base (EDTIB) faces a threefold challenge in the field of optronic detectors: achieving high performance, maintaining international competitiveness, and

securing non-dependency of supply chains. It is key to continue supporting the development of the next generation of IR detectors.

The performance of the IR detector modules is driven not only by the Photon Detector Array (PDA) but also by the silicon Read-Out Integrated Circuit (ROIC), both composing the Hybrid Focal Plane Array (HFPA). Each unit cell of the detector array is coupled to the readout cell by means of flip-chip bonding. The main purpose of the readout cell is to extract the photocurrent from the detector cell and process the signal.

As early as 2019, experts identified gaps in the availability of advanced ROIC technology at EU level, which should be necessary to fulfil the targeted performance requirements of future defence systems. This subject became the focus of the call topic EDF-2021-SENS-R-IRD with the objective to invite the EU IR detector providers to collaborate and qualify together an advanced complementary metal–oxide–semiconductor (CMOS) node in a EU foundry allowing to design ultra-small pitch ROICs interfacing with different detector technologies and allowing digital 2D and 3D architectures.

Collaboration between the main EU IR detector providers is strictly required. Access to advanced CMOS nodes available on 12''/300mm silicon foundries indeed requires heavy budget allocation, which can be barely achieved at individual Member State level. Therefore, the cost of access to an advanced CMOS node needs to be shared amongst the primary EU players. Furthermore, the limited volumes necessary for defence applications can be much better addressed through EU collaboration.

Specific objective

The goal of this topic is for EU IR detector developers to integrate detection circuits of varying wavelengths onto ROICs platforms and incorporate these focal plane arrays into integrated demonstrators. This should be carried out to enhance the technological maturity of the advanced ROIC designs and fully qualify the supply chain for advanced ROICs components compatible with the various IR technologies and 2D/3D architectures, as requested by the call topic EDF-2021-SENS-R-IRD.

A first assessment of the performances should be done at demonstrator level. In parallel, 3D stacking technologies should be explored to increase the maturity of this technological key enabler for future smart IR sensors.

This call topic contributes to the STEP objectives, as defined in STEP Regulation[37], in the target investment area of deep and digital technologies.

Scope and types of activities

Scope

The proposals must further address the advance in the development of the next generation of ROICs for IR detectors considering the EU supply chain and comprising prototyping and testing. This next generation of ROIC should be based on an advanced silicon technology (compatible with a 3D architecture) that can be used in various future cooled and uncooled IR detector architectures.

[37] Regulation (EU) 2024/795

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		Eligible?
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Integrating knowledge

  The overall objective of the proposed tasks is to increase the maturity and achieve proficiency in the development of critical technological building blocks of the supply chain of the next generation of IR detectors, hence increasing interoperability (application to different use cases) and strengthening the security of supply.

  - ROIC design optimisation of main parameters (e.g., consumption, noise).

- Increase of maturity of ROIC bumping at fine pixel pitch on 300mm CMOS wafers.

- Design
  - Collect and update system specifications from system manufacturers to derive the detectors and sub-components' specifications.
  - Design of large format small pitch (#5µm) Mid-Wave Infrared (MWIR) Integrated Detector Dewar Cryocooler Assemblies using different IR circuit detection materials.

- System prototyping
  - Assembly of the IR Focal Plane Array (IRFPA) into their specific packaging to obtain first prototypes.

- Testing
  - Partial tests for risk reduction at ROIC wafers', detection circuits and IRFPA's levels. Tests on IRFPA should be done at product operating temperature.
    - Those tests (electrical and electro-optical) have to be compatible with high data rates (#Gb/s) and with 300 mm wafers.
    - The test means should be able to validate these large array and high frequency IR detectors without limitation.
  - Electro-optical tests and performance validation to assess ROIC behaviour through High density/large format IRFPA.
  - Final test for the evaluation of Integrated Dewar Assemblies performances with respect to the system functional requirements.

In addition, the proposals should cover the following tasks:

- Integrating knowledge
  - Increase of maturity of 3D stacking architectures & process integration.
  - Development of cooled vacuum packaging adapted to the most demanding thermal and electrical requirements driven by the pitch, format and framerate envisaged for the final products.

- Design
  - Design of an extended Short-Wave Infrared (eSWIR) Integrated Dewar TEC Assembly (IDTA).

- Qualification
  - Submit Integrated Detector Dewar Cooler Assemblies (IDDCAs) and IDTAs to preliminary reliability tests.
  - Analysis of the results of the reliability and performance tests: failure analysis and derivation of the manufacturing rules.

The proposals may also cover the following tasks:

- Studies
    - Development of smart functions at ROIC level based on CMOS 3D architectures.

- Design
    - Design of camera prototypes by system manufacturer(s) for detector integration and testing.

- System prototyping
    - Fabrication of demo camera(s) based on the prototypes.

- Testing
    - First imaging demonstration through the testing of the demo camera(s) within a representative use case.

    - Preliminary assessment of advanced ROICs to space radiations

The proposals must substantiate synergies and complementarity with foreseen, ongoing or completed activities in the field of IR detectors, notably those described in the call topic EDF-2021-SENS-R-IRD on *Infrared detectors*.

Functional requirements

The proposed product and technologies should meet the following functional requirements:

- Focal Plane Array
    - High resolution, i.e., increase in range and field of view:
        - Resolution above 3 Mpixels.
        - Pitch size below 7 µm.
        - Characterisation tests / Modulation Transfer Function (MTF).
    - Dissipation target.
    - Increased operability.

- IDDCAs
    - Cool Down Time adapted to the pitch and format.
    - Vacuum holding.
    - Compactness of the interconnects.

Expected impact

The outcome should contribute to:

- Strengthening the security of supply at EU level of advanced ROIC technology.

- Improving the characteristics of infrared detectors available to the armed forces of EU Member States and EDF Associated Countries.

- Improving the situational awareness and decision-making thanks to sensors with better detection, recognition and identification performance.

- The competitiveness and innovation capacity of the EDTIB in the field of infrared detectors by providing complementary technological know-how to ongoing efforts and established solutions.

2.6.3. EDF-2025-DA-CYBER-CDOC-STEP: Improved cyber defence operations capabilities

- **Indicative budget:** EUR 34 000 000 for this topic under the call EDF-2025-DA.
- **Indicative number of proposals to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

The dynamic and effective integration of cyberspace into military operational domains presents an intricate and urgent matter for the EU Member States and EDF Associated Countries defence community, which requires new strategies, concepts, architectures, processes and capabilities to enable a complete integration at conducting military operations.

In EU Member States and EDF Associated Countries military doctrines, cyberspace is conceptualised as a dynamically distributed and interconnected domain, where operations unfold in an intangible and rapidly evolving landscape. This domain fosters distributed decision-making, where actions taken within interconnected networks have cross-domain impacts, which can be seen as a challenge for decision-makers, but also as an opportunity to explore distributed decision-centric warfare possibilities.

Specific objective

The specific objective of this call topic is to develop state-of-the-art, effective, and reliable solutions that operate and, where possible, automate larger parts of EU Member States and EDF Associated Countries military cyberspace operations in a distributed manner, including the synchronisation of kinetic and cyber exercises across domains that present multiple dilemmas to adversaries.

Proposals should demonstrate the capacity to develop such a capability aligned with the needs for military cyberspace operations.

This call topic contributes to the STEP objectives, as defined in STEP Regulation[38], in the target investment area of deep and digital technologies.

Scope and types of activities

Scope

This topic aims at consolidating existing National and EU initiatives and projects to address cyberspace challenges and assist cyberspace integration in military operations in a mosaic

[38] Regulation (EU) 2024/795

and/or distributed approach, where emerging technological enablers like artificial intelligence, distributed sensor networks, cloud computing, data fusion or simulation for serious wargaming are expected to play a major role. The proposals must cover the following areas:

- Cyber Force Multiplication: leveraging on automation and distribution to significantly enhance the overall effectiveness and impact of cyber operations. This involves using cyber tools, Tactics, Techniques and Procedures (TTPs), and resources to augment traditional military capabilities, such as Intelligence, Surveillance and Reconnaissance (ISR), C2, defensive operations, etc.
- Cyber Command Augmentation: transference and coordination of decision-making power between decentralised units, nodes, actuators and/or cyber operators. This decentralisation of command allows for quicker response times, more agile decision-making, and the ability to adapt to rapidly evolving threats in cyberspace. It enables units and operators to autonomously assess the situation, identify targets, and take appropriate courses of action.
- Self-Adaptive protection: autonomous and dynamic protection of own assets and mission progress against cyber threats and attacks. A self-adaptive protection system can detect anomalies, identify malicious activities, and automatically adjust defence mechanisms to mitigate or neutralise cyber incidents and threats as the operational conditions evolve. In the context of mission assurance, decisions on changes for reactively or proactively respond shouldbe facilitated. This enables self-protection and self-healing at both technical but also mission level.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	System prototyping of a defence product, tangible or intangible component or technology (**prototype**)	Yes (mandatory)

Types of activities (art 10(3) EDF Regulation)		Eligible
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (optional)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Studies and Design:
    - Of a solution capable of identify mission-centric opportunities for cyberspace operations in cyber force distribution and reduction of human intervention, assistance for mission planning and execution.
    - To accommodate the solution to existing and/or ongoing military systems, enable the exchange of information between the involved actors, ensure interoperability and support the life-cycle management for resulting capabilities.
- System Prototyping:
    - Prototyping of the design solutions. The prototyping tasks must include the involvement of stakeholders from relevant EU Member States and EDF Associated countries.

The following tasks should be performed as part of the optional activities:

- Testing
    - Of complementary large-scale demonstrators supported by national and EU end-users on tactical, operational, and strategical use-cases.

The duration of proposal implementation should not exceed 24 months.

Proposals should substantiate synergies and complementarity with foreseen, ongoing or completed activities at national, multinational, or EU level, notably those described in the call topics EDIDP-CSAMN-SSC-2019 on *Software suite enabling real–time cyber defence situational awareness for military decision-making*, EDF-2022-DA-C4ISR-EC2 on *European command and control system*, EDF-2021-CYBER-R-CDAI on *Improving cyber defence and incident management with Artificial Intelligence* and EDF-2023-DA-CYBER-CSA on *Cyber situational awareness*.

In addition, interfaces with existing and under development EU, NATO and national systems should be substantiated to ensure future interoperability.

Functional requirements

The proposals should meet the following functional requirements:

- Orchestration and synchronisation of distributed cyber actions in the context of military cyberspace operations. This includes coordination of cyber combat operations, incident response workflows, and playbooks for assisting full-spectrum operations.
- Decentralised battlespace management, considering areas of operations, responsibility, interest etc, for each of the distributed actors when planning and executing actions.
- Mechanisms for tracking and, when possible, monitoring cyber activities and actions performed by the distributed cyber force. The solution must consider audit trails and logs to ensure accountability and traceability, as well as compliance with legal and regulatory requirements.
- Development of mission-centric and shared cyber situational awareness between the distributed cyber force at planning and execution of cyber missions.
- Cyber defence function disaggregation, which should allow functional separation into independent components so they can be distributed between actors.
- Analysis and Assessment of multiple action patches for cyberspace operations. Proposals may consider simulation and modelling capabilities to assess feasibility and explore opportunities.
- Transparent and explainable AI algorithms to provide commanders with insight into the decision-making process, ensuring human oversight. Management of human intervention and chain of command.

Proposal should be flexible to adapt and customise solution configurations based on mission requirements. Developments should cover scenarios at all war levels (i.e., strategical, operational, tactical, and technical), but the focus must be on tactical and operational level.

Expected impact

The outcomes should contribute to:

- The improvement of the efficiency and adaptability for distributed action in the context of military operations in the cyberspace domain.
- An easier incorporation of new technologies and collaborative tactics, techniques, and procedures to EU cyberspace operations.
- The improvement of the implementation of operational strategy by strengthening the decomposition of cyber forces for tasks and battlespace domains.
- A stronger, more competitive, and technologically independent European Defence Technological and Industrial Base (EDTIB) when it comes to solutions for cyber defence capabilities, cyberspace operations and Cyber Situational Awareness.

- Improve the interoperability and future capabilities of EU Member States and EDF Associated Countries forces in the area of cyber defence for conducting cyberspace operations.
- Promote cooperative efforts in this area leveraging the implementation of EU Policy on Cyber Defence (EPCD).
- Enhance the resilience of EU cyberspace, mitigate known risks, and protect mission networks from cyber threats.

2.6.4. EDF-2025-DA-SPACE-SBISR: Space-based ISR constellation

- **Indicative budget:** EUR 66 000 000 for this topic under the call EDF-2025-DA.
- **Indicative number of proposals to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

Several EU Member States and EDF Associated Countries operate high-end Space-based ISR[39] (SBISR) systems, either as national assets or under specific transnational cooperation agreements. These systems use a wide variety of traditional spaceborne sensors and have provided EU defence with an extensive experience on the use of SBSIR. Many EU Member States and EDF Associated Countries, which do not have direct access to a SBISR system, receive space imagery through commercial providers or transnational cooperation.

As the existing systems are operated independently and are made of a low number of high-end space assets, their revisit, persistency, reactivity, and data diversity are limited. Similarly, support at tactical level is only possible with nationally operated assets because current transnational data sharing time response is not meeting the requirements for tactical support.

This SBISR call topic aims at contributing to develop an affordable constellation of small satellites, including its ground segments able to handle various types of innovative sensor payloads (optical, night vision, low light infrared, hyperspectral, RADAR, passive RF[40] detection[41], video) for ISR applications. Such a constellation would complement high-end existing military capabilities while allowing responsive and smart tasking and data collection for near real-time operational and tactical use.

The objective of the topic is therefore to develop European SBISR capabilities through three pillars:

1) An access system called the Federation Layer[42].

[39] ISR: Intelligence, Surveillance and Reconnaissance: Intelligence (I) is the gathering of information to understand an adversary or situation; Surveillance (S) is performed over large areas over long periods of time, with no specific targets in mind; Reconnaissance (R) is performed over specific targets at specific times.

[40] Radiofrequency

[41] Able to support RF analysis for defence and security applications with the aim to detect, analyse, characterise, classify, identify and localise RF emissions and able to operate in a congested and contested electromagnetic environment.

[42] A digital infrastructure, based on a federated approach, to access shared military or civilian assets, to manage catalogue access and image acquisition requests, as well as access rights and sharing rules.

2) The development of a low-latency constellation made of multi-sensor small-satellites.

3) The access to existing national capabilities and capabilities under development.

It aims to pave the way towards a future operational European Earth observation defence capability for ISR applications.

Specific objective

The specific objectives of this call topic are to:

- Define and develop the overall architecture of the constellation: types and number of satellites of each type, orbits, performance, among others revisit time; ground segment(s), i.e., control segment as well as user segment (Federation Layer), with particular attention to end-to-end responsiveness and affordability.

- Identify complementarity with on-going activities at EU (i.e., EU Space programme, EU agencies), national or multinational level (including those already supported via the EDF).

- Develop or integrate components (sensors, platforms, ground segments and other key sub-systems, including security), which meet the needs of EU Member States and EDF Associated Countries.

- Develop interfaces definition and demonstrate the Federation Layer in terms of functionality and security.

- Facilitate the use of existing national capabilities and those under development, in order to demonstrate and test a first ISR capability by the end of the action.

One of the challenges of this call topic is to achieve high performance payloads compatible with small satellites, in order to procure an affordable constellation that can federate EU Member States and EDF Associated Countries around a shared and sustainable capability. In this context, industry should propose a development that leads to an affordable solution in terms of non-recurring and recurring costs, by taking also into account the operational and maintenance costs.

Moreover, the architecture should remain modular and scalable, in order to cope with an increase in the number of satellites within the constellation or in the number of users.

The applicants should also address the challenge of ensuring that the proposed solution can be adapted to various forms of cooperation. They should develop a solution compatible with several governance models and data policy for end-users to be proposed to the current and future co-financers, including potential EU stakeholders. They should therefore define possible rules, related to the defined technical solutions, for the prioritisation of tasking or processing requests, for data management, data processing and data dissemination.

Scope and types of activities

Scope

Proposals must address the development of European SBISR capabilities through the three pillars mentioned above. Proposals must cover the development of the overall system (i.e., space and ground segment), including in particular:

- At system level:

- The deepening of the concept of operations (CONOPS) for such capability, including the functionality and security of the Federation Layer.

- The advanced design of the overall system architecture (including selection of orbits, and sensors, possible inter-satellite links (ISL), possible data relay satellites, ground stations, raw data management and processing) and the definition of each component of the end-to-end system, composed of the satellite platform(s), the ISR payloads and the ground segment(s).

- The detailed definition of minimum-security common requirements and associated impact on the design of technical solutions and on the costs.

- The development plan(s) for the new constellation; de-risking activities and technological roadmaps must consider various options for each component of the system based on existing solutions, adapted solutions and/or new developments. Different development stages must be considered for the proposal, depending on the current maturity level for each component or ISR payload. Synergies with industrial technology roadmaps and with national, multinational and EU programmes, studies and projects (e.g., European Defence Industrial Development Programme, European Defence Agency, EU space programme/secure connectivity or earth observation governmental service) should also be analysed.

- The development plan(s) for the use of existing and planned systems that can contribute to or complement the constellation, including to what extent they can contribute to an early start of the European capability compared to the plan for the launch of the small new satellites.

- The cost and cost benefit analysis - including launch costs and estimate of the overall operation and maintenance costs. Where design options are being identified (e.g., number of satellites for each constellation component, number of ground stations, functions offered by the user ground segment) the cost benefit analysis must allow to compare the proposed options.

– At space segment level:

- The development up to TRL[43] 6 for selected payloads, with the identification of suitable existing or upcoming satellite platforms, available in the EU, to host them; the proposals must clearly identify for each type of payloads mentioned above, the starting point and expected ending point in terms of TRL, and the target satellite platforms for these payloads.

- Only if duly justified in the proposal, the planning, implementation and in-orbit demonstration and validation of some payloads or technologies. The justification expected in the proposal should justify the risk of launching the production of a first batch of satellites without in-orbit demonstration (IOD) and given this risk the relevance of the proposed IOD from a cost and planning perspective. The requested EU contribution for the proposal must not cover the associated launch(s) and deployment costs (that should therefore be financed by the owners of the prototype(s)).

- The planning of the implementation (i.e., prototyping) and launch of a first batch (typically covering a single orbital plane) of satellites able to demonstrate the validity

[43] Technology Readiness Level

of the architectural solutions defined, to test the constellation management and to deliver an initial federated ISR capability. The requested EU contribution for the proposal must not cover the associated launch(s) and deployment costs (that should therefore be financed by the owners of the prototype(s)).

– At ground segment level:

  - The consolidation of the performance of each control and mission ground segments to be used for each type of satellite of the system, and of the associated operational costs.
  - The detailed design and the development of interoperable ground segments' prototypes (in terms of main control and planning functions) for multi-mission applications able to be federated through the Federation Layer.
  - The development of a Federation Layer prototype (minimum TRL 6) able to offer multi-mission tools and handle harmonised and anonymised requests for data acquisition, data processing and data dissemination, quota countering for each user, on each component of the ISR constellation or for the constellation as a whole).
  - The testing of the Federation Layer prototype using abovementioned satellite sensor prototypes and/or other available and relevant sources (e.g., commercial or national space components).

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)

Types of activities (art 10(3) EDF Regulation)		Eligible?
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

The technical maturity of the development at the beginning of the action is assumed to be:

- A PDR (Preliminary Design Review) level for the system of systems (with federation).
- A PDR level for each elementary system (each elementary system being dedicated to a type of sensor).
- A minimum of PDR level (i.e., possibly a higher level) for new sensor payloads.

Accordingly, the proposals must cover at least the following tasks as part of the mandatory activities:

- Studies:
  - Consolidation and optimisation of the CONOPS of the system of systems and of elementary systems taking into account the technical outputs of tests.
  - Consolidation and optimisation of the strategy of deployment of the system (in particular with respect to launches and operations).
  - Update of the technical and programmatic documentation from the PDR (in particular, performance budget, development plan, risk assessment, costs evaluation) taking into account technical outputs of tests.
  - Issue of a preliminary user manual of the Federation Layer.
  - Production of the technical documentation required for the security accreditation of the system by national security agencies.
- Design:
  - Completion of the detailed design definition of the system at all levels (system, space components, ground segments).
  - Production, development, testing and pre-qualification of selected critical elements and components (to be identified in the proposal).
  - Detailed definition of internal and external interfaces at system, satellite, and ground levels.
  - Demonstration (to reach at least TRL6) of new sensor payloads.
  - For sensors targeting the launch of a first batch of satellites during the action, achievement of the Critical Design Review of the payload, the satellite platform, and the system, and of the Qualification Review of the satellite.
- Prototyping:
  - Development of an operational demonstrator of the Federation Layer.

- Development of prototypes of new sensor payloads as required for demonstration of at least TRL6 (to be identified in the proposal).
- For sensors targeting the launch of a first batch of satellites during the action, production of a first batch of satellites ready for launch.

– Testing:

- Test of the demonstrator of the federation layer, with at least two types of sensor systems (commercial services, or national contributing systems, or a first batch of satellites to be launched during the action) and at least three end-users.
- Environment testing of new sensor payloads, as required for demonstration of at least TRL6 (to be identified in the proposal).
- Test and validation of all satellite and ground critical interfaces (to be identified in the proposal).

At the end of the action, the suggested system should be mature enough to allow for decision-making regarding procurement and start of initial operational capability.

The proposals must substantiate synergies and complementarity with foreseen, ongoing or completed activities in the field of Earth observation for ISR applications, notably those described in the call topic EDF-2022-DA-SPACE-ISR related to *Innovative multi-sensor space-based Earth observation capabilities towards persistent and reactive ISR*[44], as well as those performed within the EU Space programme, notably the feasibility studies on *potential EU Earth-observation services for governmental use*[45] and the EU Secure Satellite Constellation[46] IRIS².

Functional requirements

The capability to be developed should meet the following functional requirements:

– **High revisit**: develop a scalable solution allowing to accommodate a growing number of satellites (same or different payloads) within the constellation, ultimately to reach, for some use cases, intra-hour revisit.

– **Affordable very high spatial resolution**: achieve resolution below 0.5 m with small satellites for optical visible video/still imagery and SAR[47] (e.g., low altitude orbit, on-board processing).

– **Operational timeliness improvement**: develop the capability to dynamically (re)task a satellite (e.g., within a few minutes); ability to perform automatic tipping and cueing; reduce downlink latency and enhance data downlink throughput; for some use cases, reduce time between tasking of the constellation and delivery of the relevant information to the end-user (e.g., tactical use).

– **Highly digital architecture allowing advanced and flexible on-board processing**: enable autonomous extraction of actionable information from the captured imagery and data, and automatic preparation of complementary tasking of the constellation (e.g., autonomous decision to lock image over a defined object or area of interest pin-

44 EU Funding & Tenders Portal (europa.eu)

45 https://etendering.ted.europa.eu/cft/cft-display.html?cftId=13224

46 IRIS² | Secure Connectivity - European Commission (europa.eu)

47 Synthetic-aperture radar

pointing), even with different acquisition modes (e.g., video) for target detection and analysis (classification, recognition, identification) depending on task/mission, including passive RF monitoring.

- **Space-to-ground efficiency**: allow both high data rate downlink and optimisation of downlink efficiency, where relevant making use of on-board processing capabilities.
- **New space imagery and passive RF monitoring applications for Defence and Security**: develop new sensors, processes and processing compatible with a small satellite and allowing to provide new type of products of interest for Defence and Security.
- **Big data analysis**: to develop a system that could support Big Data management to achieve high-speed analysis (including fusion) and streaming of multi-sensor data for ISR purposes.
- **Interoperability**: develop a system that is inter-operable with external systems (e.g., with interfaces allowing scalable and secure information exchanges across participating EU Member States and EDF Associated Countries, and with the EU).
- **Security requirements**: develop a system that takes into account the necessary needs for integrity, confidentiality and availability (this should include affordable crypto for up- and down-links) and the multi-user dimension of the constellation (while anticipating possible future access by other institutional users for civilian missions (e.g., security or emergency).
- **Space debris**: structural design of spacecrafts and the planned end-of-life activities should comply with applicable space law(s) and implement space-debris mitigation measures.

Expected impact

Such new ISR capability should have a very high impact over the tactical means of the European stakeholders before and during a crisis, in terms of:

- Reactivity (rapid availability of information after request).
- Added value of the information collected (nature, resolution and complementarity with other ISR sources).
- Multi-users and federated access to the different components of the constellation.
- Continuity and sustainability of the information flow by providing affordable solutions to regularly gather information via the space domain.

The nature of the solution (constellation of small satellites allowing sharing of resources between Members States, and EDF Associated Countries and other users) and development plan should also allow for a timely shared or joint procurement (not excluding final stages of development) and in-service support while preserving a sufficient level of sovereignty.

2.6.5. EDF-2025-DA-ENERENV-APEM: Aircraft propulsion and energy management systems

- **Indicative budget:** EUR 49 000 000 for this topic under the call EDF-2025-DA.

- **Indicative number of proposals to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

The objective of this call topic is to develop and mature a new suite of advanced technologies for propulsion, power and thermal management system for fighter aircraft that can be applied in a modular and flexible manner to different sizes and types of systems, operating within a System-of-Systems (SoS) configuration that should include various interconnected elements, including manned and unmanned systems, swarms of drones and auxiliary platforms.

In recent years, military conflicts have become increasingly complex, even more characterised by high degree of unpredictability and uncertainty. New dynamics, like brand-new and/or mature technological development and revised military doctrines, are shaping the future of warfare, thus requiring the EU Member States' and EDF Associated Countries' armed forces to prove their agility and constant adaptation to an evolving military landscape. To effectively tackle these challenges, the concept of SoS seems to represent a viable option able to satisfy a growing need for flexibility, by integrating various elements in a multidomain environment.

In this framework, definition and role of the 6th generation of fighter aircraft are expected to change accordingly. The aircraft should move from a platform-oriented design capable to perform missions within a single domain to a SoS configuration to incorporate various interconnected elements, including a system of Manned and unmanned Teaming (MuM-T) such as Unmanned Collaborative Combat Aircraft (UCCA), swarm of drones and adjunct platforms, able to operate across the five domains (air, land, sea, space and cyber). By leveraging the collective capabilities of these interconnected components, military forces can enhance their operational effectiveness in different and diverse military scenarios. As military/warfare scenarios continue to evolve, the need for adaptable and multidomain systems becomes increasingly critical.

Challenges of enhanced stealth capability, range and electronic warfare are even more compelling needs – in addition to flexibility and life cycle cost – the development of these advanced propulsion systems must be approached collaboratively, ensuring seamless integration within the SoS configuration/elements such as UCCA.

Specific objective

In order to develop and mature a new suite of advanced technologies for propulsion, power and thermal management system for the aircraft fighter must be developed in a modular and flexible manner to different sizes and types of systems, taking into account the following points, but not limited to:

- Understanding of the full potential of the new aircraft fighter configuration with advanced propulsion technologies and making sure that the EU technologies for propulsion and energy systems are going hand in hand with the new mission requirements and operational needs.

- Development of innovative solutions and enabling technologies for both the propulsion system and other interconnected components within the SoS configuration

is necessary for an efficient and integrated energy generation and management system for future military aircraft applications.

- Increased energy efficiency and effectiveness compared to the systems that are used today.

Scope and types of activities

Scope

Proposals must provide a validated suite of advanced technologies for propulsion and energy systems that can be applied within a SoS configuration and perform a set of studies to explore challenges for the effective integration of these technologies into different size and concepts of platforms, with a particular focus on UCCA.

Proposals must show ways to greatly improve energy and thermal efficiency to accommodate the rising need of non-propulsive energy demands and therefore also show possibilities for improving the ecological footprint.

In addition, proposals may address the jointly development and evaluation of technologies on a test vehicle on ground or in flight which could be developed or adapted from an existing one within in the frame of this work. This vehicle would also be an opportunity for joint technology development activities in Europe to enhance cross border collaboration between large industrial groups, SME and academia.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes

Types of activities (art 10(3) EDF Regulation)		Eligible?
		(mandatory)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Studies:

  Perform a set of system studies to explore the major integration effectiveness of power and propulsion technologies into different size and concepts of airborne platforms, with a particular focus on UCCA. In this framework, the following studies must be performed:

  - Platforms requirements trade-offs, including mission types, lifecycle costs, maintainability.
  - Propulsion and energy systems sizing and trade-offs, including multiple engine architectures and on-board systems to meet airborne platforms requirements.
  - Engine integration studies, including sizing of thrust, power extraction and heat dissipation across the whole flight envelope, energy balance, wasted energy.
  - Study of an improved and secured electronic engine control and monitoring system covering e.g., smart sensors, cyber security.

  Furthermore, these studies should provide analyses, tools and methods concerning:

  - Parametric lifecycle costs modelling.
  - Evaluation of integration into aircraft of propulsion and energy management solutions.
  - Smart manufacturing; including improved development process duration.
  - Critical sensors.

- Test environment and instrumentation for evaluation of next generation of propulsion and energy integrated systems.

- Design:

  Continue the maturation of a specific set of technologies and knowledge (e.g., those foreseen in the EDF-2021-ENERENV-D-PES call topic) towards higher levels of TRL[48] for the development of building blocks needed for competitive novel propulsion and energy systems for future SoS configuration. The set of technologies must include the following:

  - Design of dedicated simulation tools for multi-system simulation in a collaborative and agile life cycle context.
  - Design of the test means necessary for the evaluation of next generation of propulsion and energy integrated systems and prototyping of enabling components and subsystems.
  - High-temperature light-weight materials development.
  - Aircraft and engine thermal management systems.
  - Aircraft and engine electrical systems.
  - Advance cooling and manufacturing technologies of high temperature turbomachinery components.
  - Combustion technologies, including advanced and sustainable aviation fuels.
  - Progressing with advance engine architecture, including hybrid-electric systems to increase thrust and power extraction and decrease specific fuel consumption.
  - Maturation of technologies using dedicated rigs where appropriate and if necessary.
  - improved development process to be able to reduce development time and cost (e.g., including early demonstration & rapid prototyping).
  - improved manufacturing technologies.

  Furthermore, these design activities should provide analyses, tools and methods concerning:

  - The propulsion and energy management integrated solutions.

- System prototyping:

  - Build a modular prototype/system test bed, able to evaluate synergies and optimal management of propulsion, thermal and electric energy.

[48] Technology Readiness Level

- Build/create samples of new materials for testing allowing comparison and trade-offs among new materials designed.
- Prototyping of specific components aimed to increase the Europeanisation of relevant technologies, included but not limited to controls, high temperature materials and cooling technologies.

- Testing:
  - Use test beds to provide experimental evidence about optimisation that can be achieved in terms of energy efficiency and environmental impact.
  - Test, new materials in terms of energy efficiency and environmental impact.
  - Test components prototypes to find optimisation strategies to achieve best energy management.
  - Evaluate new types of fuels in terms of, e.g., energy and power efficiency, exhaust characteristics and environmental impact.

In addition, the proposals should cover the following tasks:

- Increasing efficiency:
  - Low-cost lifecycle cost technologies development.
  - Development of integrated life cycle service (e.g., predictive maintenance, smart inspections, usage of advanced VR/AR[49] in MRO[50]).
  - Integration of electrical motor/generator on engine spool(s) for increasing thrust/decreasing the specific fuel consumption (sfc).
  - Variable flow engine to increase propulsion efficiency in respective part of flight envelope.

Consequently, the proposal must cover both the maturation of technologies and the implementation of an additional set of activities in order to maximise the synergies with foreseen and completed projects.

Proposal must substantiate synergies and complementarity with foreseen, ongoing or completed activities in the field of highly efficient propulsion and energy systems for next generation air combat and unmanned collaborative combat aircraft systems notably those described in the call topic EDF-2021-ENERENV-D-PES on *Alternative propulsion and energy systems for next generation air combat systems*.

[49] Virtual Reality/Augmented Reality
[50] Maintenance, Repair, and Overhaul

Functional requirements

The proposed product and technologies should meet the following functional requirements:

- Develop flexible propulsion system design, with extended capability to operate within a broad range of different missions and operative requirements while enhancing affordability, availability and airborne platform independence.
- Develop integrated power, propulsion solutions and modular and flexible energy management to achieve optimal airborne platforms performances across broad range of different missions and operative requirements.
- Explore, starting from existing product, trade-off alternative integrated propulsion and non-propulsion solutions or innovations. Analyse the potential gains, risks, development and production roadmaps of future military airborne engines meeting the required performances.
- Design technologies to minimise life cycle product cost.
- Provide sustainability along the product life cycle, considering digitalisation during design and production, and a reduced environmental impact due to more efficient advanced propulsion.
- Develop efficient energy management systems, coupling turbomachinery with electrical machines and heat exchangers, increasing energy generation (propulsive/non-propulsive) with complex constraints to reconcile (much higher energy needs/electrical demand of future equipment including armaments and/or sensors, Electronic Attack/Radar systems, etc.) integrated on airborne platforms.
- Improve the engine systems, from materials to system architectures through components on different levels (including heat/thermal management, energy generation, distribution, and storage).

Expected impact

The outcome should contribute to:

- Facilitate the introduction of new aerial propulsion and energy integrated systems technologies through a reduction of their evaluation time and cost.
- Develop EU autonomous industrial sector and enhance cross boarder collaboration (from large industrial group to SME).
- Contribute to EU technological sovereignty and strategic autonomy.
- Contribute to improve EU air power and to guarantee EU aerial superiority.

2.6.6. EDF-2025-DA-AIR-CAC: Collaborative air combat

- **Indicative budget:** EUR 49 000 000 for this topic under the call EDF-2025-DA.

- **Indicative number of proposals to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

Today's EU Member States' and EDF Associated Countries' air forces are built on a wide variety of heterogeneous systems. This diversity poses the challenge of interoperability at functional, software and hardware levels. With the plausible introduction of unmanned systems into air combat, future interoperability require much deeper networking, which could be provided by a new generation of tactical data links.

The overall objective is to jointly develop an EU perspective to enable EU Member States and EDF Associated Countries to harmonise, standardise and share processes and tools to efficiently operate, in the medium to long term, joint air combat capabilities combining future air combat systems, manned or unmanned platforms, legacy platforms and their evolution, including sensors and effectors.

Specific objective

In order to adapt to new tactics, concepts and collaboration standards, as well as new design rules applicable to the evolution of legacy systems evolution and future systems, the mission systems should be flexible and scalable. This requires the development of key technologies and capability building blocks for collaborative air combat, such as but not limited to:

- A service-oriented architecture that allows all nations to operate together through common standard and functional interfaces, without having to use the same equipment or assets, would contribute to the modernisation of the various EU Member States' and EDF Associated Countries' military fleets.

- Interoperability standards for Information Technology (IT) systems (e.g., communication, dissemination, service sharing, cyber security), including a common data format reference, that enable joint combat and provide a common entry point and common processes for proprietary systems.

- Scalable edge computing with huge amounts of processing power and storage capacity on board new generation assets (manned or unmanned) to implement and enhance several mission management functions. Tightly integrated operation of manned and unmanned assets (through collaborative mission management) or intelligent processing of heterogeneous sensor data (e.g., radar, optronics and electronic warfare) across heterogeneous assets could therefore be enabled, improving the overall operational performance of each asset and its perception of the rapidly evolving tactical environment.

- Dedicated Artificial Intelligence (AI) technologies in a variety of technical and operational domains, such as but not limited to flight certification and airworthiness standardisation issues, or the identification, selection and use of prototypical AI toolkits, libraries, methods (e.g., machine learning, neural networks, …), in order to ensure a trustworthy command and control of manned and unmanned systems from the perspective of an airborne combat asset, as well as the correct handling and

exploitation of the wealth of information generated by distributed sensors across collaborating assets.

Existing and future open standards (e.g., ECOA[51], IMA[52]) need to be addressed. Regarding software, these open standards need to be addressed to meet the challenge of harmonising the software footprint of all types of equipment and systems operating in the airpower framework.

Scope and types of activities

Scope

Proposals must investigate solutions for standardised collaborative air combat, supported by demonstrations, where appropriate, for application to challenging air combat scenarios in contested and highly contested environments.

Based on commonly agreed standards and requirements of the EU Member States and EDF Associated Countries, proposals must initially aim at medium-term results to be implemented as standardised collaborative mission management to positively influence the development of the next generation of EU air combat capabilities.

Proposals must consider manned and unmanned combat platform assets to be operated by the EU Member States and EDF Associated Countries, and related concepts, as part of next generation systems for air combat operations through an incremental interoperability approach.

Proposals must take into account the foreseeable evolution of mission systems, aiming at standardised functional and physical interfaces of effectors and consolidating at EU level common and harmonised processes for the operation of relevant AI technologies, with a view to ensuring EU autonomy on AI engineering tools and libraries.

In addition, to ensure compliance with NATO and other possible coalition situations, proposals must also address interoperability with systems of non-EU origin and NATO standards, allowing for extended interaction between combat aircraft and a variety of collaborative assets used in all other operational domains that contribute to air combat operations.

Proposals may consider potential implementations on existing platforms if a major upgrade is foreseen.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No

[51] European Component Oriented Architecture
[52] Integrated Modular Avionics

Types of activities (art 10(3) EDF Regulation)		Eligible?
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes (optional)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (optional)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Studies:
    - Analysis of the latest evolution of existing and emerging standards applicable to air combat, including NATO ones, and results of relevant ongoing projects and future combat programmes.
- Design:
    - Standardisation recommendations concerning the processes and methods for the development, validation, and qualification of AI-based components, both safety and non-safety critical:
        - Usage prototyping of AI toolkits, libraries, methods enabling an independent and sovereign use of these technologies by the EU for military purpose.

- Develop EU sovereign tools and libraries for the illustration of the standardisation of the process for the development, validation and qualification of AI based components and functions.

- Further develop and-or supplement existing standards and define in details, where necessary, new standards, support and promote them, addressing them with the standardisation bodies, within the following perimeters:

  - In order to support collaborative mission management and sensors collaboration between heterogeneous assets:

    - Functional and technical architecture design.
    - Functional service-oriented interface design.
    - Design of service-oriented architectures and functional service-oriented interfaces for mission system.
    - Design of services-oriented sensors interfaces.

  - In order to enable interoperability, secure exchange of resources/information and data sharing with other assets in various coalition situations (e.g., NATO, EU and non-EU, national context) while offering a better evolutivity and greater interchangeability (software and hardware):

    - Design of communications architecture (including cyber issues).
    - Design of functional interfaces of the different layers of communication architecture (Core Services and Communications Services according to C3 Taxonomy).
    - Design of validation methods and associated means (e.g., functional simulators).

  - In order to improve interoperability and development efforts of effectors:

    - Design of functional and physical interfaces of future effectors (i.e., remote carriers and weapons).
    - Further develop required standards and protocols for effector integration (e.g., Logical Store Integration Framework (LSIF)).

  - In order to improve mission system scalability and the associated development efforts (easier and faster Aerial Mission Systems development and upgrade):

    - Design of a tool for Software development.

- Develop architecture principles and standardisation of hardware interfaces for mission systems.

- Demonstrate the application of a set of proposals of standards:
  - Development of implementation references of some parts of a set of proposals of standards (functional interfaces).
  - Definition and demonstration of an Integration and Validation approach including, but not limited to, early and continuous integration and validation, using the developed implementation references.

The proposals must substantiate synergies and complementarity with foreseen, ongoing or completed activities in the field of air combat, notably those described in the call topic EDF-2021-AIR-D-CAC related to *Collaborative air combat*.

Functional requirements

The proposed product and technologies should meet the following functional requirements:

- Ensure the interoperability of heterogeneous air systems (from existing to next generation systems, manned and unmanned), including when in coalition situations with EU Member States' and EDF Associated Countries' forces and NATO forces.
- Be applicable for the design of mission system for next generation combat assets (e.g., next generation fighter aircraft systems, unmanned combat systems) and the upgrades of legacy air combat systems.

Expected impact

The outcome should contribute to:

- Shared consolidated EU perspective for Air collaborative warfare.
- Common EU standards for collaborative air combat for EU Member States and EDF Associated Countries that are interoperable with NATO standards.
- Participate to structure and develop an EU ecosystem to support AI technology sovereignty for military usages.
- Incremental increase of the interoperability of warfare systems so that the EU Member States' and EDF Associated Countries' armed forces would be able to operate collectively and efficiently.
- Better use of resources (single and multiple domains and assets).
- Quick wins identification to be implemented on current or future systems (e.g., ability to associate different generations of assets, dissemination of conception guidance for long-term development of future EU air combat system). Quick wins approach would also enable cross-border SMEs to participate in this topic.

- Harmonisation of EU industrial processes and methods for the development of assets or equipment contributing to air combat collaborative capabilities.

2.6.7. EDF-2025-DA-AIR-EPE: Enhanced pilot environment

- **Indicative budget:** EUR 54 000 000 for this topic under the call EDF-2025-DA.
- **Indicative number of proposals to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

Future warfare is likely to be largely characterised by the networking of combat systems, including unmanned autonomous assets, and a high degree of automation of many systems. As a result, a large number of actors, sensors and effectors may be connected, generating an astonishing collection of information and data.

The challenge is therefore to provide the pilot with the appropriate situational awareness, understanding of system modes and status, and the ability to act and react in a timely manner to ensure mission success.

This requires the development of new equipment and associated software that can take advantage of new technologies such as wearables, optics, haptics, voice command, virtual operator assistants, augmented reality, and 3D holography.

Based on appropriate implementation concepts, this would free crew members from repetitive tasks, allowing them to focus their resources on high-value areas of action, and also support in mission execution, thereby improving combat effectiveness.

Specific objective

From the point of view of the human-machine relationship, the new generation of military aircraft involved in this collaborative air combat is likely to require a new generation of human-machine relationship that allows ergonomic cooperation between the crew and the machine, effective and safe flight, as well as cooperation with other assets, including unmanned ones. The new technologies would make it possible to gain a tactical advantage by assisting the crew as a real teammate, responding to requests, suggesting tactics and procedures, and adapting interfaces to the pilots' and/or operators' status and needs.

The definition of a novel design and interaction principles for managing automated and autonomous aircraft cooperating with System-of-Systems (SoS) teammates, including adaptive interfaces can be defined as Human-Machine Teaming (HMT).

Taking into account the new paradigm of human-machine teaming in future collaborative and connected air warfare, this call topic aims to address the following areas:

- New or disruptive Human-Machine Interface (HMI) technologies, such as displays, wearables, vocal dialogue, augmented reality, stereoscopy.

- Pilot status monitoring in relation to the mission and systems status.

- Assisted decision-making support based on advanced techniques like Artificial Intelligence (AI) not excluding other approaches.

Preliminary analyses show that, in order to meet these challenges, future European air combat systems must be equipped with an innovative cockpit offering the pilot groundbreaking display and interaction capabilities. In this context, it seems clear that new products (e.g., head-down, eyes-out, interface modalities, virtual assistant) have to be developed.

Scope and types of activities

Scope

With a view to contributing to the development of new generations of air combat and training aircraft and systems in the EU, including existing manned and unmanned air platforms, or to upgrading those currently in service, the proposals must:

- Mature the required cutting-edge technological and engineering solutions for future enhanced pilot environments, including cockpits, through evaluation and demonstration in representative operational scenarios.

- Produce common high-level "platform agnostic" specifications and guidelines for HMI design for future cockpit equipment.

- Specify and perform, where applicable, prototyping activities for cockpit equipment incorporating these maturated solutions.

Proposals must therefore address the following four areas:

- **Adaptive human system collaboration** to improve tactical situational awareness and enable ergonomic crew-machine cooperation for safe flight and high performance in cooperation with both manned and unmanned assets. Adaptive collaborative HMIs are required with a view to enhanced human-machine/human-human/machine-machine teaming for operations in a distributed environment with multi-platform assets. Novel design and interaction principles are also required for the management of automated/autonomous aircraft functions and collaboration with SoS teammates, including adaptive interfaces.

- **Visualisation**: both visualisation products and advanced pilot information presentation capabilities, including 3D presentation, and other novel presentations, through for instance but not limited to:

    - Augmented reality, large area displays (free form, multi touch, auto-stereoscopy), 3D holography and implementation concept.

    - Helmet Mounted Display (HMD) solutions which are crucial for the next generation cockpit.

- **Crew monitoring system (CMS)** to monitor in real time the physiological and cognitive states of the crew, through systems and techniques, enabling the adaptation

of the HMI in a way to support and assist the aircrew in performing the flight and mission control in demanding operational environments.

- **Interaction modalities** to address both the modalities of interaction as well as their combination through innovative HMI technologies, such as but not limited to wearable, optics, haptics, vocal command, and virtual operator assistant.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (optional)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Studies:
    - In the area of adaptive human system collaboration:

- Explore and mature innovative HMI principles for cross platform mission management considering (human-machine/human-human/machine-machine teaming, not including the specific functional algorithms).
- Explore and mature adaptive HMI mechanisms (e.g., based on CMS outputs and in accordance with the specific operational context).

- In the area of visualisation:
  - Explore and mature technological solutions for increasing technical characteristics in terms of presentation field and functional capabilities, such as but not limited to:
    - Digital integrated night vision.
    - Primary flight display function.
    - Enhanced synthetic vision system (including live virtual constructive visual integration).
    - Target designation and view through the cockpit.
    - HMD wireless link, also considering the control of inertia characteristics (i.e., mass and centre of gravity of the HMD carried by the pilot's head).
- In the aera of CMS:
  - Explore and mature solutions for monitoring the physiological and cognitive states of the crew, for operational embedded systems as well as to training systems (embedded or on ground) from all relevant sources of information, through for instance but not limited to:
    - Support for CMS sensors,
    - Operator incapacity (e.g., G-LoC[53], hypoxia, spatial disorientation),
    - Hypo-vigilance, including mind-wandering and surprise effect,
    - Attentional tunnelling, including visual/auditory tunnelling,
    - Mental workload and mental fatigue,
    - Stress, including mind-blocking,
    - Engagement level and ability to collaborate,
    - Situational awareness.

[53] G-force induced loss of consciousness

        - Validate mature CMS models, considering a Pilot Behavioural Knowledge Base (PBKB) that needs to be contextualised in accordance with the diversity of humans, missions, and tasks, including through AI- and Machine Learning (ML)-based techniques.

    - In the area of interaction modalities:

        - Explore and mature solutions for both the modalities of interaction as well as their combination, through:

            - Sound, in terms of input/outputs: voice command, natural language processing, in a very constrained environment such as that of a fighter, voice synthesis and advanced audio functions such as 3D sound.

            - Vision: eye-tracking that is used as a CMS sensor to be dedicated to interaction, coupled with another modality such as voice, with a view to increasing efficiency for target designation in an eyes-in or eyes-out use.

            - Touch: study multi-touch (up to 5 fingers) technologies to interact with the displays.

            - Gesture controls.

            - Haptic/tactile display of information.

- Design:

    - In the areas of adaptive human system collaboration, visualisation, CMS and interaction modalities:

        - Perform demonstrations of the solutions developed with physical, digital mock-up and/or simulations that is relevant for future fighter cockpit environment, based on operational use-cases.

    - Conduct an iterative implementation of findings to continuously optimise the performance of the demonstrations.

- Prototyping:

    - Considering that prototyping is a mandatory activity, prototypes of the developed solutions must be built, where applicable, and providing a sufficient maturity is reached, in order to allow for a timely integration in other national or multinational development projects related to next generation aircraft.

In addition, the proposals may:

- Refine operational use-cases where needed in the context of SoS architectures and identify and elaborate on structuring dimensioning elements.

- Evaluate and assess increased mission capability and impact on pilot/crew workload.

The proposals must substantiate synergies and complementarity with foreseen, ongoing or completed activities in the field of air combat, notably those described in the call topic EDF-2021-AIR-D-EPE related to *Enhanced pilot environment*.

Functional requirements

The proposals should fulfil the following requirements:

(1) in order to support the future air collaborative combat:

- Take into account the new paradigm of HMT in the future collaborative and connected air warfare and adaptive cooperation between all systems, either manned or unmanned, involved in multi-assets operation.
- Ensure muti-modularity to provide greater security, resilience, and accuracy by removing ambiguity about the operators' intentions.
- Ensure flexibility and adaptability of the HMIs to meet the demands of future combat systems.

(2) in order to improve human-machine performances:

- Human-machine performance should be evaluated according to different criteria to be defined in the proposals.
- Human factor aspects should be considered to develop the technologies, especially physical and cognitive ergonomics.
- Physical ergonomics should fit the air crew anthropometrics data to ensure that physical interfaces are adapted to any crew.
- HMI should allow:
    - Strengthened and adaptive cooperation between all systems, either manned or unmanned, involved in an operation.
    - Human supervised delegation of tasks to increasingly autonomous systems.
    - Intelligent assistance to provide the crew with system proposals and to adapt interfaces.
    - Piloting performance monitoring.

(3) Specific technical requirements:

- The technologies should be scalable for existing fighters or future fighters in order to apply the "quick win" principle.
- Developed technologies, concepts, solutions guidelines, specifications should be platform agnostic.
- Each technological building and capability blocks should be evaluated and demonstrated through physical or digital mock-ups and simulations, based on representative use-cases.

- The treatments of data collection about humans to build models or algorithms must be compliant with the EU General Data Protection Regulation (GDPR)[54].

Expected impact

The outcome should contribute to:

- European platforms for enhanced combat pilot technologies tests and demonstrations to welcome joint or national tests and demonstration needs.
- Consolidation of a sector of excellence in the EU for enhanced combat pilot based on innovative technologies.
- Generation of inputs for the mid-term and long-term development of next generation air combat cockpit HMI.
- The development of novel cockpit HMI technologies.
- Increase mission capability, efficiency, effectiveness, and performance in air combat missions (e.g., safer for pilot and helping to limit the collateral damage) exploiting the emerging technologies.
- Provision of a potential starting point for developing EU guidelines in the frame of advanced HMI design for managing systems-of-systems operations.
- Provision of an opportunity for cross-ministries of defence and cross-industries exchanges in the subject of cockpit design and pilot operating procedures.
- Strengthen EU industry in advanced air combat cockpit technologies independent of third countries.
- Quick wins identification to be implemented on current or upcoming systems.

2.6.8. EDF-2025-DA-GROUND-FM2LP: Future modular multifunctional land platforms and enabling technologies, including green technologies

- **Indicative budget:** EUR 79 000 000 for this topic under the call EDF-2025-DA.
- **Indicative number of proposals to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

[54] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC, Regulation - 2016/679 - EN - gdpr - EUR-Lex (europa.eu).

Objectives

General objective

The general goal of topic is to increase the maturity of enabling technologies to enhance the performance and effectiveness of armoured land platforms and especially certification of system level solutions.

Specific objective

This topic aims to further develop the technologies required to enhance the performance and effectiveness of armoured land platform systems in high-intensity operations, making them more capable, modular, multifunctional and energy efficient by maximising synergies, standardisation and interoperability of armoured land vehicle families.

Scope and types of activities

Scope

Proposals must address development, qualification, certification and improving efficiency especially needed for reaching initial operational capability for newly developed vehicles.

Proposals must address the following activities:

- Further development and verification of systems and enabling technologies including green technologies.
- Increasing the maturity of systems and subsystems.
- Validating that target vehicles systems fulfil and achieve the operational requirements of the intended operational environment.
- Implementing and certifying applicable military and generic/civilian standards on sub-system level of enabling technologies.
- Identifying and analysing stakeholders' needs and define requirements for different land platform variants (e.g., LOG[55], C2[56], EVAC[57], CBRN[58] RECCE[59]).
- Identifying necessary supportive elements (e.g., Training and maintenance systems/ functionality, and subsequent requirements) in order to support use and lifecycle management of the proposed products/systems and enabling technologies.
- Defining system architecture for different variants maximising synergies, standardisation and interoperability.
- Designing the different system variants to help ensuring that the detailed design for the variant systems under review is sufficiently mature and ready to proceed into test phase and meet stakeholders' stated requirements.

[55] Logistics
[56] Command and Control
[57] Evacuation
[58] Chemical, Biological, Radiological, and Nuclear
[59] Reconnaissance

- Testing the different system variants prototypes; identify and analyse possible security of supply bottlenecks of systems and sub-systems; study potential strategies and solutions for materials and components where high criticality is identified (including but not limited to circular approaches).

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (mandatory)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Studies:
    - Analyse new technological solutions to comply with capability areas of functional requirements stated in the EDF-2021-GROUND-D-FMGV call text.

- Identify and analyse stakeholders' needs and define requirements for different land platform variants.
- Define and perform necessary quality assurance, configuration and risk management process during the action.
- Identify and analyse possible Security of Supply bottlenecks of systems and sub-systems, as well as potential ways to reduce risks for subsystems/components shortage (including but not limited to circular approaches).

- Design:
  - Design technological solutions to fulfil functional requirements.
  - Design the different system variants.
- System prototyping:
  - Produce different variants prototypes.
- Testing:
  - Verify the fulfilment of different functional requirements and stakeholders' requirements in operational environment.
- Qualification:
  - Validate the fulfilment of different functional requirements and stakeholders' requirements in operational environment.
- Certification
  - Certify target vehicles and systems according to standardisation requirements prioritised by stakeholders.
  - Validate and qualify sufficiently mature future modular ground vehicles sub-systems and functionalities.
- Increasing efficiency
  - Develop, test and verify Life Cycle Support (LCS) and Integrated Logistic Support (ILS) solutions.
  - Increase efficiency of technological solutions based on testing activities.

The proposals must substantiate synergies and complementarity with activities in the EDIDP-2020-GCC related to *Ground combat capabilities* and EDF-2021-GROUND-D-FMGV on *Future modular ground vehicles and enabling technologies, including green technologies*. This last topic particularly addresses All-Terrain Vehicles (ATVs) and Light Armoured Vehicles (LAVs) systems and possible integration of relevant subsystems into MBTs (Main

Battle Tanks) and IFVs (Infantry Fighting Vehicles), including different variants of target vehicles.

Functional requirements

Systems engineering activities should follow ISO/IEC 15288(2023) processes or similar with tailored conformance. The proposed product and technologies should meet the following functional requirements in the following capability areas:

1. Mobility:

   - Platforms mobility should provide a substantial improvement of mobility compared to current platforms including, when appropriate, in an extreme environment (e.g., sand, ice, heat and cold environmental condition with capability to move on snowy, desert, rocky, marshy terrains with the presence of obstacles), making them more capable and energy-efficient using green technologies and reducing the logistic footprint.

   - Same platform should have high-level tactical and operational mobility.

   - Capability of transportation of one infantry squad/team, fully equipped, plus squad/team weapons and materials.

   - Platforms should also have the capability of crossing water obstacles.

   - Platforms should have an excellent operative and strategic mobility and compatibility with most civilian and military bridges (e.g., dimensions and weight such as to allow transport on board of naval units, air and rail carriers provided by most of EU Member States' and EDF Associated Countries' forces).

   - Platforms should be equipped with a winch with an adequate self-evacuation capacity.

2. Modularity and Commonality:

   - Platforms should be designed in different variants to accomplish several tasks (e.g., personal carrier, combat, cargo, command post, MEDEVAC[60], maintenance, fuel cargo, ammunition, recce).

   - Platforms should be capable of integrating several weapons systems (e.g., small and medium calibres, mortars, anti-tank) also in remote controlled configurations.

3. Drivetrains and energy systems:

   - New platforms should have to export sufficient electric energy for mission and role kits. Also benefits of high voltage solutions and energy recovery capabilities should be enhanced.

   - Platforms should have future mobility and power solutions to demonstrate the operational interests of green technologies like hybridisation or electrical power generation solutions and to work on the production, optimisation, and management of

[60] Medical evacuation

the energy. This should improve the operational life and the efficiency of engines and power packs.

- Platforms should be capable of integrating the most modern technologies regarding required reliability to enable increased autonomy and efficiency under degraded conditions and guarantee the use of all modern weapon, protection, ISTAR[61] and C2 systems.

4. Survivability:

- Platforms protection should be modular by design and according to relevant standards (e.g., STANAG 4569/ AEP 55).

- Platforms variants should be capable of integrating most modern Active Protection Systems (APS), both hard and soft kill (e.g., STANAG 4686).

- Platform variants should be capable of integrating protection systems against improvised explosive devices (IED) and explosively formed penetrators (EFP).

- Platforms should be capable of performing their missions under chemical, biological, radiological and nuclear (CBRN) conditions and counter a variety of threats such as kinetic.

- Platforms should have counter-UAV[62] capability to self-protect from drone attacks.

- Platforms should have low visual, thermal, electromagnetic, acoustic and radar signatures.

- Platforms should be capable of integrating multispectral mobile camouflage for several type of environments.

- Platforms should be capable of performing their missions, by day, night and in extreme environmental conditions.

5. Interoperability and C4I[63]:

- Platforms should maximise standardisation using NATO Generic Vehicle Architecture (NGVA), offering growth potential and further incremental improvements possibilities, based on a System-of-Systems approach and should be also capable of integrating state of the art technologies.

- Platforms should include the integration and interoperability of manned and unmanned aerial and ground vehicles (UAV/UGV), using relevant standards (e.g., STANAG 4586[64], STANREC 4818[65]).

[61] Intelligence, surveillance, target acquisition, and reconnaissance
[62] Unmanned aerial vehicle
[63] Command, control, communications, computers, and intelligence
[64] Standard Interfaces of UAV Control Systems for NATO UAV Interoperability
[65] Robotic Autonomous Systems – Ground Interoperability Profile

- Mission system should act as the platform core for integrating all the subsystems and components.

- All the subsystems and components should be integrated in a modular way into the mission management system to enable continuous upgrades during system life.

- Platforms should be able to accommodate applicable radio transmitters and receivers during operation, also in silent-watch mode.

- Platforms should enable unmanned/optionally manned operations.

- Platforms should be cyber resilient and provide cybersecurity, given the increasing connectivity of systems expected.

- Platforms should be capable of ensuring the C2 functions also for classified data (up to SECRET level) and should be capable of integrating SATCOM (Satellite Communication), 5G (fifth generation technology standard for cellular networks), CNR (Combat Network Radio) data exchange technologies (and potential future developments).

6. Situational Awareness:

- Implementing emerging technologies/systems should substantially increase situational awareness of platforms compared to current versions, allowing a hemispheric 360º situational awareness, automatic threat detection, tracking and identification, real time updated and shared operational picture and information.

- Technologies should enhance the survivability by offering the crew situation awareness information. Implementing technologies/systems should minimise detection and response time toward entities/potential threats and improve the efficiency and effectiveness of the APS.

- Implemented technologies/systems should remain functional in Global Navigation Satellite System (GNSS) denied environment.

- The situational awareness system architecture should be open to facilitate integration into any armoured vehicle.

- The situational awareness system should be capable of contributing to a Common Operational Picture (COP).

7. Engagement:

- Small calibre weapon systems should be removable by the crew.

- Remotely controlled weapon stations should be considered for small and medium calibre.

- Remotely controlled weapon stations should include autonomous functions in order to support the activities of the systems operator. The functions should meet the normative and ethical requirements.

- Capable of integrating several weapons systems (e.g., small and medium calibres, mortars, anti-tank).

8. Life Cycle Support:

- Platforms should feature such a maintainability in solution design as HUMS[66] and Digital Twin and fleet management system in order to enable greater operational availability/readiness at lower total cost of ownership compared to current platforms.

- Design-to-cost approach and simplicity should be keys to enable global affordability of candidate solutions.

- Platforms should feature maximum standardisation and commonalities in order to decrease life cycle costs and secure the supply.

- Platforms should feature modularity across different system versions.

- Training and simulation should be embedded on the platforms.

Expected impact

The outcome should contribute to:

- Address the 2023 EU Capability Development Priority "Ground Combat Capabilities", in particular its Key Impact Areas "Next Generation Manned and Unmanned Armoured Platforms" and "Modular and Multifunctional Systems of Systems for Effective Land Capabilities".

- Provide the EU Member States and EDF Associated Countries end users with the means to integrate the qualified and certified platforms family of system of systems to reach the Initial Operation Capability (IOC) at the end of this decade.

- Increase the EDTIB[67] capacity to accelerate qualification and certification.

- Provide solutions that solve future system of systems needs for EU Member States and EDF Associated Countries including holistic life cycle fleet management and readiness systems and personnel training systems.

- Enhance and integrate the EU Member States and EDF Associated Countries desired technological building blocks for future vehicles and improve the performance capabilities of the in-service military vehicle fleets.

- Provide vehicle solutions to reduced environmental and logistic footprint.

- Provide opportunities to eliminate or limit environmentally toxic substances.

- Establish EU business consortia able to offer competitive solutions for global markets, maximising impacts on cost-effectiveness and scale-effects, while stimulating industrial cross border cooperation.

[66] Health and Usage Monitoring System
[67] EU defence technological and industrial base

- Strongly reduce the dependence from non-EU technologies and products thereby increasing the EU's Security of Supply of armoured vehicles and related systems.

2.6.9. EDF-2025-DA-GROUND-LCC-STEP: Land collaborative combat including air-land

- **Indicative budget:** EUR 44 000 000 for this topic under the call EDF-2025-DA.
- **Indicative number of proposals to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

Given the evolution of threats on the battlefield (e.g., high intensity multi-domain warfare, technological dissemination, multiplication of unmanned aircraft systems), which make the environment ever more challenging, complex and contested, collaborative warfare is meant to gain and maintain superiority over the enemy thanks to combat systems and networking. In particular, the elaboration of shared tactical picture, as well as closely coordinated actions at tactical level (up to Corps level or multinational formation), should impose a fast operational tempo on the adversary and enable to understand, decide and act quicker than the enemy.

The objectives of this call topic on Land Collaborative Combat (LCC) including air-land are:

(1) To bring existing collaborative functions to a higher level of maturity (TRL[68]>7) and improve operational performance.

(2) To develop new collaborative capabilities, through additional studies, prototyping and demonstrations in the operational environment (TRL 7). These capabilities must encompass:

- Collaborative force protection including responsive actions.
- Collaborative Threat Evaluation and Weapon Assignment (TEWA).
- Collaborative engagement.
- Land-based engagement and firing in a multi-domain warfare.

Additionally, these capabilities should encompass:

- Unmanned systems supervision and coordination including Manned-Unmanned Teaming (MUM-T).
- Joint Logistics including materiel, transport, and in-theatre tactical movements of forces.
- Dismounted soldiers.

[68] Technology Readiness Level

(3) To enhance the connectivity and interaction of collaborating platforms from different nations hosting the required technical functions, especially by means of:

- Adaptive concurrent use of robust, hybrid communication systems, e.g. radios in conjunction with 5G[69] and satellite (multipath) considering LPD/LPI[70].
- Collaborative dynamic service orchestration.
- Automated supervision throughout the global collaborative framework.
- Mission planning supported by Artificial Intelligence (AI) and Machine Learning (ML).
- Cybersecurity detection and prevention functions.
- Accurate positioning in a contested or denied environment.

Field demonstrations should provide proof-of-concept based on relevant operational use cases / scenarios and on multiple relevant national and multinational platforms joining in the land collaborative combat framework, which would result in at least a validated system prototype.

Specific objective

Battlefield transparency is still insufficient due to high complexity warfare in a multi-domain environment with increased battle rhythm, deception, and electronic warfare measures.

Deployments should happen mainly in NATO as well as in EU operations and missions and build upon a networking and service infrastructure compliant with Federated Mission Networking (FMN) spiral specifications. Some of them should need pooling and sharing capabilities. Native interoperability up to the enterprise level between all relevant platforms (e.g., command post, vehicular, dismounted) is thus an increasing operational need.

New technologies such as Artificial Intelligence AI, edge computing, cloud-native architectures, and evolving technology-based manufacturing processes such as Dev(Sec)Ops[71], allowing for continuous integration and deployment (CI/CD) of IT[72] services and Software Defined Defence (SDD) need to be adopted in the defence sector as key enablers to provide for improved decision and effect making at the relevance of speed. The distribution of commercially available storage and compute power, however, cannot but adapt to the available communication means to interconnect resources scattered throughout the combat arena and the power made available by the platforms (i.e., vehicles, and dismounted soldiers).

This call topic contributes to the STEP objectives, as defined in STEP Regulation[73], in the target investment area of deep and digital technologies.

Scope and types of activities

Scope

[69] Fifth generation technology standard for cellular networks
[70] Low Probability of Detection/Interference
[71] Development – Security - Operations
[72] Information technologies
[73] Regulation (EU) 2024/795

The proposals must address the development and demonstration of innovative multi-national collaborative land combat functional capabilities enhancing military land systems currently in use or under development in different EU Member States and EDF Associated Countries. The relevant collaborative scenario, in which the proposed solutions must perform and prove the suggested enhancements, should include all levels of operation from dismounted soldier up to command post. Here, secure information sharing between every entity on the battlefield through a robust, flexible, and secure communication framework should be ensured. Furthermore, these solutions should cover the joint military functions in the land environment: C2, Intelligence, Manoeuvre, Fires, Information, Civil Military Cooperation (CIMIC), Sustainment and Force Protection.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (mandatory)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Develop key enabling technologies.
- Implement a coordinated approach concerning architecture frameworks for land collaborative combat.
- Analyse applicable standards as well as evolution of new proposals.
- Analyse current defence and industrial Test and Evaluation (T&E) capabilities[74] in the EU related to the scope of this call and identification of those aspects whose development may represent a potential challenge for the EU in terms of T&E.
- Specify and realise incremental real-world key demonstrations including definition of operational scenarios consistent with the participating EU Member States' and EDF Associated Countries' needs and field demonstration.

The proposals must substantiate synergies and complementarity with activities in the field of land collaborative combat, notably those described in the call topic EDF-2022-DA-GROUND-CGC on *collaborative combat for ground combat*, which aimed at a first common EU vision of land tactical collaborative combat in a coalition relevant environment (TRL 5 and 6).

Functional requirements

Functional requirements should range from basic information sharing via the combination of information through data fusion to collaborative decision support and finally allowing common action.

- **Information sharing** in order to build collective capabilities (and extend national resources while keeping full control on them):
  - Map sharing: to benefit from a common and possibly extended digitised representation of the area of operation (with the same geographic characteristics: same typology, same grid references, etc.) seems to be a necessity for data exploitation to facilitate a common understanding of tactical situations:
    - in 2 dimensions.
    - in 2.5 dimensions.
    - in 3 dimensions.
  - Sharing of all relevant geospatial data and meteorological data to enhance situational awareness and help in mission planning.

- **Collaborative situation awareness**
  - **Collaborative blue force tracking**: geolocalisation extended to multiple friendly platforms with aggregations to present the localisation of units of different sizes, as for instance:

[74] European Defence Agency - Defence Test and Evaluation Base database (DTEB): https://dteb.eda.europa.eu

- Collaborative tasking of sensor and exploitation assets.
- Mobility information (e.g., to allow coordination of manoeuvres).
- Information concerning specialised support chains (e.g., combat engineering, resupply, logistics, maintenance).
- Exchange of combat status of own and neighbouring units (e.g., operative readiness, energy).
- Information exchange with civil organisations possibly by using hybrid applications.

These above-listed capabilities should encompass data filtering in order to send the adequate information to the adequate EU partners' elements on the battlefield. They should also take into account such collective capabilities in any Navigation Warfare (NavWar) environment, (e.g., Global Navigation Satellite System (GNSS), denied environment or contested electromagnetic spectrum).

- **Data fusion** (using more seamless data exchange, data fusion and possibly collective data processing) in order to share and improve a common situational awareness (and thus increase national resources) and allow coordinated manoeuvres:
  - Enhanced collaborative blue force tracking: geolocalisation can be refined through data fusion (for instance, through triangulation between multiple observations or sensors).
  - Collaborative environment modelling: refine and extend environment models through data fusion. This function could also include coordination to map the environment (observation can also apply more broadly to quickly explore a larger area with different platforms from several countries) or to define the best observation sectors for battlefield surveillance, potentially using remote sensors such as UAVs[75].
  - Collaborative scene analysis (including for instance change analysis or detection of abnormal events).
  - Tactical situation sharing (such as a Recognised Ground Picture (RGP)).
  - Collaborative engagement.
  - C2 coordination tools: Observe, Orient, Decide, Act (OODA) loops can be coordinated to achieve collaborative manoeuvres within the coalition and, if it is enhanced by AI, to help plan itineraries and analyse the situation.
- **Recognised intelligence picture**

[75] Unmanned Aerial Vehicles

- Sharing information related to the target and disseminate the battle damage assessment.
- Collaborative observation / intelligence, surveillance and reconnaissance (ISR) (sharing of pictures, videos, plots/tracks) at the tactical level (brigade and lower).
- Sharing enemy observations, including detection, recognition, identification, location and tracking.
- Collaborative detection – reconnaissance – identification – localisation and tracking: refine enemy force understanding through data fusion.
- Enemy tactical picture: to be refined through automated data fusion.

Technical solutions should be based on:

- A common set of meta data that can be utilised for a data-centric approach for both information and physical entities (Standard Bill of Material (SBOM) and user identities) to provide for system-wide data-centric interoperability and security, information exchange gateways.
- An agile architecture for various levels of integration of multinational forces within combined network-enabled, data-centric operations including an efficient (e.g., seamless, flexible, cyber resilient) communication infrastructure combined with a unified battle management system to be progressively integrated into a framework of a secured combat cloud.
- AI as integrated support and situational awareness service distributed across the various land platforms with collaborative access to various data resources.
- Measures for identifying, validating and creating valid training data in order to reassure the augmenting effect of AI support of functional services.
- Scalable architecture to adapt to the several missions and working levels.
- A system able to control the electromagnetic and data signature of the unit.
- Standard interfaces to guarantee the interoperability with the existing and new platforms. A robust and open on-board platform network.
- Automated data fusion (e.g., image processing, sensor fusion, multi-criteria optimisation, meta data management, simultaneous multi sensor usage) and Human-Machine Interface (HMI).
- Modern and innovative HMI
    - Supporting the representation, evaluation and handling of data coming from various kinds of sensors (e.g., optronics, warning systems, navigation sensors) and going to various kinds of effectors.

- Augmenting user interactions by means of intelligent speech recognition and processing.

- Standards

  - Standardisation should be considered as an integral part of the management function of the solution. It is recommended to use EDSTAR[76] platform to facilitate the development of the solution with "Best-Practice" Standards selected for interoperability, capability development and procurement of defence activities.

  - The specific solution should consider the various EDSTAR technical domains: ammunitions technologies, Information technologies, Armoured Land vehicle technologies, camouflage, system architecture, painting and coatings, CBRN[77] defence, and military clothes.

  - Furthermore, if standardisation gaps are identified during the implementation of the solution, the development of new standards should be proposed to the appropriate standard developing organisations (NATO, CEN[78], CENELEC[79], ETSI[80], OASIS[81], other multilateral standards developing organisations).

  - Additionally, the LCC system should be compatible with all other systems meeting the current FMN[82] spiral specification implementation (NATO ADatP-34 NISP).

  - Additional enabling standards should be included, like:

    - NATO STANAG 4754 Generic Vehicle Architecture (NGVA) and associated Allied Engineering Publications,

    - European Secure Software defined Radio (ESSOR) coalition waveforms for software defined radios.

    - NATO STANAG 4822 Land DAS Architectures for sharing of sensor data within and among platforms architecture for sensor systems.

  - The proposal should implement coalition services identified for land collaborative combat in a sustainable fashion ensuring agile implementation updates/upgrades as these service descriptions evolve.

  - Mandatory legal / ethical considerations: Relevant national regulations regarding the sharing of information/software and algorithms.

[76] European Defence Standards Reference System.
[77] Chemical, biological, radiological and nuclear.
[78] European Committee for Standardisation.
[79] European Committee for Electrotechnical Standardisation.
[80] European Telecommunications Standards Institute.
[81] Organisation for the Advancement of Structured Information Standards.
[82] NATO Federated Mission Network.

- Furthermore, it is necessary to keep in consideration the ethical implication concerning the employment of, inter alia, AI and Robotics and Autonomous Systems (RAS), and legislation used for military application.

– Collaborative actions should include:

  - Handover of ISR[83] robotic assets, including semi-autonomous coordination of multi-national UxV for information collection purpose.

  - Integration of the most mature functions into target platforms (e.g., vehicles or UxV associated with specific battlefield management systems and radios), which would be defined by the participant EU Member States and EDF Associated Countries (pMS).

  - Study of new functions dedicated to new use cases for common collaborative action beyond information sharing and observation (e.g., collaborative fires, engagement, and protection).

Proposed solutions should ensure:

- Automated management of joint Unmanned Air Vehicles (UAVs) and Unmanned Ground Vehicles (UGVs) introducing adequate AI support to all stages of combat. Those unmanned vehicles should contribute to a Common Operational Picture (COP).

- Collaborative observation and protection, TEWA introducing adequate AI support.

- Use of Speech recognition and C2 by voice implementing Large Language Model (LMM).

- Interoperability cyber capabilities embedded in all platforms throughout the land collaborative combat framework (e.g., command post, vehicle, dismounted soldier) implementing for instance, ICAM[84], Smart probes.

- Safety in all systems, taking into account co-hosted critical and non-critical capacities and needs of autonomous platforms.

- Availability of Time Deterministic Hardware and Software for real-time collaborative capabilities.

- Interoperability with cloud-based open virtual platforms and with the latest NATO and FMN approaches. In fact, for some operations, with the development in the other subgroups (air, maritime, multi-domain), it is expected to develop some joint capabilities for specific use-cases and interoperability with joint C2 Systems for collaborative warfare .

[83] Intelligence, surveillance, and reconnaissance.
[84] Identity, Credential, and Acess Management.

Expected impact

The outcome should contribute to:

- Enable agile, secure network- and data-centric operations that can rely on the distributed, timely facilitation of the joint military functions in the land domain among multinational combat systems (C5ISTAR[85]) on all different levels of command and physical platforms throughout a mission coalition.
- Build a credible interoperable fighting force in terms of land combat capability, by introducing, in the shortest possible time, resilient, advanced solutions for collaborative combat within coalitions.
- Introduce new innovative collaborative combat technologies and capabilities that can be adapted to various manned or unmanned platforms.
- Provide a governmental EU agreed framework that industry can use to build state of the art and highly innovative systems dedicated to collaborative/federated land combat for emerging and future capability needs.
- Provide solutions that solve emerging/future capability needs of several EU Member States and EDF Associated Countries with maximum commonality and modularity.
- Increase strategic autonomy of EU concerning technologies and products.

2.6.10. EDF-2025-DA-PROTMOB-SS: Full-size demonstrators for next generation soldier systems

As it is related to EUDIS[86], and in addition to the development activities, this call topic aims to support innovation opportunities and enable small companies to receive acceleration support and demonstrate innovative technologies relevant to soldier systems. To achieve this objective, financial support to third parties (FSTP, i.e., cascade funding) is included as part of the grant. This should increase the opportunities for various smaller actors, including those not previously active in the defence sector, to adapt innovative technologies for soldier systems, which include a significant number of small elements such as for ballistic protection, load carrying systems, textiles/clothing, including smart textiles, requirement for light batteries, electronic equipment (e.g., for communication, situational awareness, GPS, various sensors, etc.), and to identify potential business opportunities in the defence sector.

- **Indicative budget:** EUR 35 000 000 for this topic under the call EDF-2025-DA.

  Beneficiaries should provide Financial Support to Third Parties (FSTP) in accordance with the conditions set out below and those laid down in Article 207 of the EU Financial Regulation. The maximum amount to be granted to each third party is EUR 60 000. Up to EUR 1 200 000 of the total budget allocated to this call can be used for FSTP. The FSTP in the proposals should not exceed 3,43% of the requested EU contribution.

[85] Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance
[86] EU Defence Innovation Scheme

- **Indicative number of proposals to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

- **Conditions related to FSTP:** The conditions for the selection of third parties receiving financial support[87] are the following:

    - Third parties must be established in the EU, in EDF Associated Countries or in Ukraine[88].

    - Third parties must be subject to control by EU, EDF Associated Countries or Ukraine or by EU, EDF Associated Countries or Ukrainian entities[89] .

    - FSTP must target in priority SMEs, including start-ups. Applicants for FSTP must have self-assessed their SME status. The consortium should perform checks on the basis of random sampling in accordance with the criteria as defined in Article 2 of the Annex to Commission Recommendation 2003/361/EC. Participation of entities other than SMEs can only be accepted where no SMEs are available to demonstrate the capacity or expertise needed for the project during its lifetime.

    - A range of entities from different EU Member States, EDF Associated Countries or Ukraine, as well as different industry sectors, including those not active in the defence sector, should be involved.

    - FSTP calls should aim to ensure a balance between experienced SMEs and newcomers.

    - Financial support to third parties should be issued in up to two distinct calls with a target from minimum 5 and up to 10 recipients of FSTP per call, with a view to give the third parties the opportunity to demonstrate their knowledge, technologies, capabilities and products/solutions.

    - The following activities, but not limited to this list, may be considered for cascade funding:

        - Customised support for specific challenges; proof of concept; validation; innovation management support.

        - Boot camps; customised trainings; coaching; technical and business mentoring.

[87] The support to third parties cannot be provided through services offered by the consortium directly.

[88] The inclusion of entities established in Ukraine among those eligible to receive financial support is in line with the general objectives of EDF, as established by Article 3 EDF Regulation, i.e., fostering the competitiveness, efficiency, and innovation capacity of the European defence technological and industrial base (EDTIB) throughout the Union. The support to third parties established in Ukraine would contribute to the general objective of the Fund, thanks to the expertise the Ukrainian defence industry has developed in last years on the battlefield.

[89] The inclusion of entities controlled by Ukraine or by Ukrainian entities among those eligible to receive financial support is in line with the general objectives of EDF, as established by Article 3 EDF Regulation, i.e., fostering the competitiveness, efficiency, and innovation capacity of the European defence technological and industrial base (EDTIB) throughout the Union. The support to third parties controlled by Ukraine or Ukrainian entities would contribute to the general objective of the Fund, thanks to the expertise the Ukrainian defence industry has developed in last years on the battlefield.

- Hackathons; peer-to-peer evaluation by entrepreneurs.
- Dedicated business mentors with public and private capital expertise.
- Organising online training courses, webinars, virtual matchmaking platforms and marketplaces.
- Technology showcase; internationalisation.
- Testing.

- The recipients of FSTP may be involved in any type of task within the proposal. Possible tasks at the level of the call for third parties may include, but not limited to:
  - Feasibility studies on alternative solutions.
  - Preparation of sample technologies to be tested.
  - Analysis support and red teaming, war-gaming.
  - Contribution to development and analysis of current and future CONOPS and tactics.
  - Analysis of weather and other outside factors effects.

Objectives

General objective

This call topic aims to develop the next-generation dismounted soldier system (NGDSS), finding synergies with existing topical EDF projects' concepts and developments through an updated open-source architecture, as well as NATO efforts and the development of individual and networking capabilities.

It is therefore to continue the development of a demonstrator and the underlying concepts, by increasing the technical maturity for the capability suites to enable evaluation under representative conditions, and to demonstrate a new level of innovative technologies and the capability to address new threats, in the perspective of the NGDSS.

This should enable the EDTIB[90] to design and promote a common, open and an innovative standard essential to the development of new equipment and subsystems for an interoperable solution.

Dismounted combat is highly exposed to high intensity operations. Recent conflicts around the world show that improving the soldier's proximal defence is essential to maintaining a good numerical ratio on the battlefield. The roboticisation of the battlefield is a clear opportunity, but also a constant threat to which a dismounted combat platoon must constantly adapt.

The challenge for soldier systems is to improve the effectiveness, resilience, and survivability of the soldiers on the battlefield. It should be designed for an easy integration of soldiers in the digital battlefield, through interoperability features, allowing them to quickly access available information and to receive protection against new threats (e.g., swarms, loitering

[90] European defence technological and industrial base

munitions), while reducing the total burden on the soldier (i.e., including physical load and cognitive load).

The development of the NGDSS aims to meet this objective by finding synergies with emerging concepts and developments, through an updated open-source architecture and individual and networked capabilities.

Specific objective

The objective of this call topic is to enable the EDTIB to design and promote an innovative and open standard essential for the development of new equipment and subsystems for an interoperable and sovereign solution for a NGDSS.

Taking into account the lessons identified from recent conflicts, this call topic aims at addressing solutions in response to new threats, in particular those based on quickly adoptable civil technologies. These solutions should be applicable to urban and densely populated environments in temperate, cold, and hot climates. Certain individual solutions can be combined to achieve a collective effect at the platoon level.

The main specific challenge is to increase the maturity of the different building blocks required in terms of survivability, sustainability, mobility, energy, observation, and lethality, and to improve the ergonomic integration and system reliability at the soldier system level.

Another challenge is to further explore and demonstrate the benefits of emerging technologies, in particular to protect soldiers against growing and evolving threats in a high-intensity warfare environment. Therefore, the consortium is requested to reach out to third parties across the EU, EDF associated countries and Ukraine, in particular SMEs, including start-ups, to test a broad spectrum of technological solutions and give those innovative players the opportunity to demonstrate the potential of their ideas to relevant players in the defence application field. As a tool to enable this open innovation approach, funding for financial support to third parties (FSTP) is an integral part of the awarded grant. The consortium is required to organise calls to third parties to select and award start-ups and SMEs.

The selected third parties should be offered the opportunity and financial support to test their solutions, receive technical mentoring and other relevant acceleration services for a specific period. This should support the creation of a cross-border defence innovation network that encompasses players that would otherwise not have the means to access EDF actions, thereby further enhancing innovation capacity and competitiveness of the EDTIB.

The consortia responding to the call may include a large variety of entities, such as military or civil test centres, research institutes, universities, industry, certification authorities, accelerators, or incubators as well as other organisations that can play an important role to contribute for the benefit of the proposal.

Scope and types of activities

Scope

With a view to a NGDSS capable of facing new types of threats, the proposals must further develop the concepts and open architecture for soldier systems with leading edge innovative technologies, by increasing the technical maturity of the capability suites to enable evaluation

under representative conditions, including prototyping and testing of relevant soldier capability suites and devices.

The proposals must therefore address:

- The update and further development of the European open and modular architecture for Soldier Systems[91], in the perspective of the NGDSS with possibilities of open-source interfaces for integration of technologies and networking (e.g., with Battle Management Systems).
- The detailed analysis of requirements for the NGDSS, including end-user perspectives view and observations from recent conflicts.
- The study and the design of a range of innovative technologies for new equipment, specifically focused on high intensity combat.
- Prototyping activities for the various hardware and software building blocks for individual soldiers and teams.
- Testing and evaluation activities for the integrated hardware and software building blocks for individual soldiers and teams.

The proposals must describe how entities with expertise on the relevant technologies know-how should be supported, including the proposed implementation conditions for FSTP. Recipients of FSTP that contribute to the technology development must receive financial support to prepare a sample of their technology, to attend and support the testing of their technological sample, and to technologically improve their solution.

FSTP may also be provided to entities that contribute with analysis and measurement capacities, technology-specific expertise, innovative tools, or support the manufacturing of technology test samples or components necessary for testing. The proposals must include technical mentoring for the selected recipients of the FSTP as well as the set-up of additional measures to support the recipients of the FSTP business case.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)

[91] Based on the Generic Open Soldier System Reference Architecture (GOSSRA) - https://gossra.net/

Types of activities (art 10(3) EDF Regulation)		Eligible?
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Studies:
    - Update the use cases, with specific focus on high intensity warfare (e.g., in overstretched combat zones with a lack of personnel on the ground).
    - Conduct detailed requirements analysis including end users view and observations made in current conflicts.
    - Update the GOSSRA[92] soldier system architecture including their interface descriptions for the integration of, but not limited to, extended interfaces with Battle Management Systems, anti-tank weapons and combat vehicles.
- Design:
    - Design and evaluate a new set of Proof-of-Concepts and technological demonstrators fulfilling the functional requirements.
    - Design a set of innovative functionalities to create new capabilities, specifically focused on high-intensity combat, including but not limited to:

[92] Generic Open Soldier Systems Reference Architecture

- Integration of new materials such as textiles for improved survivability, protection, and signature reduction.
- Improved integration of effectors (e.g., weapon systems).
- Capabilities to interact with highly autonomous unmanned systems (unmanned aerial systems – UAS and unmanned ground systems – UGS).
- Capability to detect, identify and contribute to neutralise disruptive threats such as UAVs in order to improve soldier protection and contribute to collaborative combat for a coordinated action.
- Cooperation with UxS[93]-Swarms in different environments.
- Capability of collaborative combat with combat vehicles.
- Defensive cyber measures for soldier systems.
- Optimising power management by minimising energy consumption in a soldier system. Focus on efficient power sources, power management systems, energy-efficient equipment and data, communication optimisation and energy harvesting.

- System Prototyping:
  - Build prototypes for the soldier capability suites and devices:
    - External augmentation of soldiers to counter the physical load induced by the carried equipment and supplies, for scenarios to be defined by the end users.
    - Manned-Unmanned Teaming (MUM-T), with UGS and UAS and including swarms of UxSs to fulfil ISTAR[94], force protection, and combat tasks, including protection against aerial threats.
    - Integration with Battlefield Management Systems (BMS) enabling connection with existing and new technologies, e.g., unmanned systems.
    - Integration of sensors and effectors with regards to human and machine interfaces for ease of usage (i.e., intuitive, easy operation).
  - Build a full system prototype, based on the selection of the most mature Proof-of-Concepts.
- Testing:
  - Perform validation testing at squad and platoon level under representative combat and environmental conditions and against the functional requirements.

Concerning the implementation of the FSTP, the proposals must cover the following tasks:

[93] Unmanned systems
[94] Intelligence, Surveillance, Target Acquisition, Reconnaissance

- Screening and identification of landscape of suitable candidates from various sectors, including those that have not been active in the defence sector before, for the sub-calls organised by the consortium providing FSTP.
- Preparation of the call documentation to issue up to two sub-calls for FSTP.
- Organisation of up to two sub-calls for FSTP.
- Selection and award of recipients for FSTP.
- Providing technical mentoring for recipients of FSTP.
- Providing networking and cooperation activities between the EDTIB and third parties, as well as the establishment of additional measures to support the business case and innovative ideas of recipients of FSTP within the scope of the call topic.
- Providing recipients of FSTP calls with the necessary knowledge on doing business in the defence sector, in particular on IPR protection, IPR strategies, export control and other specificities of the defence sector.
- Describe how the support to recipients of FSTP may be contributing to any type of task within the proposal.

In addition, the proposals must substantiate synergies and complementarities with foreseen, ongoing or completed activities in the field of ground combat capabilities and Force protection and mobility, notably those described in the call topic on *Force protection and advanced soldier systems beyond current programmes/Generic Open Soldier Systems Architecture* under the Preparatory Action on Defence Research (PADR), and the EDF call topics EDF-2021-PROTMOB-D-SS on *Soldier Systems* and EDF-2022-MATCOMP-SMT on *Smart and multifunctional textiles*.

Functional requirements

Considering the experience gained from existing deployed soldier systems, including usage of large numbers of UxS, the proposed Soldier System and Capability Suites sub-systems should meet the following functional requirements:

- Have a system approach including standardisation and harmonisation of system specifications and modular open architecture, to ensure system adaptability and interoperability in a cost-effective manner.
- Enable enhanced individual soldier combat capabilities, with improved ergonomics and reduced physical load through an optimised Size, Weight, Power and Cost (SWaP-C) approach.
- Ensure interoperability and enhanced networking capabilities, at/beyond the squad and platoon levels by implementing efficient Observation, Orientation, Decision and Action (OODA) loops and battlefield information sharing, including interaction with manned combat vehicles, unmanned ground and aerial systems and anti-tank weapons.

- Enable operations indoor (e.g., urban terrain, subterranean), in confined space (e.g., trenches) and under GNSS[95] denied conditions, while maintaining collaborative combat capabilities and resilient global situational awareness.

- Develop disruptive solutions focused on reducing cognitive load on the soldier.

- Provide a modular, open, scalable, and cyber-secure architecture with defined and standardised interfaces for different technology components and devices, including integration with non-autonomous and autonomous systems and subsystems, including future manned and unmanned capabilities.

In order to meet the above requirements, the proposed soldier system and the devices and capability suites associated with the soldier system should demonstrate the following:

- Interchangeability and interoperability, through the implementation of modular and standardised open architecture.

- An updated open architecture to be published for interface adaption by equipment vendors.

- An advanced situational awareness with application of disruptive technologies such as artificial intelligence (AI) and augmented reality (AR), leading to an effective detection, reconnaissance and identification chain and improving decision-making process.

- An improved survivability at soldier level, with high protection level facing a wide range of threats, including the latest emerging ones.

- High level of ergonomics integration at soldier system level, with reduced physical and cognitive load and improved comfort and mobility.

- Accelerated OODA loops, at individual and collaborative levels with a low cognitive load.

- Advanced smart engagement with possible application of AI to improve the effectiveness of the augmented soldier system.

- Disruptive power management solutions to improve soldier ergonomics, lethality, and survivability by controlling power distribution allowing longer run times.

- Robustness to meet the demands of the harsh military environments.

- Compatibility with severe military environmental conditions[96].

- An embedded training capability to facilitate system usability on the field.

- A minimised logistics footprint through standardisation.

- Optimised power consumption.

[95] Global Navigation Satellite System.
[96] Environmental conditions should be described based on the NATO's AECTP-230.

In addition, the FSTP includes the following specific requirements:

- The consortium should:
    - Organise one or two calls for third parties selecting target of minimum 5 and up to 10 entities per call, depending on the industrial landscape of the target domain, whereas each third party may be supported with up to EUR 60 000 for a maximum 6-months long acceleration programme that encompasses the associated tasks.
    - Provide the third parties with the opportunity to demonstrate their knowledge, technologies, capabilities, and products.
    - Foster the possibilities for future involvement of these third parties in the European defence community.
    - Provide a clear methodology allowing to measure the FSTP's contribution to the innovation performance of the supported SMEs in the short-term, e.g., via indicators such as numbers of new or significantly improved products (goods and/or services), processes, new marketing methods, or new organisational methods, and to its impact on resource efficiency and/or turnover.
    - Aim at a wider impact on innovation performance of the supported entities in the medium-term.
- The proposals should clearly delineate the expected contributions from the main beneficiaries as well as from the recipients of FSTP, to ensure their coherence and impact.
- Concerning the organisation of FSTP, the proposals should include a description of:
    - The method for calculating the exact amount of the financial support requested by the third parties.
    - The payment arrangement options to third parties.
    - The possible types of activities for which a third party may receive financial support.
    - The potential results to be obtained.
    - The roles and responsibilities of the consortium with regard of the management of FSTP.

Expected impact

The outcome should contribute to:

- Address the 2023 Capability Development Priority "Future Soldier Systems".
- Provide standardised and harmonised solutions that meet the future capability needs of participating EU Member States and EDF Associated Countries with maximum

commonality and modularity that can be quickly integrated into existing soldier systems and equipment.

- Develop and increase the maturity of innovative technologies specifically adapted to the soldier needs of all EU Member States' and EDF Associated Countries' Armies.

- Enhance EU industrial capacity to develop, produce and provide soldier systems and soldier equipment.

- Reduce dependences on non-EU technologies and products.

- Increase the opportunities for various smaller actors in the defence sector established in the EU, EDF Associated Countries or Ukraine - including those not previously active in the defence sector, to adapt and apply innovative technologies for defence applications- and promote technological edge in the field.

- Increase opportunities and future involvement for third parties participating in FSTP in the field of force protection and mobility within tasks described previously in the call text under "Conditions related to FSTP".

2.6.11. EDF-2025-DA-NAVAL-DSNCC-STEP: Digital Ship and Naval Combat Cloud

- **Indicative budget:** EUR 54 000 000 for this topic under the call EDF-2025-DA.
- **Indicative number of proposals to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

It is difficult for the armed forces to keep pace with the speed of the development of digital technologies on the civilian market. However, the rapid integration of more powerful devices and applications into naval units is key to provide naval forces with the capabilities needed to successfully conduct their missions.

The adoption of a common ship digital architecture for naval units allows the operation of different systems of the ship (SOTS), either on-board or off-board, and is key to provide the required flexibility to quickly incorporate new SOTS or improvements or upgrade key functions where needed and thus should alleviate the aforementioned problem. This also aims to maximise the interoperability between SOTS and the integration of collaborative capabilities.

This approach should improve:

– The speed in the observe–orient–decide–act (OODA) loop, mission performance, and operational readiness while training on real data.

– Level of anticipation by predictive/prescriptive capabilities for operations.

– SOTS availability and reliability, including safety and ship survivability and resilience.

– Training, automation, and in-service support.

– The cost associated to the whole life cycle of the ship.

Specific objective

The specific objective is:

– To design, prototype and test a digital platform as an EU-based infrastructure framework (i.e., digital platform) for the integration and common operation of the SOTS.

– To launch the initial design of a multidomain naval combat cloud which could cover the gap between the cloud at naval platform level and the global and joint inter-services combat cloud.

The multidomain naval combat cloud should combine and federate services provided by or distributed in different naval units, to allow for an effective and efficient collaboration between the different platforms and assets involved in a naval combat scenario, including surface, sub-surface, and air assets. The possibility to work in cooperation should increase and extend the operational capabilities of the platforms.

The proposal should consider the use of Model-Based Systems Engineering (MBSE) as a key enabler of a common and overarching engineering environment tool. Such a design approach should provide a realistic testing environment for the continuous integration of evolving digital technologies (e.g., processing, data storage capacities, fog-/edge-computing, Internet of Things (IoT)) to ensure the openness and scalability of the digital architecture.

The proposal should specifically address cybersecurity aspects. It should consider new trends in cybersecurity such as the Data Centric/Dynamic Zero-Trust Security, or any other evolution in cyber warfare that may be applicable during the execution.

This call topic contributes to the STEP objectives, as defined in STEP Regulation[97], in the target investment area of deep and digital technologies.

Scope and types of activities

Scope

This topic aims to:

– Define the set of common services required to support to the SOTS.

– Design in detail the ship digital architecture to provide the main services (e.g., operational environment, connectivity, data and models management) for the functional integration of SOTS.

[97] Regulation (EU) 2024/795

- Identify the required standards (including hardening standards) so the SOTS can be integrated seamlessly.
- Build a prototype for functional integration of SOTS and functional performance of a EU based naval combat cloud.
- Test that prototype, including various systems of the ship as representatives use cases to utilise the infrastructure as the supporting operational environment.
- Initiate the design of an EU based multidomain naval combat cloud.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	System prototyping of a defence product, tangible or intangible component or technology (**prototype**)	Yes (mandatory)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Studies
    - Identify and analyse the systems implemented across the EU navies to be integrated in the digital platform.
    - Analyse the standards required to put in place the digital platform.
    - Define the Key Performance Indicators (KPI) to measure the efficiency of the digital platform in providing services to the supported SOTS.
    - Establish the building blocks for a multidomain naval combat cloud.
    - Review the state-of-art as regards the digital platform and system digitalisation.
    - Review the Concept of Operations (CONOPS) of the digital ship under the direction of the participating Navies.
- Design
    - Design in detail the system architecture.
    - Initiate the design of a multidomain naval combat cloud.
- System prototyping
    - Produce a prototype of the digital platform while implementing the digital architecture compatible with the multidomain naval combat cloud functionalities.
- Testing
    - Perform extensive testing on the prototype to validate the proposed solution and extract conclusions for a future system implementation.

The above-mentioned studies, design, prototyping, and testing activities related to cloud based digital platforms must only be based on cloud service providers both established in the EU Member States or EDF Associated Countries and owned and controlled by EU Member States or EDF Associated Countries or entities.

The proposals should substantiate synergies and avoid unnecessary duplication with foreseen, ongoing or completed activities under EDIDP and EDF, in particular but not limited to those related to the topics EDF-2021-NAVAL-R-DSSDA (Digital ship and ship digital architecture), EDF-2021-NAVAL-R-SSHM (Ship Structural Health Monitoring), EDF-2021-DIGIT-D-MDOC (Military Multidomain Operations Cloud), EDF-2022-DA-NAVAL-NCS (Naval Collaborative Surveillance) and EDF-2024-DA-NAVAL-FNP (Functional smart system-of-systems under an integral survivability approach for future naval platforms).

Functional requirements

The digital architecture solutions should comply with the following functional objectives by design:

- **Resilience:** to identify architectural principles against undesirable events (e.g., combat damages resulting in decreased capabilities, loss of electrical power and chilled water supply, cyber-attack) that allow continual use of core functions or fast recovery in degraded mode.

- **Security:** to define and select common architectural principles, policies and interoperability components that maximise security against cyber and physical threats.

- **Sustainability:** to facilitate both the ability to maintain the operational availability of the architecture at reasonable costs (e.g., maintainability, obsolescence management) as well as the optimisation of resource-usage (e.g., lean architecture, energy optimisation). Furthermore, the architecture should facilitate the ability to evolve and integrate future technologies and architectural patterns as a key aspect of sustainability.

- **Interoperability:** to ensure interoperability/compatibility with other potentially cloud-based infrastructures in place (e.g., maritime as well as multidomain).

The digital platform implementing the digital architecture should additionally fulfil the following requirements:

- Follow an MBSE approach for the analysis, design, production, and testing.

- Provide a modular, interoperable, scalable, and flexible architecture that should be adaptable to the requirements of the end-users.

- Include several systems functionalities representative of the main SOTS, such as the Combat System, Platform Control System, Navigation and Bridge System, Communication System, Cyber-systems, or Digital Twin, among others.

- Allow the integration of new SOTS.

- Provide the services required by the SOTS including their potential requirements.

- Provide timely response to the services requested by the SOTS.

- Integrate the SOTS by using the adopted, hardened and/or developed standards.

- Consider the operational situation to optimise the performance of the ship.

- Consider how to apply trustworthy and efficient Artificial Intelligence (AI) and Big Data techniques to the monitoring and detection of vulnerabilities.

- Be based on a cloud service provider based, owned and controlled in the EU or associated country.

The multidomain naval combat cloud should additionally fulfil the following requirements:

- Apply and merge domains involved in the naval combat to achieve a highly integrated network for communication, data capitalisation and resources sharing services.

- Combine real-time data and non-real-time data networks and synchronise information.
- Consider the application of big data analysis and its impact on cloud resources (e.g., computing power, storage) in the architecture options.
- Consider the development of custom trustworthy and efficient AI solutions to analyse information.
- Define the requirements for communication networks for data and control exchange within the naval scenario's connectivity particularities.
- Provide a modular and scalable concept.
- Consider a decentralised approach with distributed computing power and allow for autarkic operations of single assets to ensure the continuity of operations in case of communication disconnections or interruptions.
- Allow to shift operations between different nodes in the cloud to make full usage of the available resources.
- Enable the prioritisation of the tasks according to military hierarchical levels.
- Guarantee protection of classified data.
- Optimise defensive and offensive courses of action by analysing the effects delivered by both kinetic and non-kinetic (e.g., cyber) effectors, while minimising associated collateral damages.
- Consider the development of custom trustworthy and efficient AI solutions to analyse information and support decision making.
- Be based on a cloud service provider based, owned and controlled in the EU or associated country.

Expected impact

The outcome should contribute to:

- Accelerate the battle rhythm of naval operations based on real time exchange of data and synchronised collaboration between naval assets.
- Optimise data communication requirements (e.g., protocol, bandwidth, latency, throughput).
- The commonality of EU Member States' and EDF Associated Countries' naval systems by proposing a common digital ship architecture, a comprehensive portfolio of related standards, services and products, and a naval combat cloud environment.
- Increase interoperability and interchangeability among EU Member States' and EDF Associated Countries' naval industries and EU Member States and EDF Associated Countries.

– Reduce the costs linked to the development of future systems, their upgrade, looking for continuous/regular capability updates, and their in-service support throughout their life cycle.

– Strengthen the European naval capability landscape and promote EU's strategic autonomy in the naval sector.

2.6.12. EDF-2025-DA-UWW-AUWN-STEP: Advanced underwater networks

- **Indicative budget:** EUR 25 000 000 for this topic under the call EDF-2025-DA.
- **Indicative number of proposals to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

The rapid emergence of unmanned systems in all military operational domains leads to radical changes in the operational strategies of the armed forces. This topic aims to address these changes and in particular EU capabilities to operate and coordinate unmanned systems in the underwater warfare domain (UWW). These systems are limited by the challenging environment (e.g., low communication range/bandwidth, no satellite navigation, poor visibility) and technology gaps (e.g., incompatible technologies, missing common interoperable standards).

Ongoing research on underwater observation, detection, acquisition and communications is expected to make an evaluation of critical technologies for detection of underwater threats for protection of maritime infrastructures and coastal strategic areas and assets and identify novel technologies for improved situational awareness. Several unmanned underwater vehicles (UUVs) and stationary systems with different characteristics and capabilities exists in Europe, but currently no manned-unmanned teaming and swarms (UTS) technology is available at a satisfactory maturity level to utilise available synergies and to increase the mission performance of combined tactical units for navies. Furthermore, infrastructure elements such as offshore wind farms and power cables with different sensors are to a large extent unused in this context. Current UUVs have challenges regarding performance, incompatible subsystems and lack of possibilities for retrofit capability extensions.

Specific objective

The aim of this call topic is to develop a new generation of Unmanned Underwater Super Systems (UUSS) and networks, where systems and subsystems would reach a technology maturity level of up to TRL[98] 7, potentially TRL 8 on sub-system-level. The goal is to address specific needs of future UTS missions and to demonstrate these systems in an operational seawater environment. Current state of the art UUVs and fixed infrastructure should natively support UTS by application of a common non-proprietary and interoperable standards without the limitations of retrofit solutions.

[98] Technology readiness level

Depending on the requirements and the concept of operations (manned-unmanned teaming, swarms, squads, detection and manipulation of objects), the UUSS technical elements can differ significantly in size, range, endurance, payload (e.g., mission equipment, communication bottom node or buoy, towed sonar sensors), onboard systems (e.g., communication, navigation, human machine interface (HMI), sonar sensors, optical sensors), level of autonomy[99] and the collaboration capabilities with unmanned vehicles (UxV) from the same or different domains (i.e., air, ground, sea, subsea).

This development should build on results from prior EU underwater research activities, with the aim to design and develop operationally relevant systems employing the available existing research outcomes.

This call topic contributes to the STEP objectives, as defined in STEP Regulation[100], in the target investment area of deep and digital technologies.

Scope and types of activities

Scope

Requirements and the concept of operations across the EU Member States' and EDF Associated Countries' armed forces must be surveyed and analysed to cover a wide range of use cases and to avoid duplications or incompatible technology developments. The outcome should be used as input for conceptional design studies of different UUSS types. This analysis must serve the design. The conceptional design factors should include among others:

- System performance and technologies:
    - Endurance, range, dive depth and payload requirements.
    - Different energy sources (e.g., batteries, motor fuel, fuel cells).
    - Propulsion types (e.g., electric, diesel, hybrid (diesel–electric)).
    - Concept of operations (manned-unmanned teaming, swarms, squads).
    - Mission profiles (e.g., combination of multiple mission segments such as launch, recovery, fast transit, silent, idle).
    - Capability of being deployed via Air, Land and Sea.
- Mass, dimensions and shape:
    - Existing systems (e.g., launch and recovery systems (LARS), torpedo tubes).
    - Logistics (e.g., cargo space, 20/40 ft cargo containers).
- Sustainability and innovation management:
    - Integration of existing or novel subsystems (e.g., definition of assembly space).
    - Definition of a certification plan and data for a future certification.

[99] Proposals are invited to use as reference, for instance SARUMS Best Practice Guide (BPG): https://eda.europa.eu/docs/default-source/documents/eda_ums-bpg-edition-2022_public.pdf

[100] Regulation (EU) 2024/795

The requirements on the new generation of UUSS, systems and subsystems are expected to evolve rapidly in the near future due to high pace of technological innovation in the area in particular employment of new UxV. This development risk must be mitigated by innovative, interoperable, and future-oriented designs with a modular structure to maximise the operational lifecycle, sustainability and consequently minimise costs. The feasibility and suitability of the design should be proven by the assembly of early demonstrators or far-developed prototypes and should include features such as:

- Configurability (e.g., variable mission equipment).
- Expandability (e.g., exchangeable fuselage section / swap heads).
- Cross-platform subsystem development (e.g., navigation and communication devices).

Depending on the maturity of the of early demonstrators or the far-developed prototypes, the supersystem (e.g., multiple vehicles and fixed unfractured elements such as bottom nodes and offshore wind farms, power cables), the system (e.g., single vehicle) or subsystem (e.g., vehicle components) may be validated, demonstrated and tested in a relevant or operational seawater environment and may be operated in different concept of operations (e.g., manned-unmanned teaming, swarms, squads). Furthermore, qualification (e.g., non-destructive, destructive) and certification of the UUSS, system and subsystem should be conducted. Possible activities should consist of:

- Technical aspects
    - Structural (e.g., limit loads, ultimate loads, failure loads, pressure, vibration, shocks).
    - Electrical (e.g., over voltage, over current, overload power, energy storage).
    - Thermal (e.g., temperature, heat transfer, cooling).
    - Radiation (e.g., electromagnetic, acoustic, optical).
    - Manipulation devices (e.g., drilling, handling).
- Operational aspects
    - Demonstration, testing and validation of mission segments or profiles.
    - Demonstration, testing and validation of collaborative capabilities (e.g., interoperability, shared communication, serial/parallel task execution, initialisation and reconfigurations of formation).
    - Checking of the UU supersystems, systems and subsystems performance against the operational requirements of potential operators.
    - Information Security in military operations.
- Regulatory aspects
    - Certification by public regulations and standards (e.g., regulatory authorities, industry standards, EU, NATO).

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		Eligible
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (mandatory)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	System prototyping of a defence product, tangible or intangible component or technology (**prototype**)	Yes (mandatory)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (optional)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Integrating Knowledge
    - Integration of available existing outcomes from research, development and industrial progress, and others.
- Studies
    - Survey and analysis of requirements and the concept of operations.
    - Execution of conceptional design studies with different UUV types/configurations, concept of operations and mission profiles.

- Definition of a certification plan and data in view of the future certification of the UUSS, systems and subsystems by the concerned authorities.
- Authentication for manipulations of objects with the vehicles.

– Design

- Design and dimensioning of innovative, interoperable and future-oriented of UUSS, systems and subsystems to fulfil the wide use cases across EU Member States' and EDF Associated Countries' armed forces.

– Prototyping

- Assembly prototypes of UUSS, systems and subsystems to validate configurability, expandability, and cross-platform subsystem development.

The following tasks should be performed as part of the optional activities:

– Testing

- Testing and validation of UUSS, systems and subsystems by executing mission segments or profiles in relevant or operational seawater environment through live demonstrations.

– Qualification

- Non-destructive or destructive qualification of UUSS, systems and subsystems (e.g., structural, electrical, thermal, radiation), checking that the UU supersystems, systems and subsystems meet its operational requirements to effectively accomplish its mission and user needs.

– Certification

- Certification of UUSS, systems and subsystems by public regulations and standards (e.g., regulatory authorities, industry standards, EU, NATO, etc.)

The proposals should substantiate synergies and complementarities with foreseen, ongoing or completed activities in the field of underwater warfare, notably those described in the call topic EDF-2022-RA-UWW-UTS related to *Underwater manned-unmanned teaming and swarms* and others regarding a common non-proprietary and interoperable standard for UTS operations. Other European or NATO standards must be integrated into the new generation of UUSS, systems and subsystems.

Functional requirements

The solution should comply with the following functional requirements:

– The system architecture should be open, non-proprietary, modular, adaptable and agile.

– The next generation of UU supersystems, systems and subsystems should be innovative, interoperable and future-oriented.

- The system should incorporate solutions adopting artificial intellect (AI) and machine learning (ML) for data analysis, information handling, system monitoring, and decision aid.

- Fill capability gaps of EU Member States' and EDF Associated Countries' armed forces concerning UTS as expressed in supporting their capability requirements.

- Enable enduring operations in several EU maritime environments.

The solution should be supported by a concept of operations. The concept of operations should cover the areas Anti-Submarine Warfare (ASW), Seabed Warfare (SBW), Mine Countermeasures (MCM), Intelligence, Surveillance and Reconnaissance (ISR), Special Forces (SF) Support, Multi-Domain Operations (MDO), protection of critical infrastructure as well as situational awareness, and may include others.

The UUSS should support different ranging, navigation, and communication topologies (e.g., single-link, star, multihop) and a combination of stationary deployed nodes, buoys, surface ships and underwater vehicles of different sizes:

- Small and Medium UUVs:

    - Formation of large groups of rather homogenous UUVs (swarms) to benefit from overloading and scaling effects.

    - Formation of small groups of rather heterogeneous UUVs (squads) to benefit from shared individual vehicle capabilities and serial/parallel task execution.

- Large and Extra-Large UUVs.

- Sensors and actors, like different manipulation devices to cut cables, nets, etc.

- Assistance of human divers from SF during ISR missions at the enemy coastline by for instance, transporting heavy equipment to support the mission or even the diver itself.

- Long range and endurance capabilities for the surveillance of critical infrastructures (e.g., pipelines, communication, and power cables).

- Mothership / carrier concepts to launch and recover multiple small UxVs from different domains (air, ground, sea, subsea) for high-risk missions.

Expected impact

The outcomes should contribute to:

- Enhanced security for EU Member States and EDF Associated Countries for the areas ASW, SBW, ISR, SF, MCM, MDO, protection of critical infrastructure and situational awareness.

- Use of synergies within European Defence Technological and Industrial Base (EDTIB) to develop common interoperable standards, to avoid duplications or incompatible technology solutions and to reduce development risks/costs.

– Improvement of EU strategical competitiveness and autonomy.

2.7. Call EDF-2025-DA-SI

- **Targeted type of actions:** Development actions
- **Form of funding:** Actual costs grants following the call for proposals
- **Targeted type of applicants:** Any eligible consortium as defined in Articles 9 and 10(4) of the EDF Regulation.
- **Specific provisions for the call:** The proposals must build upon or integrate results that have been achieved within one or several projects that had been funded under an EU programme call with a focus on civil applications. This previous project(s) may be completed or may still be ongoing. The submitting consortium does not need to be constituted or even to include a participant of previous project(s) or result owner of those previous project(s). However, applicants must provide a confirmation that they have or will have the necessary rights to use and commercialise the results of the previous project(s).
- **Indicative budget for the call:** EUR 98 000 000 for two call topics addressing two categories of actions.

2.7.1. EDF-2025-DA-SI-SPACE-3OS: On-orbit operations and services

- **Indicative budget:** EUR 49 000 000 for this topic under the call EDF-2025-DA-SI.
- **Indicative number of proposals to be funded:** One proposal is to be funded for this topic. However, depending on the quality of the submitted proposals and the available budget, more than one proposal may ultimately be funded for this topic.

Objectives

General objective

Given the evolving threat environment in Space, Defence users are likely to require tailored assets to conduct space-to-space operations in support of Space Domain Awareness, to protect and ensure the uninterrupted services of space systems used for defence applications, in particular to inspect, repair, update, maintain or deorbit military satellites. Although the European defence community recognises the strategic need for such capabilities in the medium term, no operational assets are currently available in the EU Member States' and EDF Associated Countries' armed forces to carry out such missions.

Building upon or integrating results from relevant civilian EU-funded actions, the EDF intends to remedy to this shortfall by addressing R&D actions paving the way to future capabilities for on-orbit operations and services for defence applications.

Specific objective

The specific objective of this call topic is to develop a 'dual-use by-design' demonstrator of the space systems, sub-systems and related key technologies, ready for IOD/IOV, needed to address the abovementioned defence needs. The demonstrator has to be designed to be

potentially operated by defence users through their military C2 ground segments in order to enable or perform on-orbit operations and services on their own satellites.

This call topic therefore aims to focus on:

- the proposal of possible detailed CONOPS and related feasibility analysis for on-orbit operations and services as defined below in *Scope and types and activities*, considering also the 'dual-use by design' of the required capabilities and, where relevant, the *High-Level Requirements* included in the technical guidance document produced under Horizon Europe.

- a design that, taking into account relevant civilian developments as background information, can provide defence capability planners and national armament directorates with the in-orbit demonstration of potential solutions to be implemented to achieve the required capability.

- development of technological and capability demonstrators (TRL[101] 6 - ready for IOD/IOV) of systems or sub-systems to be designed to perform on-orbit operations and services on current and planned satellites owned by EU Member States and EDF Associated Countries Ministries of Defence.

Scope and types of activities

Scope

Proposals must address a detailed technical feasibility analysis pointing out the operational benefits of space missions designed to perform space-to-space operations for defence applications and aiming at producing the related technology roadmaps and TRL maturation for selected key critical technologies.

Proposals must develop a demonstrator of these technologies ready to be launched and compatible with the CONOPS and performances described below.

With the aim to take advantage of technologies developed within other relevant EU-funded programmes, the proposals must substantiate synergies avoiding unnecessary duplication with civil space (see below) and highlight the potential cost benefits of those synergies, taking into account the performance and governance implications as well as potential improvements required by EU Member States' and EDF Associated Countries' Ministries of Defence.

The defence needs and associated CONOPS to be considered include:

- the space-based ability to support space operation centres in their identification and attribution of designated in-orbit unfriendly behaviours from cooperative and non-cooperative space objects, in all relevant orbits.

- Rendez-vous Proximity Operations (RPO), docking and berthing: the ability to perform autonomous close-proximity operations, rendez-vous and capturing of cooperative and non-cooperative, prepared and non-prepared, Resident Space Objects (RSO) for de-orbiting (e.g., emergency debris removal) or servicing (e.g., life extension) enabling military space logistics (e.g., assembly, maintenance and repairing) and responsive space capabilities.

[101] Technology Readiness Level

- the ability of the servicer to perform multi-purpose and multi-functional operations thanks to at least one advanced robotic arm and manipulator, including a tool exchanger device.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes (optional)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (optional)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

Accordingly, the proposals must cover at least the following tasks as part of the mandatory activities:

- Studies:
    - CONOPS and detailed technical feasibility analysis for on-orbit operations and services addressing the defence needs mentioned above with a ‘dual-use by-design’ end-to-end approach.
    - Analysis of potential synergies with past and on-going activities in the civil sector, at technology and capability level. Technologies specific to defence missions (including in terms of performances), if any, must be identified either as a gap filler of civilian developments or as an additional development

required to accommodate military needs, maximising the time-to-readiness of the technologies.

- Design:
    - System(s) and subsystem(s) mission design, focusing on at least one type of orbit (LEO, MEO, GEO).
    - Payloads/sensors/technologies and interfaces (between the servicer and the receiver) design, focusing on at least one type of orbit (LEO, MEO, GEO).
    - Ground systems design for Hardware-in-the-loop (HIL) testing and autonomous or teleoperated operations, including solutions for military C2 systems.
    - Definition of technology roadmaps and TRL maturation of selected top-priority key-technologies for specific defence purposes, focusing on at least one type of orbit (LEO, MEO, GEO).
    - Development of technological demonstrators ready for IOD/IOV to demonstrate and validate advanced mission scenarios and capturing manoeuvres considering the complexity related to unprepared and non-cooperative RSOs, the need to operate on military satellites and to perform multi-functional systems, including specific and dedicated RPO sensors, robotic arms and manipulators system(s).

In addition, the proposals may also cover the following tasks:

- Studies and Design:
    - Development of a demonstrator of Space Defence Operations lab allowing to simulate the end-to-end system architecture for all defence missions, considering all types of orbits (LEO, MEO, GEO), and to illustrate the associated CONOPS. This lab should support the studies activities mentioned in the previous paragraph.

The proposals must explore and substantiate potential synergies with the on-going call topics on In-Space Operations and Services (ISOS) within the Horizon Europe Cluster 4 (HORIZON-CL4-SPACE-2025-01-21 to 25)[102] and any other EU-funded technology that target a comprehensive dual-use by design space infrastructure supporting ISOS and composed of servicing, host, logistics and satAPPS[103] components[104]. In addition, given the spin-in nature of the call, the proposals must build upon or integrate results from relevant civilian EU-funded actions.

Functional requirements

The capability to be developed should meet the following functional requirements:

- The capability should be able to perform several in-orbit operations and services on military-class satellites.

[102] Including the High-Level Requirements included in the technical guidance document (expected to be available by end of March 2025)
[103] Satellite applications
[104] Where relevant from a Defence end-users perspective and requirements

- The capability should be able to perform RPOs and at least two of the following operations and services: assembly, repairing, integration and refuelling operations onto a prepared/unprepared and non-cooperative/cooperative target.

- The robotic system should have the capability to handle, eventually with more than one robotic arm, an inertia of an object whose mass is at least 1500 kg.

- The robotic system should have at least one robotic arm with 7 degrees of freedom and an end-effector able to interact with several geometric profiles, including those applicable to large-dimensions spacecraft structures.

- Include a tool exchanger device able to perform the different operations and services over the mission profile.

- At least some of the force-torque sensors should allow fine and precise contact control.

- The robotic system should be able to manage contact operations with the target with impedance control, establishing rigid contact with the target on military satellites.

- The system should have a robotic re-fuelling interface for enabling the flow motion in life-extension applications on military satellites.

- The system should have a muti-spectral system integrated for far-range and proximity operations management and target features recognition.

- The system should have electronic subsystems suitable for GEO/MEO/LEO missions with internal routed harness.

- The system should be cyber-resilient.

- The system design should ensure the complete reliability of orbital operations during the execution of the tasks assigned.

- The system should include key management and security accreditation, to guarantee protection of mission-sensitive data and processes, from all kinds of illicit, unauthorised and adversary access: this should include advanced real time operating systems for security-critical space missions.

- The system should include communication and transmission security, to guarantee protection of mission-critical space-to-space and space-to-ground data exchanges, against all kinds of intentional spoofing, corruption and eavesdropping.

- Technologies and techniques to detect, resolve and respond to RF threats, sourced from ground and/or co-orbital, including advanced Artificial Intelligence (AI) for threat intelligence.

- The system should comply with space security requirements, regulations and certifications.

- The rendez-vous system should be flexible and adaptable to cope with RSO rotations or manoeuvres, also considering that the estimation of the state vector could not be accurate.

- The far-range inspection (including GNC[105]/pointing accuracy) should rely on complementary high-resolution sensors (e.g., lidar and optical/infrared cameras) to enable the servicer capacity for inspection and approaching operations of non-cooperative and unknown space objects in a wide range of situations.

- The on-board processing computation power should be optimised not only for the RSO inspection, but also for proximity operations and rendez-vous path. The response should be quick and able to deal with mission contingencies (e.g., ability to perform escape or evasion manoeuvres).

- The servicer should be able to operate and manoeuvre autonomously without receiving feedback from C2 mission ground station during proximity operations.

- The capacity should offer stable capturing systems and AOCS[106]/propulsion take-over subsystem to enable future life-extensions and relocation applications specific for GEO/MEO/LEO defence/military applications.

- The capability to autonomously rendez-vous and capture non-cooperative space objects should allow to retrieve and service a variety of target RSOs.

- The use of AI algorithms to perform autonomous missions, responsiveness and capability to monitor and identify alerts by means of imagery processing in different bands should be assessed and validated.

- The use of improved accuracy navigation filters for updating the status vector should be considered in order to implement adaptive guidance for flight conditions.

- The advanced detection systems (sensors + software) should be able to detect and track approaching space objects to increase the capability of protections of the space assets.

Expected impact

The outcome should contribute to:

- Pave the way to future European on-orbit operations and services able to deal also with security and defence satellites.

- Enhance the ability of the armed forces of the EU Member States and EDF Associated Countries to conduct operations and act in space, enabling responsive space capabilities.

- Optimising investment by leveraging synergies with past, ongoing and future EU civilian R&I in the field of in-space operations and services.

2.7.2. EDF-2025-DA-SI-GROUND-DAMM: Drone-based affordable mass munitions

As it is related to EUDIS[107], and in addition to the development activities, this call topic aims to support innovation opportunities and enable small companies to demonstrate innovative technologies relevant to drone-based affordable mass munitions and receive limited

[105] Guidance, navigation and control
[106] Attitude and Orbit Control System
[107] EU Defence Innovation Scheme.

acceleration support. To achieve this objective, financial support to third parties (FSTP, i.e., cascade funding) is included as part of the grant. This should increase the opportunities for various smaller actors, including those not previously active in the defence sector, to adapt innovative technologies for drone-based affordable mass munitions and to identify potential business opportunities in the defence sector.

- **Indicative budget:** EUR 49 000 000 for this topic under the call EDF-2025-DA-SI.

  The requested funding cannot exceed EUR 9 800 000 per proposal.

  Beneficiaries should provide Financial Support to Third Parties (FSTP) in accordance with the conditions provided below and the ones established by Article 207 of the EU Financial Regulation. The maximum amount to be granted to each third party is EUR 60 000. Up to EUR 600 000 of the total budget allocated to this call topic can be used for FSTP. The FSTP in the proposals should not exceed 6.12% of the requested EU contribution.

- **Indicative number of proposals to be funded:** Several proposals may be funded for this topic.

- **Other information:** The action is expected to be implemented within 24 months. However, other durations can be proposed.

- **Conditions related to FSTP:** The conditions for the selection of third parties receiving financial support[108] are the following:

  - Third parties must be established in the EU, in EDF Associated Countries or in Ukraine[109].

  - Third parties must be subject to control by EU, EDF Associated Countries or Ukraine or by EU, EDF Associated Countries or Ukrainian entities[110].

  - FSTP must target as a priority SMEs, including start-ups. Applicants for FSTP must have self-assessed their SME status. The consortium should perform checks on the basis of random sampling in accordance with the criteria as defined in Article 2 of the Annex to Commission Recommendation 2003/361/EC. Participation of entities other than SMEs can only be accepted where no SMEs are available to demonstrate the capacity or expertise needed for the project during its lifetime.

[108] The support to third parties cannot be provided through services offered by the consortium directly.

[109] The inclusion of entities established in Ukraine among those eligible to receive financial support is in line with the general objectives of EDF, as established by Article 3 EDF Regulation, i.e., fostering the competitiveness, efficiency and innovation capacity of the European defence technological and industrial base (EDTIB) throughout the Union. The support to third parties established in Ukraine would contribute to the general objective of the Fund, thanks to the expertise the Ukrainian defence industry has developed in last years on the battlefield.

[110] The inclusion of entities controlled by Ukraine or by Ukrainian entities among those eligible to receive financial support is in line with the general objectives of EDF, as established by Article 3 EDF Regulation, i.e., fostering the competitiveness, efficiency and innovation capacity of the European defence technological and industrial base (EDTIB) throughout the Union. The support to third parties controlled by Ukraine or Ukrainian entities would contribute to the general objective of the Fund, thanks to the expertise the Ukrainian defence industry has developed in last years on the battlefield.

- A range of entities from different EU Member States, EDF Associated Countries or Ukraine, as well as different industry sectors, including those not active in the defence sector, should be involved.

- Financial support to third parties should be issued in at least one call with a target from minimum 3 and up to 10 recipients of FSTP per call, with a view to give to the third parties the opportunity to demonstrate their knowledge, technologies, capabilities, and products/solutions.

- The following activities, but not limited to this list, may be considered for cascade funding:

    - Customised support for specific challenges; proof of concept; validation; innovation management support.

    - Boot camps; customised trainings; coaching; technical and business mentoring.

    - Hackathons; peer-to-peer evaluation by entrepreneurs.

    - Dedicated business mentors with public and private capital expertise.

    - Technology showcase.

    - Testing.

- The recipients of FSTP may be involved in any type of task within the proposal. Possible tasks at the level of the call for third parties may include, but not limited to:

    - Support for development and analysis of current and future CONOPS and tactics.
    - Analysis support and red teaming, war-gaming.
    - Testing activities in relevant conditions.

Objectives

General objective

The war in Ukraine demonstrates the need for a massive use of ammunition in the battlefield to defeat a conventional adversary in a high-intensity warfare scenario. Besides regular artillery ammunition, loitering munitions (including, e.g., First Person View (FPV) drones) equipped with warheads and other type of Unmanned Combat Aerial Systems (UCAS) have proliferated on the battlefield. The use of such new types of effectors, particularly if deployed in massive scale, have become a force multiplier with substantial impact in the ground operations.

The current degraded international security situation in Europe calls for the development of affordable effectors, in terms of precision and mass, with particular interest on Loitering Munitions and small UCAS and the necessary industrial adaptation for their mass production.

Most of the Loitering Munitions and small UCAS research and development activities have been taking place outside EU and only recently the interest in these capabilities has increased.

EU Member States' and EDF Associated Countries' armed forces need modern capabilities based on both Loitering Munitions and small UCAS, which can be produced and deployed at scale to gain battlefield advantage.

Thus, the EU Member States and EDF Associated Countries must quickly set conditions to develop and deploy affordable technological solutions for Loitering Munitions and small UCAS, alongside with the ramp-up of production of conventional munitions, such as 155mm artillery rounds.

Furthermore, such solutions should benefit from Ukrainian firsthand experience from the battlefield and integrate innovative approaches.

Specific objective

This call topic aims to study, design, develop, prototype and test new generation of affordable mass munitions for ground combat indirect fire. Solutions should predominantly focus on affordable loitering munitions and small UCAS operating for tactical and/or operational level effects. It should be possible to use these systems in massive quantities in the battlefield, preferably with swarm capability. Such solutions should be possible to manufacture at scale and at the speed of relevance to ensure battlefield superiority against a conventional adversary.

To better integrate experience and innovations resulting from the Ukrainian battlefield, the consortium is requested to reach out to third parties across the EU, EDF associated countries and Ukraine, in particular SMEs and start-ups. Funding for the financial support to third parties (FSTP) is an integral part of the awarded grant. The consortium is required to organise at least one call to third parties to select and award start-ups and SMEs to bring open innovation to the project. The selected third parties are offered the opportunity and financial support to demonstrate and test their solutions and receive support services for further improving such solutions, in a specific period.

This aims to strengthen possibilities to involve smaller players that would otherwise not have the means to access EDF actions, thereby further enhancing innovation capacity and competitiveness of the European Defence Industrial and Technological Base (EDTIB).

Scope and types of activities

Scope

The scope concerns Loitering Munitions and small UCAS for tactical and/or operational level effects. Loitering Munition is to be understood as a munition able to remain over a designated area seeking for targets and be assigned/reassigned for selective engagement of one of them. Small UCAS are to be understood as recoverable unmanned aircraft able to carry and drop lethal payloads for tactical and/or operational level effects and return to the launch or other dedicated position after their mission.

It is expected that each submitted proposal must tackle at least one of the following solutions:

a) 5-10 km short range loitering munition or small UCAS against infantry and other soft and armoured targets.

b) 10-50 km mid-range loitering munition or small UCAS against soft and armoured targets.

c) 50-200 km long range loitering munition or small UCAS against soft and armoured targets.

Proposals must address:

- Affordable technologies for autonomous flight control, autonomous target acquisition and autonomous engagement capability (including lethal payloads that are easily integrable into the platform, safely handled, and designed for maximum performance), with meaningful human control.

- Ability to operate in heavily contested electronic warfare environment.

In addition, proposals should address:

- The possibility to be assisted by machine learning/Artificial Intelligence (AI).

- Technologies for collaborating/swarm capabilities with other Loitering Munitions and small UCAS.

- Designs that are easily upgradeable (e.g., by use of modularity and standards) to utilise technological development and adjust to changes in the operating environment.

- Study and design of payloads with smart target seeking and fuze features using new or already existing technologies.

Furthermore, proposals may address:

- Integration into current battle management systems using relevant standards.

Proposals must not address:

- Fully autonomous weapon systems.

Furthermore, the proposals must describe how FSTP is planned to be used in the project and how entities with relevant expertise is expected contribute to their implementation.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		**Eligible?**
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No

Types of activities (art 10(3) EDF Regulation)		Eligible?
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes (optional)
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes (mandatory)
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes (mandatory)
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes (mandatory)
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes (optional)
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes (optional)
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes (optional)

Accordingly, the proposals must cover at least the following tasks as part of mandatory activities:

- Studies:
    - Feasibility studies concerning identified technologies and their manufacturing possibilities for mass production, including security of supply of critical components and raw materials.
- Design:
    - Preliminary definition and design of the proposed components and technologies for Loitering Munition and small UCAS.
    - Detailed definition of the proposed components and technologies.
    - Design activities concerning identified technologies and its manufacturing possibilities for mass production, taking into consideration security of supply of critical components and raw materials.
- Prototyping:

- Creation of the weapon system based on the technological solutions identified.
- Following the track of keeping the cost of the prototype reasonable (purpose to execute for mass production).
- Develop technology, which matches TRL[111] 7.

- Testing:
  - Testing of the defence technological solution or mature product in the relevant environment.

In addition, the proposals should cover the following tasks:

- Integrating Knowledge:
  - Analysis and integration of Ukrainian war lessons learned, in particular the use of Loitering Munitions and small UCAS in the different warfare scenarios.
  - Identification and assessment of technological solutions that can be produced in mass and at an affordable cost.

Concerning the implementation of the FSTP, the proposals must cover the following tasks:

- Organise at least one call for FSTP in support of the mandatory activities: studies, design, prototyping or testing.
- Prepare documentation, organisation, selection, and award of recipients of the FSTP call.
- Select and award of recipients of FSTP.
- Provide technical mentoring for the recipients of FSTP.
- Provide the third parties with necessary knowledge on doing business in defence domain, in particular with respect to protection of IPR, IPR strategies, export control and other specificities of the defence sector.
- Provide networking and cooperation activities between the EDTIB and third parties, as well as the establishment of additional measures to support the business case and innovative ideas of recipients of FSTP within the scope of the call topic.
- Describe how the support to recipients of FSTP may be contributing to development and analysis of current and future CONOPS and tactics, analysis support and red teaming, war-gaming and testing activities in relevant conditions or other tasks deemed relevant for the proposal.

The proposals may seek synergies and complementarity with activities in the field of unmanned aircraft systems, notably those described in the call topic EDF-2024-DA-C4ISR-SEEU-STEP related to *Small enhanced European UAS,* EDF-2024-LS-RA-CHALLENGE-

[111] Technology Readiness Level

SENS-RADNP related to *multi-sensor integration for robust autonomous drone navigation*, and EDF-2024-RA-GROUND-IWAS related to *intelligent weaponry and ammunition systems*.

Functional requirements

The proposed technologies and future product should meet the following functional requirements:

- The range of 5-10 km, with the appropriate flight duration time, for short range loitering munition or small UCAS.
- The range of 10-50 km, with the appropriate flight duration time, for mid-range loitering munition or small UCAS.
- The range of 50-200 km, with the appropriate flight duration time, for long range loitering munition or small UCAS.
- Easily useable and applicable to tactical actions (e.g., with minimised/sub-unitary number of operators per shot required for Loitering effectors/munitions and small UCAS).
- Systems based on existing and available sensors and/or mature new sensor technologies to achieve the desired effects.
- Capability to improve system performance based on collection and analysis of system data from operations (e.g., by use of machine learning and/or AI, if suitable for the expected application).
- Possibility of integration in existing and future Command and Control and Battle Management Systems, for receiving and providing target data and Battle Damage Assessment.
- Affordable cost in mass production, especially when compared to precision-guided weapons, with similar range and effects.
- Communication link resistant to enemy electronic warfare systems detection, location and jamming.
- Ability to navigate in a GNSS denied environment.
- Swarming capability, to combine munitions in strike packages including with deception dummies. The aim is to overwhelm and degrade opponent’s air-defence and have more efficient kill effect.

In addition, the FSTP includes the following specific requirements:

- The consortium should:
    - Organise at least one call for third parties selecting target of minimum 3 and up to 10 entities. Each recipient of FSTP should be supported with up to EUR 60 000 for a maximum of a 6-month long period.

- Provide the third parties with the opportunity to demonstrate their knowledge, technologies, capabilities, and products.
- Foster the possibilities for future involvement of these third parties in the European defence community.

- The proposals should clearly delineate the expected contributions from the main beneficiaries as well as from the recipients of FSTP, to ensure their coherence and impact.
- Concerning the organisation of FSTP, the proposals should include a description of:
  - The method for calculating the exact amount of the financial support requested by the third parties.
  - The payment arrangement options to third parties.
  - The possible types of activities for which a third party may receive financial support.
  - The potential results to be obtained.
  - The roles and responsibilities of the consortium with regard of the management of FSTP.

Expected impact

The outcome should contribute to:

- Improve engagement capabilities by extending the range and precision of land-based precision strike capabilities, delivered in a massive way.
- Gain technological superiority for deploying affordable Loitering Munitions and small UCAS, for defeating conventional adversary targets.
- Foster the integration of Ukrainian war lessons learned into EU defence industry products.
- Enhance EDTIB capabilities to mass produce effective Loitering Munitions and small UCAS.
- Reduce non-EU dependencies in the field of Loitering Munitions and small UCAS.
- CDP priority Land Based Precision Engagement.
- Increase the opportunities for various smaller actors in the defence sector established in the EU, EDF Associated Countries or Ukraine - including those not previously active in the defence sector, to adapt and apply innovative technologies for defence applications- and promote technological edge in the field.

- Increase opportunities and future involvement for third parties in the field of ground combat capabilities, within tasks described previously in the call text under "Conditions related to FSTP".

2.8. Call EDF-2025-LS-DA-SME

- **Targeted type of actions**: Development actions (dedicated to SMEs).
- **Form of funding:** lump sum grants following the call for proposals.
- **Targeted type of applicants:** any eligible consortium as defined in Articles 9 and 10(4) of the EDF Regulation. Members of the consortium must be SMEs (as defined in Commission Recommendation 2003/361/EC).
- **Indicative budget for the call:** Up to EUR 36 000 000 to support one call topic:

2.8.1. EDF-2025-LS-DA-SME-NT: Non-thematic development actions by SMEs

- **Number of proposals to be funded:** several proposals may be funded for this topic.
- **Range of EU financial contribution per proposal:** The requested funding cannot exceed EUR 6 000 000.

Objectives

This call topic encourages the driving role of innovative SMEs to turn technology and research results into defence products in a fast and cost-efficient way, possibly by adapting technologies from civil applications or addressing hybrid warfare.

Scope and types of activities

Scope

The proposals must address innovative defence products, solutions and technologies, including those that can improve readiness, deployability, reliability, safety and sustainability of forces in defence tasks and missions, for example in terms of operations, equipment, infrastructure, energy solutions, surveillance systems or digital solutions.

The proposals must address any area of interest for defence.

In addition, to best complement R&D efforts already targeting civil applications and to encourage the efficient spinning-in of knowledge, innovation and technological development to the defence sector, this call topic also welcomes proposals for add-on development actions to adapt solutions originally developed for civil applications and previously not applied in defence sector. The proposals should drive forward or integrate results of projects funded under EU funded programme calls with a focus on civil applications and under the provision that the applicants have the necessary rights to access and commercialise the results of the precursor projects.

Types of activities

The following types of activities are eligible for this topic:

Types of activities (art 10(3) EDF Regulation)		Eligible?
(a)	Activities that aim to create, underpin and improve knowledge, products and technologies, including disruptive technologies, which can achieve significant effects in the area of defence (**generating knowledge**)	No
(b)	Activities that aim to increase interoperability and resilience, including secured production and exchange of data, to master critical defence technologies, to strengthen the security of supply or to enable the effective exploitation of results for defence products and technologies (**integrating knowledge**)	Yes
(c)	**Studies**, such as feasibility studies to explore the feasibility of new or upgraded products, technologies, processes, services and solutions	Yes
(d)	**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, including partial tests for risk reduction in an industrial or representative environment	Yes
(e)	**System prototyping** of a defence product, tangible or intangible component or technology	Yes
(f)	**Testing** of a defence product, tangible or intangible component or technology	Yes
(g)	**Qualification** of a defence product, tangible or intangible component or technology	Yes
(h)	**Certification** of a defence product, tangible or intangible component or technology	Yes
(i)	Development of technologies or assets **increasing efficiency** across the life cycle of defence products and technologies	Yes

The proposals must address at least one activity among design, system prototyping, testing, qualification, certification and increasing efficiency.

The proposals must describe a clear work breakdown structure and link the proposed tasks to eligible activities.

The proposals should include clear descriptions of the proposed criteria to assess work package completion.

Functional requirements

This call topic is open to any technology development for defence. The proposals should describe the targeted functionalities and the foreseen means to measure progress toward the achievements of these functionalities.

Expected impact

The outcome should contribute to:

- Innovative, rapid and cost-effective solutions for defence applications.

- Ground-breaking or novel concepts and approaches, new promising future technological improvements or the application of technologies or concepts previously not applied in the defence sector.
- Enhanced innovation capacity across Europe by involvement of SMEs that can make a difference in the future.
- Potential for future market creation for SMEs, especially by facilitating access of SMEs to defence markets and supply chains.
- Contribution to the development of EDTIB ecosystems and to the strengthening of EU Member States' and EDF Associated Countries' defence supply chains.

2.9. Call EDF-2025-CSA

2.9.1. EDF-2025-CSA-NFP: Support to the EDF National Focal Points (NFP) network

- **Targeted type of actions**: Coordination and support action
- **Form of funding:** Actual costs grants following the call for proposals
- **Targeted type of applicants:** Applicants must be the national support structures hosting the EDF-NFP or the alternate EDF-NFP officially nominated to the Commission by a Member State or an EDF Associated Country.
- **Indicative budget:** Up to EUR 2 000 000 under the call EDF-2025-CSA.
- **Number of actions to be funded:** Up to one proposal may be funded.
- **Other information:** The action is expected to be implemented within 36 months. However, other durations can be proposed.

Objectives

The National Focal Points for the EDF (EDF-NFPs) consists of a network of individuals nominated by EU Member States and EDF Associated countries that are supported by national structures established under the responsibility and control of the EU Member States and EDF Associated Countries. The NFPs form an essential part of the EDF implementation by providing practical information, advice, training, and other forms of assistance to stakeholders on all aspects of participation in the EDF.

This action aims at facilitating trans-national cooperation between EDF-NFPs with a view to identifying and sharing good practices and raising the general standard of support to (potential) programme applicants, taking into account the diversity of actors that could benefit from the programme and thus contribute to strengthening the EDTIB.

Scope and types of activities

Proposals must include coordination and support activities in accordance with the following requirements, with a view to improving the competence of EDF NFPs by rapidly acquiring the know-how developed in other EU Member States and EDF Associated Countries.

Key project tasks such as project management and organisation of trainings are not eligible for subcontracting.

NFPs that choose not to participate as a member of the consortium, are nevertheless invited and encouraged to participate in the action activities (e.g., trainings), and the costs incurred by the consortium for such participation (e.g., travel costs paid by the consortium) may be included in the estimated budget and be eligible for funding by the Commission.

Requirements

The proposals should include:

- A detailed management plan that is adequate for the size and scope of the project
- NFP-organised joint trainings to improve the services they provide, share experiences and best practices in relation to their support for the EDF.
- Twinning arrangements/facilities (in person visits or virtual), where NFPs can learn from their counterparts about the different approaches adopted in supporting national entities' participation in the EDF.
- The development of information and promotional materials (both in digital and physical formats) that can be used by the whole NFP network, relating to the services the NFP network is providing and on practical aspects of participating in the EDF.
- The organisation of cross-border matchmaking events at selected international and European defence fairs or at national information activities such as national EDF Info Days.
- The setting up of a website providing information about the services supported by the action, including, but not limited to listing relevant events, introducing the EDF with a special focus on entities that are new to defence research and development, and a facility to conduct partner search taking into account existing platforms and practices.
- The development of methodologies to help EDF-NFPs to interact with Enterprise Europe Network that has already well-established contacts with entities that are active in civilian R&D and can facilitate matchmaking.
- Interaction with relevant national industry associations and with relevant Horizon Europe NCP networks, with the objective to have a wider reach to industrial entities and make the EDF better known.
- The action should provide clearly defined and quantified deliverables and milestones in line with all the activities mentioned.

Expected impact

The outcome should contribute to:

- Enhance the functioning of the EDF-NFP network.
- Increase the impact of the EDF in maximising the competitiveness of EU defence industry, its capacity to innovate and contribute to developing key technologies for the future.

- Strengthen cross-border collaboration between EDF-NFPs and improve coordination in EDF-NFP-related activities that reach more than one Member State or Associated Country.
- Continuously improve the services of the individual EDF-NFPs with respect to all aspects of participation in the EDF and to all stakeholders concerned.
- Foster matchmaking activities to facilitate the forming of consortia participating in the EDF calls.
- Enhance the cooperation of EDF-NFPs with the Enterprise Europe Network and other relevant networks.

Appendix 1 - Preliminary Evaluation Plan for the EDF 2025 Technological Challenge

Preliminary evaluation plan
for the EDF technological challenge on Human-AI Dialogue Systems
(Topics EDF-2025-LS-RA-CHALLENGE-DIGIT-HAIDP and EDF-2025-LS-RA-CHALLENGE-DIGIT-HAIDO)

1. Introduction

This Annex 4 is the preliminary evaluation plan for the EDF Challenge on Privacy-Preserving Human-AI Dialogue Systems (HAID). It provides a general description of the testing environment, metrics and protocols under which the research teams participating in the challenge will evaluate their systems. It is provided as part of the call documents for the topics of the EDF call EDF-2025-LS-RA-CHALLENGE in order to frame the challenge and to enable applicants to prepare projects that can cooperate smoothly with one another. For each actual test campaign, a more detailed evaluation plan will be produced by the challenge organisers in coordination with the participating teams.

2. Overall concept and timeline

This technological challenge aims to **support the progress of human-AI dialogue systems** developed by the participants to the challenge. It introduces two major novelties. The first is a way to **measure in an objective and comparable manner the performances** of such systems. The second is to evaluate **privacy-preserving learning** capabilities for such systems.

Measuring the performance of dialogue systems in an objective and comparable way is known to be difficult due to the **high variability of the possible acceptable outputs**. Indeed, classical automatic metrics work by comparing system outputs with human-generated reference outputs and computing some edit distance or similarity measure (cf. Figure 1a). Since it is difficult to anticipate all possible reference outputs before the test, the higher the variability, the less accurate is the measurement. In the case of dialogue systems, the variability is generally too high to get meaningful results with this approach.

Another approach, which has been created for Machine Translation, is to have the reference outputs generated by manually editing the system outputs (Cf. Figure 1b). This solves the variability issue and yields quite accurate measurements. However, it involves human intervention for each evaluation campaign, which does not allow agile system development.

In this technological challenge, a new approach to overcome this dilemma between automatisation and accuracy is explored by **using AI-based correction systems that have access to reference outputs** and any other relevant guidance about what is a correct output, to play the same role of the human correctors in the previous example (cf. Figure 1c).

While such AI-based answer correction systems may not be as accurate as humans, they can take advantage of having access to human-generated reference information to enhance the outputs of the systems under evaluation and thus drive the progress of these systems through automatic evaluations. Building AI-based correction systems that are accurate enough to effectively drive progress is an ancillary but important goal of this technological challenge.

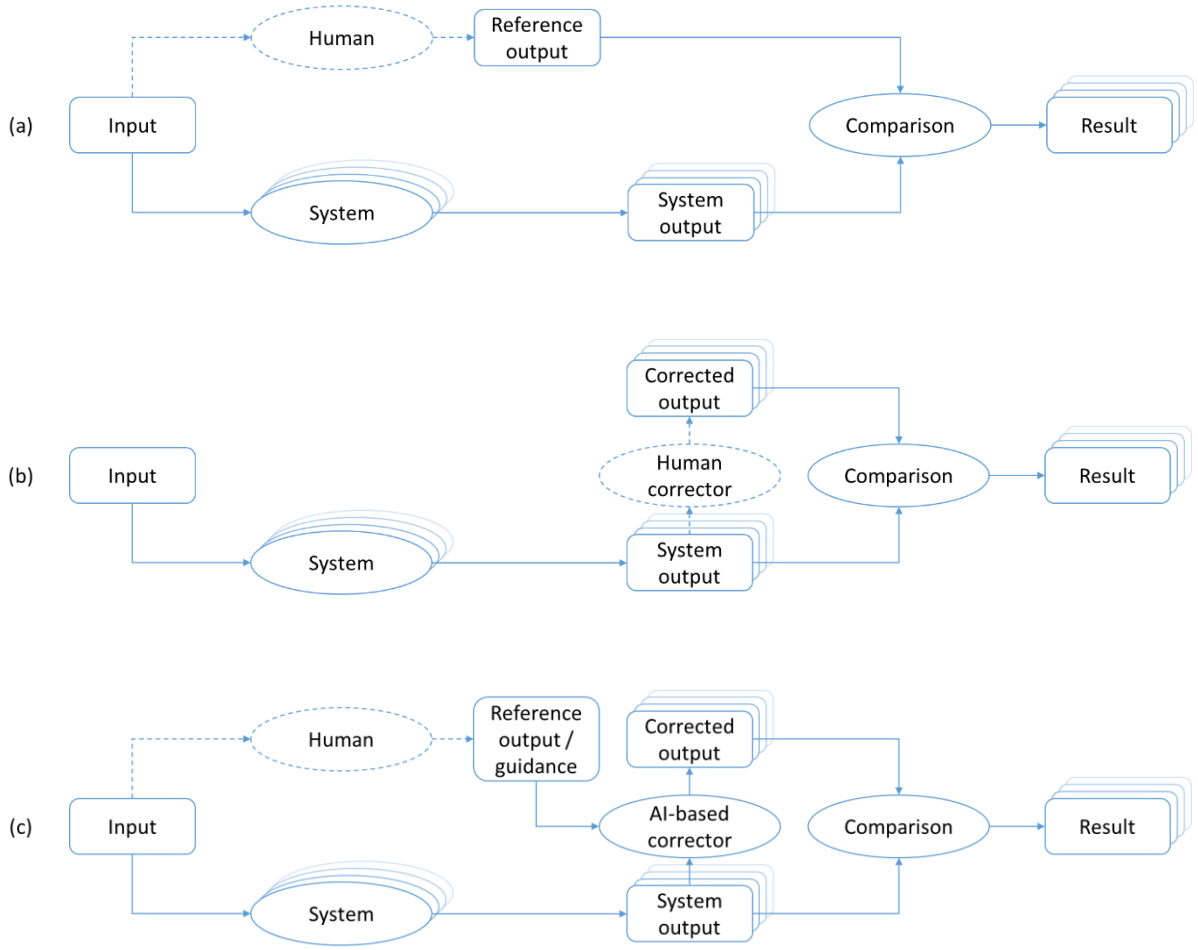


Figure 1: Workflow of a classical automatic metric (a), of a metric based on human post-edition (b), and of the proposed metric based on guidance-augmented AI-based post-edition (c).

The challenge organisers make available such an AI-based answer correction system. This system should be open source to ensure the transparency of the measurements. Before an official test, the organisers prepare a set of prompts accompanied by high-quality human-generated reference information that can be used by this automatic correction system. During the test, the system outputs in response to prompts are edited by this correction system and the initial outputs are compared to the edited ones with a standard metric to yield a measurement.

The proposed metric for the comparison is an edit distance between two texts where edits can be a token insertion, a token deletion, a token substitution, or a token sequence shift. This metric is already used in the context of Machine Translation, where it is called *Translation Edit Rate (**TER**)*[112]. However, for the sake of generality, in the context of this challenge it is proposed to call it ***Text-to-text Edit Rate***. To clarify that the measurement involves AI-based editing, in the same way as the TER measured on human-edited outputs is called *HTER*, it is proposed to refer to the TER **measured on AI-edited outputs** as *AITER*.

Following an initial automatic measurement, the challenge organisers check the quality of the results. If needed, the human-generated information used by the automatic correction systems is improved to ensure the accuracy of the measurements. The organisers then share the results of each participating team with this team and give it the opportunity to comment on any

[112] Matthew Snover, Bonnie Dorr, Richard Schwartz, Linnea Micciulla, and John Makhoul, *A Study of Translation Edit Rate with Targeted Human Annotation*, Proceedings of Association for Machine Translation in the Americas (AMTA), 2006

remaining issue. This **adjudication phase** can lead to further enhance the test data quality and measurement accuracy.

The participating teams may seek to enhance the correction system made available by the organisers or develop their own correction systems, in view of enhancing the efficiency of their development process. They can then propose that these systems contribute to the correction process during the evaluation to make the evaluation process more robust. In such a **committee approach**, these additional systems are entitled to suggest improved corrections to the main correction system, which takes them into account while ensuring the overall consistency. The information produced in this phase is also reviewed by the organisers and by the participating teams during the adjudication.

This AI-based evaluation process is expected to support the work of the human evaluators during the test campaigns, and thus enable to produce more high-quality reference data. The set of reference data produced during a test campaign can be later used, in combination with the automatic correctors, to further develop dialogue systems.

As a second main novelty of this technological challenge, **the ability of systems to manage sensitive or private information is also evaluated**. For this purpose, some training data is deemed to be restricted to specific user groups, while the rest is deemed to be public data. During the tests, different scenarios are considered depending on which group the user belongs to, and therefore on which type of information they are entitled to have access to. When the user is entitled to such access, the reference guidance included in the test data may require that a correct answer includes the relevant sensitive information. When the user is not entitled to such access, any sensitive information included in the answer constitutes an information leakage. Such leakage is measured by the overall metric as insertion errors. However, given the importance of this type of errors, they are also tagged, measured and analysed separately.

The dialogue systems should take into account the long-term context of previous dialogue turns. Performances are measured over **full dialogues**. However, when developing systems, using a fixed series of prompt when the sequence of answers can vary may lead to artificial dialogues. Therefore, a baseline question answering task with no dialogue context is also evaluated.

The ability of systems to provide source information backing the answers and some reasoning relating part of the answer to this source information (**explainable AI**) is evaluated by focusing on questions that require such types of answers.

The ability of systems to learn from user supervision without intervention from the system developers (**continuous / autonomous learning**) is evaluated by providing the reference information to the systems after each dialogue turn and measuring to which extent they can take advantage of it to improve their performances.

Collaboration among systems and research teams is encouraged. System outputs may be shared, and systems allowed to propose improved outputs knowing these first outputs. Besides, teams can team up to submit joint outputs.

As a baseline task, systems are tested in writing and on English only. In addition, the following two test conditions are evaluated: the dialogue is **spoken** instead of written, and other EU languages than English are used. The exact choice of the languages to be covered in

each campaign is part of the definition of the evaluation plans. **All EU official languages** are covered in at least one evaluation campaign.

In addition to the automatic tests described above, in order to test complete systems in live conditions and collect representative data, **live tests** are conducted. These tests involve representative defence users and are based on scenarios that are designed to put the users in conditions that are as realistic as possible. The scenarios can relate to various military functions such as intelligence, strategic planning, tactical operations, and life-cycle support.

These live tests also serve as subjective evaluations. At the end of each live test campaign, users provide feedback on their experience using the systems.

The challenge lasts four years and covers **four evaluation campaigns**, each lasting about a year.

For each of the three fully-fledged campaigns, a proposed general timeline is as follows:

- January: Evaluation plan discussion workshop;
- April: Data-based tests;
- June: Debriefing workshop;
- September: Live tests;
- November: Debriefing workshop.

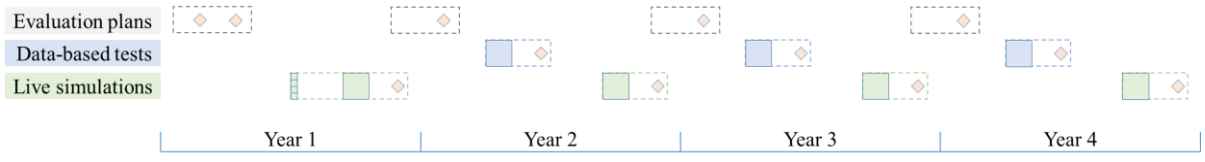
For the first campaign, a proposed general timeline is as follows:

- Spring: Evaluation plan discussion workshops;
- September: Live tests;
- November: Debriefing workshop.

The first evaluation campaign is a **dry run**, whereby setting up the testing protocols is a goal in itself and the meaningfulness of measurements might not be guaranteed, but any measurement issues should be identified and remedied in order to ensure that subsequent campaigns do yield meaningful measurements.

Tests are followed by **debriefing workshops**, where the organisers present the consolidated performance measurements, and the participating teams present an analysis of their approaches and results.

This proposed general timeline is illustrated below.



3. Data collection, annotation and sharing

The **data collected during the live test exercises** complement data produced directly by the organisers, which might be slightly less realistic but are more controlled and can be produced in larger quantities. Collecting data from **real military exercises** should also be sought. Means to address data that is classified should be considered whenever relevant. The collected data is annotated by the organisers.

System outputs should be shared across teams to enable a full analysis of the results and foster collaboration.

Test data for one evaluation campaign can be used as **training or development data** for the next ones.

4. Systems

Systems should include user-friendly interfaces that enable them to be used during the live tests. They should also include modules that can be tested on each task below.

5. Tasks and metrics

Overview

The table below provides an overview of the minimum set of tasks to be evaluated in the framework of the technological challenge. The first task is a baseline upon which each of the other tasks builds by adding a specific feature. All tasks listed in the table are covered in each evaluation campaign. Further tasks, and in particular tasks combining several features, may be added as deemed needed.

Task	Condition	Metric
Baseline question answering	Single question (monolingual, written interaction)	AITER
Dialogue	Interaction takes into account the context of previous dialogue turns	AITER computed over the set of dialogue turns
Explainable question answering	Focus on prompts that require the dialogue systems to provide source information	AITER
Privacy-preserving question answering	Need to know is taken into consideration in the training and test data	AITER + Leakage rate
Continuously-learning question answering	Systems have access to the reference information related to the previous questions and answers	AITER
Spoken question answering	Interaction is by voice	WER + AITER
Multilingual question answering	EU official languages beyond English are covered	AITER

These tasks are detailed in the following subsections.

Baseline question answering

The systems are evaluated on their answers to a single prompt, without any dialogue context. The metric is AITER.

Dialogue

The systems are evaluated on multi-turn dialogues. The metric is AITER computed over the dialogue turns.

Explainable question answering

The systems are evaluated on prompts that require them to provide source information and some reasoning relating part of the answer to this source information. The metric is the same as for the baseline question answering.

Privacy-preserving question answering

The training data is organised in silos, some data being deemed restricted to specific user groups. Test scenarios consider which groups a user belong to, and the system answers should be tuned to be as informative as possible for the user while respecting the need to know. The main metric is AITER. Information leakage is evaluated via a separate metric.

Continuously-learning question answering

After each answer, the reference information is provided to the system, which can use it to update its models before having to process the next question. The metric is the same as for the baseline question answering. Systems are deemed able to continuously learn without intervention from developers if they can take advantage of this supervision to improve their performances in comparison to the baseline situation where they do not get any feedback on their answers.

Spoken question answering

The interaction with the system is by voice. The main metric is the same as for the baseline question answering, measured on the written output of the systems before conversion to speech. For systems that are not end-to-end, the Word Error Rate (WER) on the speech transcription and the performance of the dialogue system on the correct speech transcription are also measured.

Multilingual question answering

EU official languages beyond English are covered. The exact list of languages for each campaign is determined during the technological challenge.

6. Communication

Without prejudice to other provisions, participating teams may communicate on their own results and methods. Documents on challenge-level results are prepared by the organisers and are submitted for comments to the participating teams and for approval to the granting authority before actual publication.

7. Participation rules

Participants must respect the rules ensuring that data-based tests are not biased. In particular, they should not look at the data content until completion of its processing during the test.