EUROPEAN DEFENCE AGENCY

OCEAN2020

Open Cooperation for European mAritime awareNess

2018-2021

Technological demonstrator for enchanced situational awareness in a naval environment

OC20-001 20/10/2021

OCEAN2020 has received funding from the European Union's Preparatory Action on Defence Research under grant agreement No 801697

Funded by the European Union's Preparatory Action on Defence Research (PADR) and implemented by the European Defence Agency, the **OCEAN2020** "Open Cooperation for European mAritime awareNess" project represents the ambition and vision of a European maritime initiative, in line with the strategic approach shared by all its participants. Within PADR the OCEAN2020 is the largest of the three projects selected in the 2017 call for proposals, with a funding of 35.480.000 €.

PADR, launched in 2017, is the preparatory action for the broader Research strand of the European Defence Fund launched by the European Commission in 2017. With 90 M€, the three-year program of the PADR aims at assessing and demonstrating the added-value of EU supported defence research and technology (R&T), via several targeted projects. In doing so, it heralds the launch of a framework program to support defence research starting in 2021.

Coordinated by Leonardo, OCEAN2020 brings together 43 partners from 15 European countries for a project duration of 36 months further extended by 7 after COVID-19, and is focused on the development of a "Technological demonstrator for enhanced situational awareness in a naval environment" with the main aim to prove:

- Enhanced situational awareness in a maritime environment through the deployment and integration of Unmanned Systems
- How to meet the challenges in Persistent Wide Area Surveillance and Maritime Interdiction
- How to accomplish a project of substantial complexity in a demanding timescale through EU wide cooperation of End Users, large industries, research institutes and Small/Medium Enterprises.

Nowadays, in an ever changing international security environment, naval forces are permanently engaged in various types of conflicts, including asymmetric and conventional threats. They must control their environment in order to scan, detect and analyse the potential threats as soon as possible, and in order to retain capacity of initiative, freedom of movement and achieve the desired end-effect. In this respect, maritime Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) chain is a critical enabler to the common Recognized Maritime Picture (RMP), for detection, identification, tracking and target acquisition, as well as for strengthening interoperability.

Within this context, OCEAN2020 will pave the way for future EU defence cooperation or initiatives by integrating legacy and new technologies for unmanned systems and ISTAR payloads. Data from multiple sources are exploited into a Recognized Maritime Picture (RMP). The aim is to have a common RMP shared between national Combat Management Systems (CMSs) and form the front line of a future EU Maritime Operation Centre (MOC).

Project Ambitions

OCEAN2020 is expected to have an impact on many areas, based on an innovative approach that ensured the development and implementation of the following:

- improved unmanned capabilities such as detections of small maritime targets from high grazing angles and increased level of integration, addressing UAS taking-off and recovery on Naval Platforms, and also integration of effectors
- deployment of multiple complex unmanned systems
- increased levels of autonomy of single vehicles with reduction of operator loading with workload and enabling over-the-horizon operations with multiple vehicles in squad
- automation in data fusion at the platform, CMS and MOC (Maritime Operation Centre) level with greatly enhanced integration of data from unmanned systems into real systems operated by EU member states navies
- increased interoperability (including interchangeability and multinational squad operations) and enhanced information sharing across systems and national boundaries
- secure architecture offering a common, robust approach to secure a distributed network of systems
- steps towards the creation of an EU MOC.


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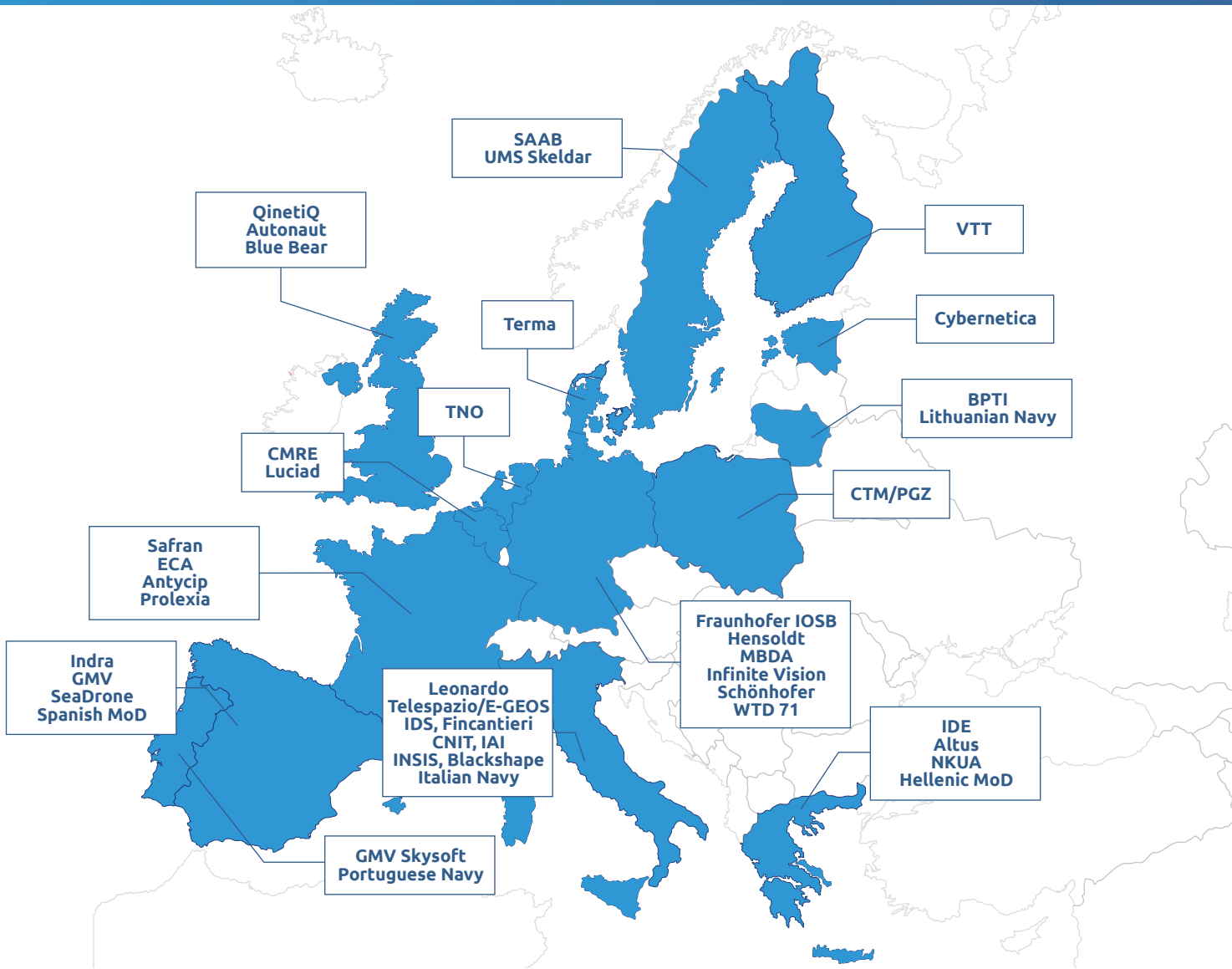
Preparatory Action on Defence Research

PADR-US-2017
Technological demonstrator for enhanced situational awareness in a naval environment

Grant Agreement 801697 - OCEAN2020
"Open Cooperation for European mAritime awareNess"

PPPA-PADR-RA
(Preparatory Action on Defence Research –Research Action)



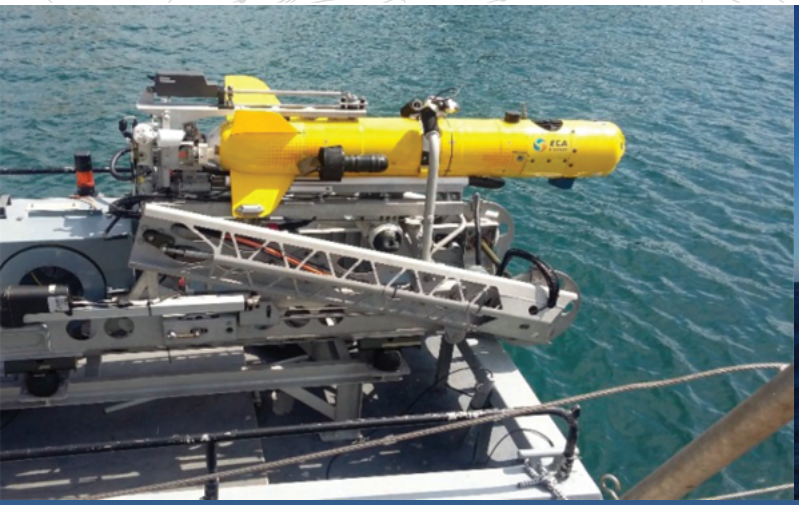
Participants

OCEAN2020 Consortium includes 43 participants from 15 European countries. This European dimension, encompassing larger and smaller Member States, is fundamental to demonstrate the possibility to pursue together future collaboration on defence capabilities and programs in an effective manner.

All participants are involved in the Maritime Defence domain, though to different extents. All partners bring in management and technical excellence, wide operational experience as well as an individual network of relationships with the aim to identify operational needs and scenarios, existing gaps, acceptability issues and societal impacts that the proposed innovations may entail.
As a key success factor, End-Users are involved as full partners providing coordination and expertise on Maritime Defence in order to ensure consistency of data models, scenario-based requirements and use-cases with operational requirements.

The OCEAN2020 partners possess excellence in their respective fields of competence:

- Design and Production:
  - UxS
  - Sensor
  - Combat Management System
  - Maritime Operation Command System
  - Communication System
  - Naval Platform
- Communication and Information System Security
- Space Communication and Sensing
- Maritime Research and Experimentation
- Modelling & Simulation
- Data and Video Processing and Fusion
- Electromagnetic Engineering
- System Integration
- Human Computer Interface.



Project Description

The project included the setting-up of a demonstrator representing the European Union Maritime Operations Centre to demonstrate sharing situational awareness at a European operational and strategic level. The project objectives were pursued by using a specific methodology, based on consolidated and proven systems engineering lifecycle with an accurate and detailed work break down. This approach lead to project activities in five main areas:

Incorporating the user perspective

The project followed standard proven processes and facilitated user involvement during the whole project cycle, from definition to demonstration and assessment. This approach was essential to align the objectives and scope of OCEAN2020 with the EU Members Navies, vision and cover requirement elicitation, validation of potential technologies for future certifications, standardization and procurement strategies. This group of activities relates to the *WP1 Requirements* in the work breakdown.

Building up a common architectural vision through best practices

The system architecture included communications, data definition, processing of information and integration of assets. Special attention was given to interoperability aligning multi-domain standardization efforts with NATO initiatives. Open, modular and scalable system architecture were achieved as a logical consequence of this effort. This group of activities relates to *WP2 Design* and *WP3 Technology Development*.

Removing barriers

Different types of barriers have to be removed for the effective integration of UxSs in tactical naval systems. That implies work on naval systems, platforms, sensors and information fusion functionality. The project put a strong emphasis in operations modelling and simulation to test the overall OCEAN2020 architecture's resilience against environmental, operational, technical and functional obstacles. The optimization of the systems usability and the training processes were also addressed, analysing operator tasks and operator training needs, and designing prototypes of future operator interfaces and effective training tools. This group of activities relates to *WP3 Technology Development*, *WP4 Integration* and *WP5 Human Factor* in the Project Implementation.

Integration and evaluation trials

The project activities included platform and ship integration, adaptation of legacy assets to the system architecture and participating countries MOC. Simulated and live demonstration trials, in the Mediterranean and the Baltic Seas, were carried out. The live demonstrations showed integration of close-to-market existing platforms and integration of data from multiple sources. The simulated trials demonstrated technology improvement, de-risk live trials and address specific aspects that cannot be covered in live trials (e.g. contested environment, meteorological conditions). This group of activities relates to *WP3 Technology Development* and *WP4 Integration* in the Project Implementation.

Impact Assessment

The project results were translated into recommendations for technology exploitation and procurement. Dissemination and exploitation of project results will lead to improvements in the competitiveness and innovation of the European defence industry and stimulate cooperation amongst actors in all Member States. Specific focus was put on UxS standardization and integration. This group of activities relates to *WP6 Impact Assessment* in the Project Implementation.

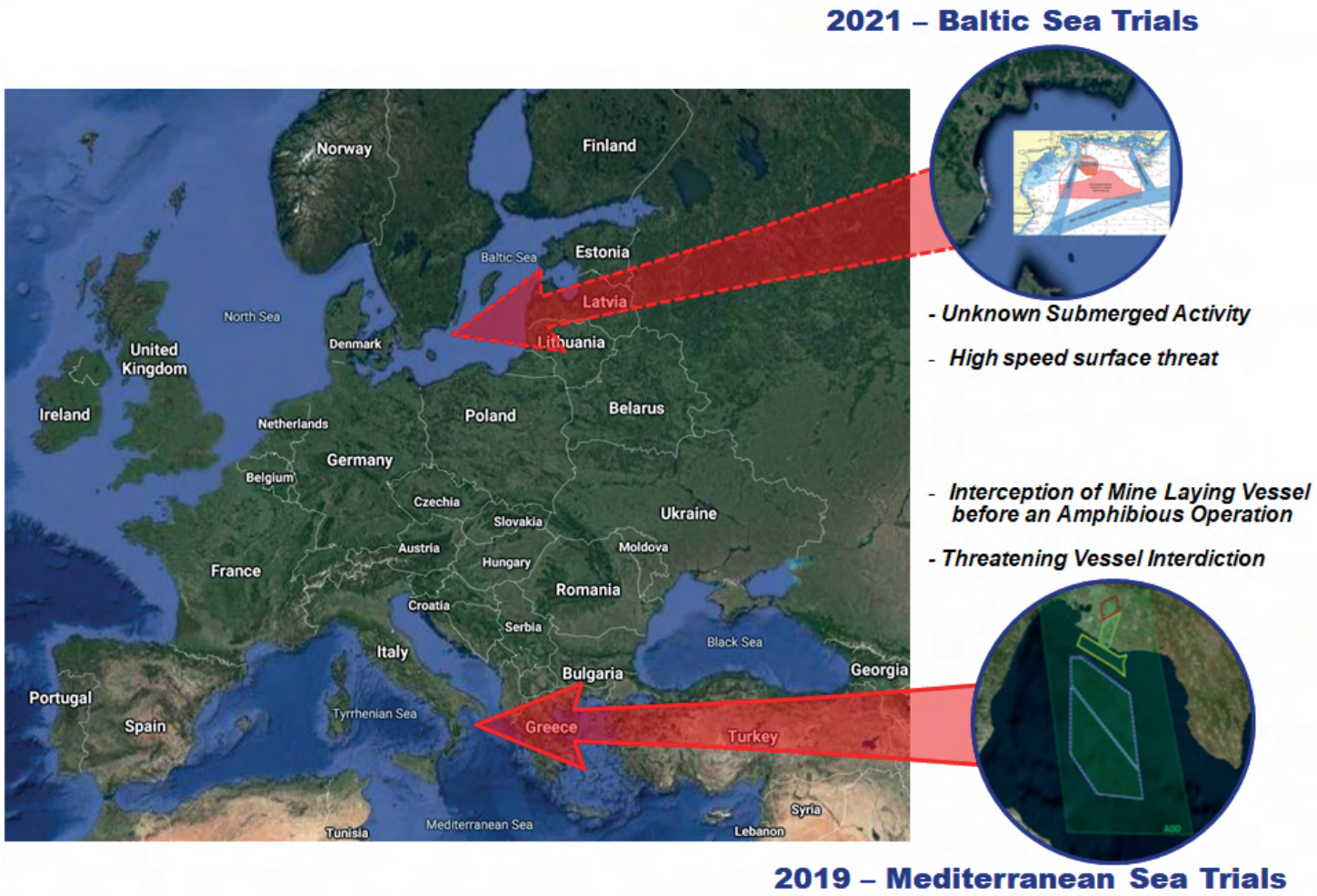
Sea Demonstrations

Two live demonstration trials were planned in the Mediterranean and in the Baltic Seas. Both of them contributed to achieving a common single picture in the EU-MOC and were conducted in conjunction with national operational exercises deploying existing military platforms.

The first demonstration was carried out in November 2019 in conjunction with an international exercise (Mare Aperto) hosted by the Italian Navy and taking place in the Gulf of Taranto.

The second sea demonstration was carried out in August 2021 in Hano Bight, Baltic Sea.

OCEAN2020
SEA DEMONSTRATIONS



The first sea demonstration Mediterranean Sea, Gulf of Taranto

The first sea demonstration was successfully launched on the 20 and 21 November 2019 in the Gulf of Taranto, Italy. The OCEAN2020 Live Sea Demonstration involved a total of:

Nine unmanned assets

AWHERO

BK180-ISP

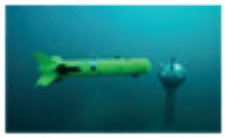
PELICANO

SW-4 SOLO

INSPECTOR

SEARIDER

SEAD-23



SEASCAN

A9

Five naval units

FASAN (IT)

LIMNOS (GR)

MARTINENGO (IT)

SANTA MARIA (ES)

VAR (FR)

Morever, Demo established five naval command stations: EU, Italian, Spanish, Portuguese and Greek. All units were supported by five satellite systems: COSMO SkyMed, ATHENA FIDUS, HELLAS, SYRACUSE and INMARSAT for the demanded communication network and surveillance activities.

The sea excercise was focused on two scenarios:

- Threatening Vessel Interdiction
- Interception of a Mine Laying Vessel before an Amphibious Operation

The first sea demonstration Mediterranean Sea, Gulf of Taranto

Scenario 1

Combined maritime surveillance and interdiction using unmanned vehicles against a threatening vessel.

Videos and tracks generated by all unmanned systems, thanks to the advanced communication infrastructure, were visualized in real time at the MOCs. What was more, there were also presented onboard the different ships of the Task Group (not only the ship controlling each system).

Scenario 1 was executed in the following phases:

- **Phase 0** - Scenario preparation / Persistent Surveillance.
- **Phase 1** - Alert for anomaly detection.
- **Phase 2** - Resource tasking and area search.
- **Phase 3** - Localisation, classification and identification.
- **Phase 4** - Surface engagement (simulated).
- **Phase 5** - UW localisation of the threat remains.

During the operation, the frigates were tasked to provide visual tracking with their USVs and UAVs deployed in different areas.

Videos and tracks generated by all unmanned systems, thanks to the advanced communication infrastructure, were visualized in real time at the MOCs. What was more, there were also presented onboard the different ships of the Task Group (not only the ship controlling each system).

The first sea demonstration Mediterranean Sea, Gulf of Taranto

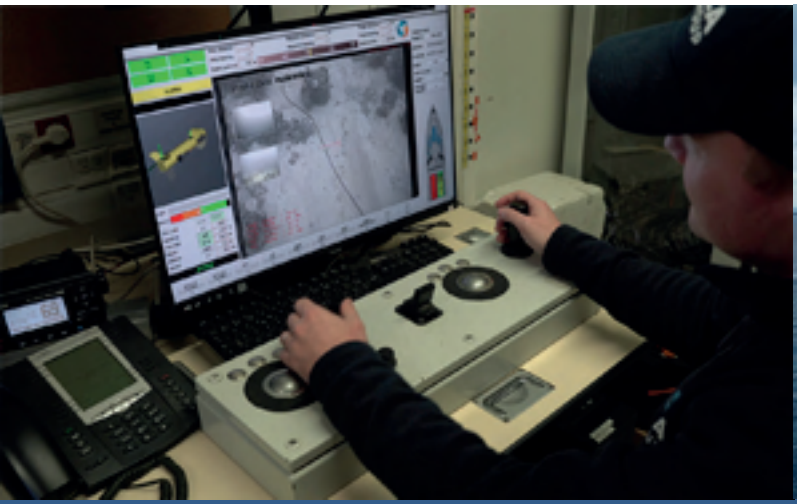
Scenario 2

involved covert and overt tracking of a suspect vessel using unmanned vehicles: UAV to support a boarding action, and UUV to search and localize mines on the seabed.

The ongoing situation was presented on the maps, based on information from different sensors and optical satellite images. It was combined with simulated intelligence data, indicated the presence of a suspect Fishing Vessel (FV), in a nearby port (controlled by an unfriendly faction) believed to be a disguised mine-laying vessel.

Scenario 2 was executed in the following phases:

- **Phase 0** - Scenario preparation / Intelligence received.
- **Phase 1** - Suspect vessel leaves the harbour and is detected by USV and UAV.
- **Phase 2** - Covert localisation and tracking with UAV.
- **Phase 3** - Mines are released by the vessel.
- **Phase 4** - Boarding with UAV support.
- **Phase 5** - Mines localisation and identification with UUV.



The first sea demonstration Mediterranean Sea, Gulf of Taranto

During the exercise, the demonstrator of an **EU Maritime Operations Centre** (EU MOC) was developed. This prototype was connected to the operations in the Mediterranean Sea involving naval assets and national MOCs. Prototype allowed to test how the EU MOC received live data from the participating unmanned systems and integrated them into an operational picture to enhance situational awareness.

Scenarios presented on the exercise enabled the demonstration of:

- launch and recovery of UxS from vessels including automatic take-off and recovery of Remotely Piloted Aircraft Systems (RPAS)
- integration of EO, Radar and AIS payload to collect and provide multi-source data and video streaming
- use of satellite data for augmenting the
- situation awareness
- manned-unmanned teaming
- integration between Unmanned Systems and naval CMS (Combat Management System)
- link chain of information flowing to national MOCs and EU-MOC Prototype

The second sea demonstration Baltic Sea, Hano Bight

The second sea demonstration was successfully launched on the 25 and 26 August 2021 in the Hano Bight, Sweden. The OCEAN2020 Live Sea Demonstration involved a total of:

Twelve unmanned assets


SW-4 SOLO


PATROLLER


COBRA


WATER STRIDER


ENFORCER III


PIRAYA


SEA RAIDER


DEDAVE


BIONDO


GAVIA


SEA WASP


OCEANSCAN

Four naval units


ORP CZAJKA


PELIKANEN


P11 ZEMAJTIS


R/V PLANET

Morever, the demo established two naval command stations: the Commander Task Group (CTG) at tactical level and the EU-MOC (Maritime Operation Centre) prototype at operational level. All units were supported by COSMO SkyMed satellite systems and one manned aircraft equipped with new generation airborne radar.

The sea excercise was focused on two scenarios:

- High Speed Surface Threat
- Unknown Submerged Activity

The second sea demonstration Baltic Sea, Hano Bight

Scenario 3

High Speed Surface Threat

Scenario 3 combined surveillance, identification and engagement of multiple high speed unmanned surface threats.

Scenario 1 was executed in the following phases:

- **Phase 0** - Scenario preparation / Persistent Surveillance.
- **Phase 1** - Alert for anomaly detection.
- **Phase 2** - Resource Tasking and Area Search.
- **Phase 3** - Localisation, Classification and Identification.
- **Phase 4** - Engagement (simulated).
- **Phase 5** - Damage assessment of underwater wrecks.

Videos and tracks of detected high speed surface threat generated by all unmanned systems and satellite assets, thanks to the advanced communication infrastructure, were visualized in real time at the EU MOC and CTG. Contacts were localised, classified identified and finally “neutralized” (simulation). Underwater search of sunken ships in one location was also presented.

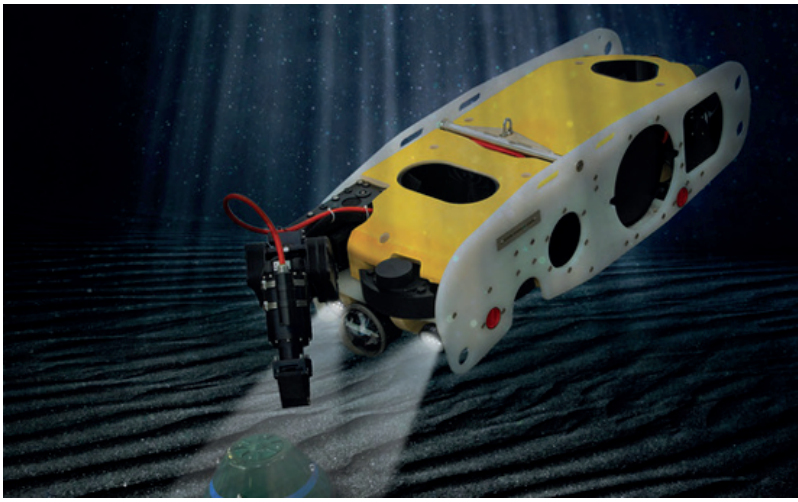
The second sea demonstration Baltic Sea, Hano Bight

Scenario 4

Unknown Submerged Activity

The focus of the Scenarios 4 was to detect and identify underwater threats, e.g. hostile submarine and layed mines

The ongoing situation was presented on the maps, based on information from different aerial, surface and underwater sensors under command of CTG. It was combined with sonar search for mines, indicated the presence of a suspect submarine believed to performe mine-laying activity.



Scenario 4 was executed in the following phases:

- **Phase 0** - Scenario preparation / Intelligence received.
- **Phase 1** - (scenario start) - Suspect submarine detected .
- **Phase 2** - Resource Tasking and Area Search.
- **Phase 3** - Localisation, Classification and Identification.
- **Phase 4** - Neutralization (simulated destruction of a detected mine).

The second sea demonstration Baltic Sea, Hano Bight

OCEAN2020 has successfully completed the execution of the second sea demonstration, with the participation of European companies, research institutes and defence ministries from 10 different EU Countries. The sea demonstration showed how the information collected from the assets deployed in the area of operations can be integrated to create a **Recognised Maritime Picture (RMP)**.

The demonstration enabled the achievement of the following objectives:

- Launch and recovery of unmanned surface systems from vessel
- Launch and recovery of an underwater remotely operated vehicle from an unmanned surface system
- Maritime patrolling, surveillance and identification by unmanned aerial systems
- Unmanned Systems autonomy
- Collaborative autonomy within a squad of underwater vehicles
- Integration between unmanned systems and naval Combat Management Systems (CMSs)
- Fusion and display of information from UxS by CMS and transmission to the EU Maritime Operation Centre (EU- MOC)
- Use of satellite assets to collect and provide data for augmenting situational awareness
- Integration of information at the EU-MOC including UxS video analysis for automatic detection and classification of surface targets.

Potential of Unmanned Systems

The demonstrations included the use of heterogeneous groups of unmanned vehicles, equipped with different types of sensors. The reason for the inclusion of many unmanned systems was to demonstrate the integration of different capabilities and the interoperability of a wide range of unmanned systems in joint military operations. Different sensor configurations were integrated to show the flexibility of the unmanned platforms in operational missions.

UAS
Unmanned Aerial Systems

AWHERO - LEONARDO

PATROLLER - SAFRAN

PELICANO - INDRA

SW-4 SOLO LEONARDO

BK 180-ISP - BLACKSHAPE

COBRA - BLUE BEAR

SKELDAR - UMS Skeldar

USS
Unmanned Surface Systems

SEARIDER - IDE

SEAD 23 - SEADRONE

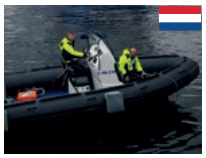
PIRAYA - SAAB

WATER STRIDER - Fraunhofer IOSB

INSPECTOR MKII - ECA

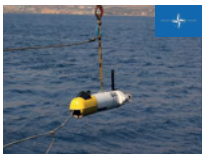
AUTONAUT - AutoNaut

ENFORCER III - SAAB



SEA RAIDER - TNO

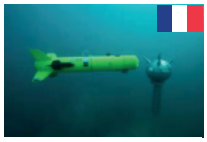
UUS
Unmanned Underwater Systems



BIONDO - CMRE

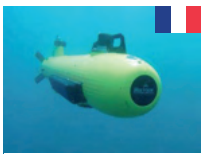
SEA WASP - SAAB

DE DAVE - Fraunhofer IOSB



SEASCAN - ECA

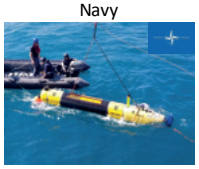
OCEANSCAN - TNO



A9 - ECA

WAVEGLIDER - CMRE

GAVIA - Portuguese Navy



MUSCLE - CMRE

The unmanned systems presented in the project consist of:

- Vehicle / unmanned vehicles
- Control of the unmanned system responsible for the implementation of the elements of planning, control and supervision of the vehicle during the mission, exchange of data from sensors located on their deck and, if necessary, remote control of the vehicle
- System components providing access to extensive communications, including data and control capabilities.

The current state of technology, process automation, miniaturization and the possibility of using the features of artificial intelligence or machine learning, create incomparably greater possibilities of using unmanned systems. The results could orient the evolution based on set of drones model, performing the tasks at the same time in an independent manner according to different levels of complexity. In the long term, combined with the development of functions and capabilities of the unmanned vehicles themselves, it will be possible to create complex hybrid systems capable of carrying out tasks in a diverse environment.

Expected Impacts

Due to the broad focus of the project, the expected impacts include:

- convincing demonstration of the potential EU-funded research for defence applications
- development of the European industrial capability in the market segment of unmanned systems for defence capabilities
- reliable operation of the proposed solutions in various, complex and extreme maritime environments
- substantial gains towards autonomous and safe operation of UxS from navy ships offering suitable potential in terms of payload capacity, range and handling quality for operations under adverse conditions
- enhancement of maritime situational awareness, through command and control capability, secured data exchange and real time/near real time transmission of information
- extended capabilities of a vessel platform, fully integrated with the vessel mission systems (CMS and sensors)
- improved interoperability with existing, multilateral EU defence systems and infrastructures, naval platforms and mission systems
- improved interoperability between manned and unmanned systems
- informing the shape of future military structures in view of the use of advanced unmanned systems
- improving innovation capacity and the integration of new knowledge
- strengthening the competitiveness and growth of companies
- improved efficiency and cost-effectiveness.

Social and Environmental Background

Technologies demonstrated in OCEAN2020 will improve maritime awareness and response. In particular Persistent Wide Area Surveillance is functional to missions carried out both in warfare scenarios and in operations against threats (terrorism, drug trafficking, acts of piracy, illegal transport of migrants, etc.), defending sovereignty and sovereign rights at sea.

Participation in OCEAN2020 for organizations, project teams or even single specialists increased skills and competencies on specific areas of activities. Their participation to project events, such as technical workshops, training courses, consortium meetings, also benefitted the project realization.

Improvement of ISTAR capabilities derived from OCEAN2020 will increase protection of EU citizens, maritime border security, search and rescue operations and military capacity to operate in critical areas, increasing the deterring power of Europe against external threats. By contributing to reduce the level of EU technological dependency from third parties on key military capabilities, the project supports an enhanced European strategic autonomy.

Calendar

2019
November
Mediterranean Sea Demonstration

2021
August
Baltic Sea Demonstration

Contact

Fiorella Lamberti
Communication Manager

fiorella.lamberti@leonardocompany.com

Antonino Arecchi
Project Coordinator

antonino.arecchi@leonardocompany.com

Coordinator **Leonardo S.p.A.**

43 Participants - **15** countries

Project duration **2018 - 2021**

Total budget **35 480 000 €**