EDF-2022-LS-RA-CHALLENGE-DIGIT-HTDP: Unmanned ground and aerial systems for hidden threats detection – Participation to a technological challenge

Budget

The Union is considering a contribution of up to EUR 20 000 000 for this topic under the call EDF-2022-LS-RA-CHALLENGE.

Range of financial contribution of the Union per proposal: the requested funding should not exceed EUR 5 000 000.

Number of actions to be funded: Several actions related to the participation in the challenge and addressing different solutions may be funded for this topic.

Objectives

Improvised explosive devices (IEDs) and landmines are a significant threat to military personnel, civilians and equipment, and a major cause of casualties for European forces during operations. Countering these hidden threats is essential to protect soldiers, reduce loss of equipment, secure critical logistic activities, improve mobility and freedom to act by increasing the security of operation areas, and more generally enhance operational efficiency. Furthermore, in a hybrid warfare context, these threats are increasingly used against civilian populations. In particular, they have the potential to severely disrupt both military and civilian supply chains, damage critical infrastructures and affect strategic lines of communication.

Detecting these hidden threats is a first essential step to counter them. Since they are by design difficult to detect for humans, automatic detection technologies can play an important role. However, the task is intrinsically difficult, and the performance of existing technologies is still far from answering the needs. Scenarios classically encountered by armed forces in past missions such as route clearance already represent a challenge. In addition, IEDs are increasingly used in urban scenarios where the detection is even more difficult, especially if multiple IEDs emplacements are used. There is a need to enhance detection technologies, especially for scenarios where single detection devices are not sufficient and the use of distributed sensors is deemed useful. There is also a need to determine their type (e.g., how they are triggered), in particular to ease their neutralisation (rendering safe, disabling or destroying).

While the above issues have been the subject of much research over many years, progress is hindered by the lack of standardised benchmarks, and there is a need to evaluate the performances of integrated functional demonstrators in an objective and comparable manner, using representative testing environments and well-defined metrics.

Overall progress in IED and landmine detection and characterisation can be driven by progress along several lines:

- Physics-based sensors enhancement;

- Collection of representative data, combined with various artificial intelligence (AI) techniques, e.g., computer vision for object detection and localisation;

- Use of various sensors borne by a fleet of unmanned ground and aerial systems, combined with information fusion techniques;

- Better exploitation of limited amounts of data and use of models that are easier to adapt to new environments (through innovative AI techniques such as learning methods requiring

less supervision from expert developers, transfer learning…);

- Multidisciplinary cooperation between the hardware sensors and AI communities.

Scope and types of activities

Scope

Proposals should address technological solutions to detect and characterise IEDs and landmines in complex environments, using a combination of advanced sensors, information fusion from these sensors, and unmanned ground and aerial systems to extend the detection capabilities. These solutions should be evaluable through the testing environment set up in the framework of the technological challenge.

Proposals should include clear descriptions of criteria to assess work package completion. Criteria should include the participation to the test campaigns organised in the framework of the technological challenge, the delivery of sensor data collected during the field tests, and the delivery of descriptions of the systems submitted to the tests.

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 (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 (**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 proposals must address in particular the following as part of the mandatory activities:

- Research on new approaches and technologies for hidden threat detection and characterisation

- Participation to the evaluation campaigns organised in the framework of the technological challenge, including:

  o Contribution to the exchanges with other stakeholders on the evaluation plans

  o Submission of the systems to experimental performance measurements during the field and online test campaigns managed by the challenge organisers

  o Collection and sharing of data

  o Participation to debriefing workshops

Functional requirements

The proposed solutions should fulfil the following requirements:

- Ability to go through a zone with IEDs or landmines while minimizing the risk of damage

- Ability to detect and map IEDs and landmines in a given area, with maximum accuracy

- Ability to characterise IEDs and landmines, with maximum accuracy

The performances for these abilities should be measurable through the test campaign conducted in the framework of the technological challenge, using protocols and metrics based on those described in the preliminary evaluation plan provided as part of the call documents. Details about how the proposed approaches and systems will address the tasks outlined in the preliminary evaluation plan should be described in the proposals.

Systems should be able to record the data acquired through their sensors, in order to enable reproduction of experiments in a software environment. The types of data that could be shared with other teams should be described in the proposals.

While much flexibility is left concerning the system configuration for the challenge, systems should be designed to experiment operationally relevant solutions.

Expected impact

The expected impacts are:

- Enhanced clarity on performances of equipment for IED and landmine detection and characterisation

- Availability of databases to further develop and test equipment

- Enhanced soldier protection and increased survivability, through reduced risk for lethal or damaging incidents

- Enhanced freedom of action

- Reduced risks of disruption of strategic infrastructures