REP16-Atlantic exercise: the perfect international collaboration lab for cutting edge autonomous solutions

From 5 to 31 July 2016, off the coast of Portugal, the Portuguese Navy, the NATO Centre for Maritime Research and Experimentation and the University of Porto operate again together in the maritime exercise which also marks the first international at-sea campaign for NRV Alliance under the Italian Flag.

Several different Autonomous Surface Vessels (ASVs), Autonomous Underwater Vehicles (AUVs) and Unmanned Aerial Vehicles (UAVs), equipped with different sensors and acoustic payloads, are being used together in the seventh annual edition of REP16-Atlantic exercise, a joint exercise of the Portuguese Navy, the NATO Centre for Maritime Research and Experimentation (CMRE), and the University of Porto.

REP16-Atlantic stands for Recognized Environmental Picture (REP) Atlantic 2016 and it is being conducted from 5 to 31 July in the Atlantic Ocean, off the coast of Portugal, south of Sesimbra and Setubal. It also involves participants from the Belgian Navy, Oceanscan (Portugal), as well as observers from Naval Undersea Warfare Center (USA), NASA (USA), and European Project H2020 JPI Oceans.

For the third time in a row, the nexus of autonomous solutions is at sea to demonstrate robotic capabilities in mine countermeasures, expeditionary hydrography, search and rescue, maritime law enforcement operational scenarios, and Rapid Environmental Assessment. This will also include the demonstration of a solution regarding the operational use of SeaCon Class AUVs in combination with the Portuguese "Tridente" Class Submarines.

REP16-Atlantic aims at assessing how significantly multi-domain cooperative robotics could improve current capabilities of Navies at sea. To this end, robots are being deployed from the Portuguese navy ships NRP Escorpião, NRP Pégaso, NRP Andrómeda, NRP D. Carlos I, submarine NRP Arpão, in addition to the NATO Research Vessel Alliance.

CMRE scientists on board the NATO ship, in particular, are testing collaborative autonomous behaviours of underwater vehicles for ASW applications, while also testing the performance of network-based solutions for vehicle localization and navigation. For underwater acoustic communications, networking and equipment capabilities are being tested, including Wave Gliders used as autonomous gateways. The exercise includes an assessment of the capabilities of JANUS, an underwater digital communication protocol, developed at CMRE, which is in the process of becoming a NATO standard and is currently being promoted in the maritime industry.

Through REP16-Atlantic, all the partners will enable collaborative research to increase interoperability and underwater communications capabilities, automation and cooperation of unmanned underwater, surface and aerial vehicles.

REP16-Atlantic also marks the first international research campaign of the NATO Research Vessel Alliance after the new flag agreement with the Italian Navy.

The REP16-Atlantic features and objectives have been presented on 18 July in Lisbon (Portugal), in the presence of Rear Admiral Matthew A. Zirkle (U.S. Navy), Deputy Chief of Staff Submarines – COMSUBNATO, Ana Paula Vitorino, Minister of the Sea of Portugal, Marcos Perestrello, Secretary of State for Defence, General Artur Neves Pina Monteiro, Chief of Defence of Portugal.

The Research, Development and Innovation (RD & I) Department in the **Portuguese Navy** aims to develop a framework of partnerships with industry, universities, science and technology institutions to enhance industrial and technical solutions in order to support its mission.

The **NATO STO CMRE** (Centre for Maritime Research and Experimentation) is an executive body of the NATO Science and Technology Organization. Located in La Spezia, Italy, the Centre focuses on research, innovation and technology in areas such as anti-submarine warfare, underwater communications and networking, mine countermeasures systems, maritime security, modelling and simulation, development of the common operational picture, maritime component of expeditionary operations, and marine mammal risk mitigation.

The **University of Porto** participates in this exercise through the Laboratório de Sistemas e Tecnologias Subaquáticas, installed in Faculty of Engineering of University of Porto. The Laboratório de Sistemas e Tecnologias Subaquáticas designs, builds and operates unmanned underwater, surface and air vehicle systems for networked operations, whose applications include oceanography, biology, security, defense and environmental surveys. The LSTS successfully tested unmanned air, surface and underwater vehicles in innovative operations in the Atlantic and Pacific oceans, as well as in the Mediterranean Sea. The LSTS has been organizing, in cooperation with the Portuguese Navy, the Recognized Environmental Picture (REP) annual exercise since 2010.

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