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

EDF-2021-C4ISR-D-HAPS: High altitude platform systems;

Budget

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

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

Information superiority is a critical capability to be developed and improved with the aim to address future challenges to be faced by European Defence Forces and NATO stakeholders, and more specifically to support reactive and efficient decision-making processes. In order to improve systems dealing with command, control and communications (C3) capabilities, as well as Intelligence, surveillance and reconnaissance (ISR) capabilities, emergent technologies should be considered to enhance ISR and CIS operational availabilities, through persistence, acquisition of high quality data, automatic airborne processing and dissemination of information to relevant stakeholders.

While current observation satellites provide daily revisit frequency and upcoming constellations of small satellites propose a revisit time within an hour, this frequency will still be too low to understand properly the behaviour of a terrestrial, maritime or air target, and to track it. Stratospheric persistent airborne systems or High Altitude Platform Systems (HAPS) are particularly suitable to reach persistence, as environmental conditions are stable and allow continuous operations with limited meteorological impacts, thus contributing to high-availability operational requirements.

With respect to terrestrial and satellite networks, technical advantages provided by HAPS are numerous, among which:

- Better propagation conditions for connectivity, lower latency, better sensor resolution;
- Ability to remain continuously and persistently in an area for a long period.

HAPS, operating in the stratosphere, can provide an efficient solution to European Defence Forces, featuring simultaneously a capacity of permanence and endurance over a large area. HAPS can complement the surface, airborne and satellite systems for the surveillance and monitoring services, *e.g.* keeping a stationary position (at a first approximation) with respect to the ground and thus acting like a fixed observation platform. They provide unique performances in terms of resolution and/or link margin thanks to its relative proximity to the ground. They can provide over the horizon detection capabilities of ground, sea or low altitude air targets. Furthermore, the deployment and operation of multiple different sensors providing different types of data that will deliver high quality and valuable information when fused can strongly improve the relevance of such HAPS.

HAPS development projects can benefit from improvements in composite materials, low-power computing, battery technology and solar panels technologies, available in Europe. Main HAPS mission profiles are:

- Broadband Net Nod, facilitating regional communication particularly among command posts;
- Surveillance/Airborne Early warning, offering down to ground level month-long uninterrupted long range detection;

- Persistent Threat Detection both for terrestrial and maritime surveillance, providing moving target indicator, imagery (EO/IR/SAR) or even detection of muzzle flashes, shockwaves or impact of the ammunition (rockets, artillery, mortar);
- SIGINT/ESM, detecting and analysing electronic emissions over long distances;
- Communication Cell Node, offering a central management node designed for short range at line-of-sight propagation.

Specific challenge

The development of HAPS solutions necessitates solving specific technological, industrial and operational challenges:

- Development of the concept of operation of such innovative assets integrated with other capabilities (including HAPS);
- Maturity of the key technologies required to develop such persistent platforms;
- Adaptation of platform materials, electronics and payloads to the stratosphere environment and high altitude position;
- Real time processing of the data flow and data fusion both on board, and ground-based to maximize HAPS efficiency, or to integrate it into C4ISR architecture;
- Integration in airspace during critical phases and respect of airspace sovereignty.

Scope

The proposals must aim to validate HAPS solutions, developing at least two different flight demonstrators of different kinds[7] to test properly the operational and technical challenges of the different HAPS platform types, and as such making a substantial contribution to European Defence and Security applications.

The proposals must include in particular:

- Definition of the Concept of Operations of HAPS solutions in their various missions, taking into account their specific operational capacities. Such CONOPS will be used to design the prototypes or the new HAPS solutions (platform and payloads, including data processing);
- Demonstration of the various HAPS demonstrators (platforms and payloads) to de-risk the key technologies and highlight the operational performances that can be expected from each demonstrator type;
- Study of current and foreseen technology status and identification of road maps for each demonstrator involved.

Targeted activities

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

- Studies, such as feasibility studies to explore the feasibility of new or improved technologies, products, processes, services and solutions.
- The design of a defence product, tangible or intangible component or technology as well as the definition of the technical specifications on which such design has been developed which may include partial tests for risk reduction in an industrial or representative environment.

In particular, the proposals must cover the in-flight demonstrations of at least two high- altitude demonstrators (platform and mission) of different kinds[2] and the preliminary phases of the design of the HAPS products and associated mission systems, including in particular:

- Design and realization of high-altitude platform demonstrators, design and realization of various missions from communication relay to surveillance/threat detection, including features of data acquisition and processing, the flight tests of the demonstrators including operational payload and the related conclusions in terms of key technologies and operational interests and benefits.
- CONOPS definition, system specifications, detailed requirements review (DRR) and architecture definition of the European HAPS capacities.

The proposals can also include the potential development of specific laboratory technological demonstrators, in order to support decision making during the design phase.

A detailed planning of possible further development phases will also be provided, including the identification of implementation priorities, according to operational needs of EU and Member States. Subsequent phases up to operational readiness should include in particular prototype development, qualification and test activities.

Functional requirements

For each of the HAPS platforms concerned, the proposals must meet the following main functional requirements in order to meet Defence needs:

- High altitude of operation (stratospheric layer, typically between 18 000 and 25 000 m) to ensure operational flexibility with respect to weather conditions;
- Permanence, necessary to detect critical threats, with sufficient freedom of evolution to reach operational areas and follow battle rhythm;
- Endurance with the objective to stay in flight at least for one month and up to one year, but lower endurance has to be compensated by higher capacity for the related platform to be rapidly deployed, even from not prepared terrains. Ability to support operations without limitation throughout their duration must be investigated;
- No ground logistical impact on the operational theatre;
- A powerful and diversified payload capacity, including telecommunication services and long range sensors, such as powerful imagery and radars, electronic and signal sensors, necessary for ISR missions (terrestrial, aerial or maritime) ;
- Capacity to be relocated or deployed over foreign theatres;
- Capacity to embark diverse payloads , according to the mission and to the user requirements, thanks to a modular design and a standardized interface (plug and play), including towards the data management system. Each Member State can define its own payload, based on its own sensors. This capacity will be demonstrated by swapping payloads for diverse purposes and diverse origins;

- Capacity to address mission profiles previously described (cf. specific challenge);
- Capacity for the HAPS to be networked either with other HAPS or with other ISR platforms in order to increase the operational impact and resilience if needed;
- Telecommunication applications, embarking a suitable telecommunication relay for ground, naval and aerial forces, and SATCOM relay;
- Ability to transfer imagery and signal data collections to reach back centres like processing, exploitation and dissemination cells, potentially with the help of artificial intelligence must be investigated;
- Ability to be easily integrated in current and foreseen C2 systems;
- Electromagnetic and cyber resilient platform and payloads: only authorised parties must be allowed to take control of the system or to access information to and from the platform.

Expected impact

- Convincing demonstrations of the potential of various HAPS configurations in support of EU critical defence and security solutions.
- Cartography of technologies and systems effectiveness based on common key performance indicators.
- Ensure reliable, secure and autonomous availability of high performance and (re)configurable permanent surveillance solutions to military end-users.
- Provide flexibility for telecommunication and ISR aspects, which go beyond capabilities of satellites.
- Payload development and breakthrough on-board data processing technologies.
- Improvement of situational awareness, resilience and security of operations.
- Reduction of the personnel footprint and the global cost of military operations.
- Contribute to strengthening the European industry and help improve its global position through the development of innovative technologies along a new European manufacturing value chain.
- Supporting European Union industrial competitiveness by allowing development of innovative technologies in the framework of multiple emergent industrial domains such as aerospace, energy management, payload development, digital technologies and defence and security sector.