### 2.4.10. EDF-2022-DA-NAVAL-MSAS: Medium-size semi-autonomous surface vessel

#### Budget

The Union is considering a contribution of up to EUR 65 000 000 for this topic under the call EDF-2022-DA

**Number of actions to be funded:** Up to one action may be funded for this topic

#### Objectives

The goal is to study, design, prototype and test a medium-sized semi-autonomous surface vessel (MSAS) with at least an ISR modular mission payload.

Medium-sized should be understood as a vessel that can host the designed mission modules, be optionally manned based on the level of ambition described in scope and functional requirements sections of this call text.

Semi-autonomy should be understood as a primarily option to operate the platform and mission modules remotely. Due to the constrains related to certain use cases (e.g., legal restrictions, security and safety aspects, non-permissive electromagnetic environment), the vessel should be operable using a minimal manning to oversee the automated functions and/or operate mission modules and/or weapons on-board. Requirements linked to human factors when the vessel is manned (e.g., on-board facilities) and subsequent impact in the design (e.g., size) should be considered.

The main results should be a core platform designed to support unmanned operations with optional/minimal manning, 24/7 littoral operations, ISR missions, and providing versatility in terms of capability packages at affordable cost.

The use of a best practice as guidance to terminology and definitions regarding Unmanned Maritime Systems (UMS) is advisable.

As part of the exploitation actions considered by a potential dissemination and communication strategy for sharing information and results towards external stakeholders, a live demonstration focused, in particular, on the Navies of Member States and associated countries should be considered.

The mission modules to be considered are:

a. ISR as part of the core platform (design & prototype)

b. Naval Mine Warfare (NMW) (design)

c. Anti-surface Warfare (ASuW) (design)

d. Anti-submarine Warfare (ASW) (design)

#### Scope and types of activities

*Scope*

The proposal must address challenges at three levels:

LEVEL 1: Digital and environmental transformation

Proposals must facilitate the cross-fertilization between civil and defence sectors and intend to speed up the adoption of novel autonomy and green energy technologies in the naval domain by developing a MSAS that European navies can begin taking into service starting from the end of this decade.

LEVEL 2: Confined littoral operating environment

A littoral force of smaller and many, rather than larger and few, tends to offer greater flexibility in crisis and conflict, which is why a MSAS has advantages in confined littoral operating environment.

LEVEL 3: Modularity and affordability

Mission dedicated naval assets are typically too expensive and unaffordable for small navies to cover sufficiently board range of coastal naval capabilities. To fill the capability gaps, decisive steps need to be taken towards innovative solutions that are more cost-efficient, affordable and lean in terms of manning. This is possible through modularity, automation/autonomy of certain functions, and through design choices that reduce production and life-cycle costs. Where possible, mission module designs should take stock of existing technologies/components rather than designing completely new solutions.

*Types of activities*

The following types of activities are eligible for this topic:

| | **Types of activities**<br>(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 (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) |

In particular, proposals must address:

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

- Studies:
  - o Technical feasibility studies must include, at least, the following aspects:
    - core components (e.g., autonomy including COLREG40 compliant re- routing algorithms);
    - secure communications, and command and control (C2);
    - sensor data and other information management principles (e.g., storage and handling on-board, outside, both);
    - mission modules and their integration with the core platform; cyber security requirements;
    - Safety of Navigation assessment, and certifiability according to national and international laws at sea;
    - logistic and user's package, including emergency procedures.
- Design:
  - o System architecture.
  - o Core platform, including ISR module.
  - o Autonomy package.
  - o Control station (equipment needed for remote/autonomous monitoring/control of MSAS).
  - o Secure communication suit (e.g., internal, seashore, sea-sea).
  - o Mission modules and mission modules integration.
- Prototyping:
  - o Core platform with all key components, including ISR module.
  - o Control station (equipment needed for remote/autonomous monitoring/control of Platform).
- Testing:
  - o Components and system integration.
  - o Trials in harbour and at sea.

## Functional requirements

(1) General

a. Suitable for operating in harsh marine environments with large temperature variations from weather decks to machinery spaces with long mean time between repairs.

b. Capable of at least 2 000 nautical mile and/or 10 days self-sustained operations at 10 knots. Although the speed should be reliant on hull form, the selection of propulsion plant and

propelling system should consider reaching minimum 20 knots at maximum RPM41 configuration.

c. Along with conventional combustion engine, proposals should consider electrical propulsion, Air Independent Propulsion (AIP), other alternative means (e.g., fuel cells) and/or advanced alternate fuels, as well as an optimal management of the integrated propulsion energy system.

d. The MSAS should be deployable, including by means of sealift, and capable of a sustained deployment, operating independently or as integral part of a naval task group.

e. The conceptual approach to the logistic and user's package should consider advanced techniques related to system diagnostics, and capable of making conditional prognoses. Reduction of cost and time in production and in-service support should be taken into account from design.

f. Appropriate measures through its design or other means should be considered to reduce all facets of visual characteristics, electronic emissions and own signature, including the monitoring and reduction of radar, acoustic, infrared and magnetic signatures

g. The system should consider AI42 algorithms for automatic situational awareness, threat identification and behavioural analysis. Without prejudice of the man-in-the- loop condition when required, those AI algorithms should improve decision- making in real-time without the intervention of the control station.

h. A self-defence weapons suit should be considered as part of the core platform. Any specific mission module (e.g., ASuW, ASW) should incorporate specific weapons as required by the concerned mission.

i. The option of standoff operations, cooperating with, or deployed from the MSAS, should be also considered. This could result in making the MSAS a remote- controlled data hub platform comprised of smaller USVs43 and/or UUVs44 and the MSAS operating as a rely-station to extend the operating radius.

(2) Positioning, Guidance, Navigation and Control

a. Alongside the encrypted (military) GNSS45, an alternative positioning system should be considered, in order to provide redundancy and positional reliability in a GNSS denied environment.

b. Continuous generation and updating smooth, feasible and optimal trajectory commands to the control system according to the information provided by the navigation system, assigned missions, vessel capability and environmental conditions.

c. Identification of USV's current and future states (i.e., position, orientation, speed, acceleration) and their surrounding environment based on past and current states of the USV, also environmental information (e.g., winds, currents) obtained from sensors.

d. Control system to determine the proper control forces and moments to be generated, in conjunction with instructions provided by the guidance and navigation system, while satisfying desired control objectives.

(3) Autonomy package

a. Without excluding and fully compatible with a manned operation mode to be used when appropriate, an autonomy package should enable the MSAS to be operated until the Degree 3 in accordance with the 100th session of IMO's46 Maritime Safety Committee (MSC 100): The M-SASV is remotely controlled without seafarers on board. The ship is supervised from another location and controlled and operated when necessary.

b. It should enable the vessel to navigate autonomously, understand its environment, and be able to make decisions and to determine actions by itself for a safe navigation under supervision. Sensors could be added to meet the need for autonomy.

c. In particular, it should allow MSAS to transit out of harbour, follow a mission pattern in a designated area for a designated period.

d. It should enable to control the proper functioning of the equipment, systems and facilities on-board, taking the necessary actions to protect them.

e. Each mission module should consider an unmanned operating mode enabling at least to operate the mission module remotely.

(4) Secure communications suite

MSAS should include a communications suite in order to allow for secure, real-time, automated two-ways connexion between the control station and both the core platform and on-board mission module, to guarantee as required, the proper governance of the vessel and the execution of the mission.

(5) ISR module (sensor suit)

a. MSAS should include a sensor suit equipping the core platform as needed to fulfil an ISR mission. Any other specific mission module could benefit of the outputs of this sensors suite and should complement it as needed.

b. Information gathered by on-board sensors (e.g., radar, EO/IR47) should be transmitted automatically via secure communications, to the control station. It should be possible to filter sensor information sent from the platform to the control station in accordance with pre-set criteria.

c. Capable of successful undertaking of surveillance tasks such as patrol and search. Sensors on-board should be capable of all weather, day/night operations in extreme climate and littoral operating environment.

d. A radar system capable of detecting surface targets with parameters characteristic in coastal areas ranging from Low Observable (LO) to major surface combatant and air targets with parameters ranging from either slow moving or loitering Remotely Piloted Aircraft System (RPAS) to fast moving stealthy combat air targets, should be considered

e. Electronic support measures (ESM) should be considered.

(6) Other specific mission modules

a. Specific mission modules should be standardised to the maximum extent to reduce specific design requirements related to their integration in the MSAS, and to reduce the time of reconfiguration of the mission profile of the MSAS.

b. The NMW module should support as a minimum, naval mining operations. The feasibility of supporting naval mine countermeasures (NMC), mine hunting, minesweeping or both, should be evaluated during the study phase, taking into account ongoing dedicated programmes. The option of standoff NMC operations, deployed from the MSAS, should be also explored.

c. ASuW module should be capable to engage surface targets in such manner that out-of-action effect is achievable against a large defended surface target. The MSAS should become a weapon carrier integrated into a wider C4ISR48 network. The operation of the weapons system should still require a man-in-the-loop for engagement. Engagement of air targets should be limited to self-defence.

d. ASW module should consist of sensors and effectors to detect, locate, classify, track, and

engage as needed, sub-surface targets by using passive and/or active acoustic devices at sufficient range. Innovative acoustic sensors for the detection of submarine and/or incoming torpedoes should be considered. Operation of the weapons system should still require a man-in-the-loop for engagement.

(7) Cyber security

Considering MSAS heavy reliance on software and connectivity, an improved protection against cyber threats should be considered, in particular as regards:

- Navigation and control systems communicating with shore-based or naval task group networks;
- Control systems monitoring the MSAS condition;
- Secure communication systems, gaining access to ship's GNC49 or other systems/subsystems via radio, satellite or wireless means, including the data exchange interface with on-board or shore-based control station;
- Machinery and propulsion systems;
- Launching and recovery systems.

## Expected impact

- A new affordable medium-sized naval vessel class especially suitable for small and medium sized navies, and for larger navies for specific missions, depending on mission module configuration.
- Mission tailorable open architecture concept to facilitate operational versatility.
- Modular design to facilitate support in congested spaces.
- Unmanned naval operations, in particular ISR, with man-in-the-loop and lean manning when needed, ensuring increased crew protection and 24/7 operational mode.
- Reduced environmental footprint.