FEUP LSTS
NEW CONCEPTS OF OPERATION

The Laboratory of Underwater Systems and Technology is developing a new concept for AUV operations in remote areas. Pg.21

AQUACULTURE THE NEXT

Worldwide aquaculture production equalled in 2015, but stronger growth is needed a off-shore aquculture is the way. Pg.2

EUROMARITIME 2017 SPECIAL EDITION · DIRECTOR GONÇALO MAGALHÃES COLLAÇO

JORNAL DA Economia DO Mar

BIOTECHNOLOGY
BLUEBIO ALLIANCE

The future of the world lies in biotechnology development and the Bluebio Alliance is working for it. Pg.16

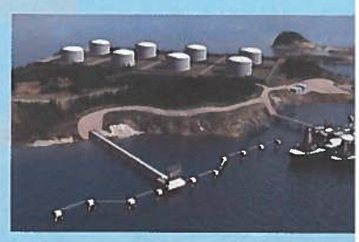
HYDROGEN PROPULSION

THE SOLUTION TO ACHIEVE ZERO CO2 EMISSIONS

Hydrogen is the solution to achieve zero CO2 emissions. However, it is still too expensive to produce and, in the meantime, LNG and electric-diesel solutions seem to be way to meet the standards for the shipping industry. Pg.03

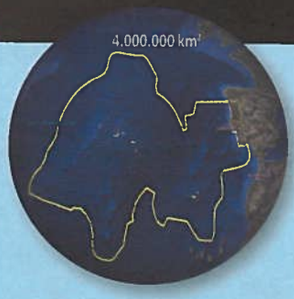
MAR A SUCCESS STOR

Madeira's international shipping reg a total of 453 registrations, is alread the best international shipping regist European Union. A success story. Pg.



LNG A TECHNICAL CHALLENGE

The LNG industry is a relatively youn and the storage of natural gas, mostl in liquid form, creates a tremendous challenge. Pg.29



INVESTING IN PORTUGAL A QUICK GUIDE

PORTUGAL IS MOVING AGAIN TO THE SEA AND THERE ARE LOT OF OPPORTUNITIES FOR INVESTMENT. Biotechnology, aquaculture, renewable off-shore energies are some of the sectors experiencing rapid expansion and here is a quick guide for potential investors. Pág.34

SHIPPING
CHOPPY WATERS AHEAD

Technology is changing globaliza and the new globalization will comple change the shipping industry. Auto tion, Robotics, 3D Printing are leadin to the verge of a new era. Pág.38

FEUP STRENGTHENS COOPERATION WITH NORWAY

Communications System in Remote Ocean Areas

The Faculty of Engineering of the University of Porto (FEUP) hosted on 17 November the Norwegian Ambassador, Anders Erdal, who traveled to Porto with his entourage on the occasion of the Business2Sea event

During the meeting, FEUP's Laboratory of Underwater Systems and Technology (LSTS) had the opportunity to present the work carried out in the area of autonomous vehicles and present the results already achieved at the level of the Networked Ocean (NetOcean) project, funded by EEA Grants.

This visit comes at a time of strong interactions with Norway, maintained by FEUP's LSTS within NetOcean, with particular emphasis on maritime operations on the Norwegian coast during the first two weeks of September. The objective was to demonstrate the system developed by the project partners: LSTS-FEUP, Naval Research Center and Portuguese Institute of the Sea and Atmosphere. "It is a system composed of a network of autonomous vehicles and is designed to ensure the communication and persistent collection of data in remote areas," explains João Sousa, FEUP professor and researcher responsible for the project.

In addition, the Norwegian Center for Autonomous Marine Operations and Systems (NTNU-AMOS), KTH Royal Institute of Technology (KTH) and Maritime Robotics AS (MR), together with the Norwegian Defense Research Establishment - Division for Air and Space Systems (FFI), have collaborated closely on the results of the project.

According to João Sousa, "The current Networked Ocean partnership is not new. However, the project has fostered a shared vision among the partners for a sustainable and persistent presence in the oceans that could meet the challenges posed by their national authorities. " The main results of the project include the acquisition of capabilities and know-how for sustainable and cost-effective operations in the Atlantic and Arctic oceans and the established cooperation model, which allows accelerating the application of new developments to environments Complex actions.

NEW CONCEPTS OF OPERATION

The great advantage of the NetOcean system is that its elements, when subdivided and analyzed by relative proximity, form local observatories with distributed autonomy capabilities, to which vehicles can join or leave. These local observatories have the same operational capabilities as the NetOcean network as a whole and can operate independently in the event of an unexpected break with the overall network.

Indeed, this system can be launched in a remote sea area and adjust its parameters in a deliberative way, as operational elements and / or objectives change in the course of the process. This is key to optimizing the use of available resources.

In addition, system parameters specify how remote components communicate and collect data, since both functions are strategically linked. "For example, AUVs will periodically synchronize to the surface with other intervening elements," explains Sérgio Ferreira, researcher of the project, "in order to take advantage of the payload of long distance communications that exists specifically on board these elements." However, low-bandwidth underwater communications between AUVs and the remaining elements are also used if the latency of the transmitted information is not a prerequisite.

FIELD EXERCISES

NetOcean operational tests have been divided between Portuguese and Norwegian national territory. Among the various exercises, the degree of difficulty and complexity was gradually increased, in order to evaluate the different elements of the system, as well as its synergy with the rest of the emerging communications network.

Preliminary testing took place in April in Norway, where it was possible to verify the operation of the first long-range radio integrations in NTNU-AMOS UAVs. This step allowed for initial flights and communication between the different nodes, about 5 km away from the central operations station.

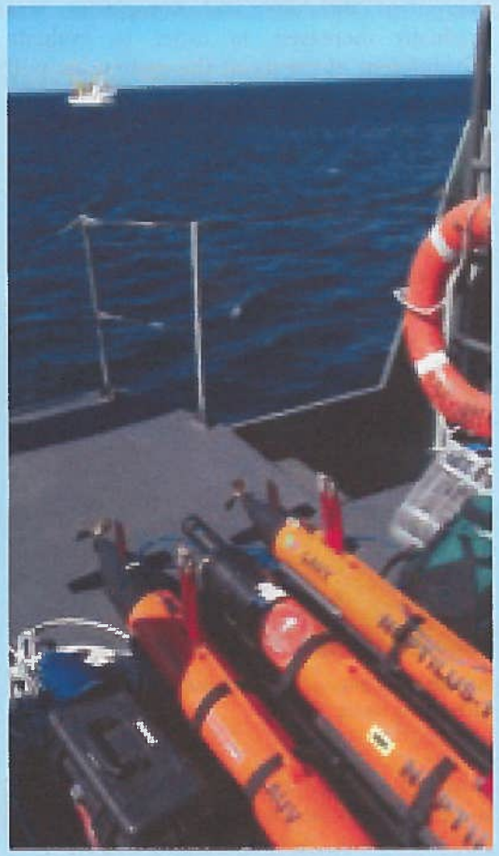
NTNU-AMOS UAVs, prepared with MBR radios, about to perform test flights

All the management was centralized aboard the ship Gunnerus, which served as the main hub for the actions and merging of data from the various autonomous vehicles, which were part of the exercise.

Research vessel R / V Gunnerus belonging to NTNU-AMOS

In July, the theater of operations was implemented in Portugal during the REP16 - Atlantic - exercise co-organized by the Portuguese Navy and LSTS-FEUP, in partnership with the NATO Center for Maritime Research and Experimentation (CEMR). The REP16 - Atlantic was attended

by several national and foreign institutions, notably the Belgian Navy, SPAWAR (USA) and OCEANSCAN and TELEDYNE companies, as well as observers from the Naval Undersea Warfare Center (USA). US Navy, NASA-AMES (USA), GEOMAR (GER) and JPI Oceans. In this context, tests were carried out on the software implementations, designed in the operational toolchain of the vehicles.

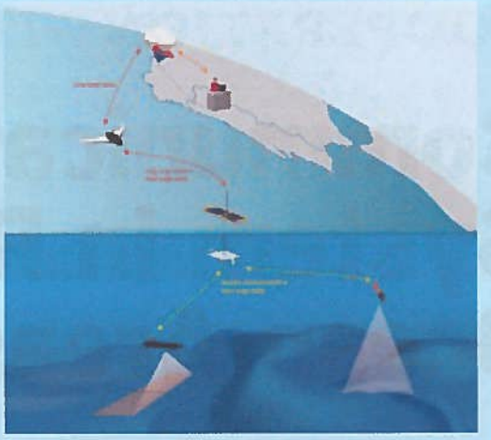


Joint operations between autonomous and manned vehicles during REP16 - Atlantic

Finally, the activities returned in September to Norway, and were divided into several operating areas: Slettvika, Brekstad and Trondheim. Over two weeks, the focus was to consolidate the software developed and ensure its application in the most realistic environment possible. In this sense, multidisciplinary exercises have been designed to put into practice the different aspects of NetOcean and ensure their evaluation on long-range communication issues, but also the ability to collect / disseminate and use data within the same network.

During the first week, the tests were performed on an individual basis, with incremental evaluation of the capabilities of the software toolchain, with bathymetric shore survey exercises and interaction exercises with 3G / 4G telecommunications network.

NETWORKED OCEAN SYSTEM



The system consists of autonomous surface (ASV) and long-range unmanned aerial (UAV) vehicles, long-range underwater autonomous vehicles (AUV), communication gateways, helikites and control stations. The objective is to create a network of persistent data collection (environmental, maritime traffic, biological, etc.) and at the same time provide a communications network operating autonomously in remote ocean areas.

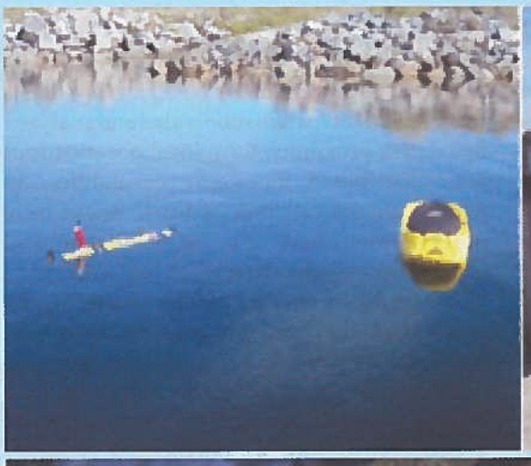
The robustness of the communication services of this autonomous network is that all of its nodes support data routing protocols for direct communication (through UAV persistent relays), and for communications tolerant to data transfer delays (using UAVs or other elements as data mules). In addition, the entire system supports interoperability protocols, allowing for expansion to third-party vehicles.

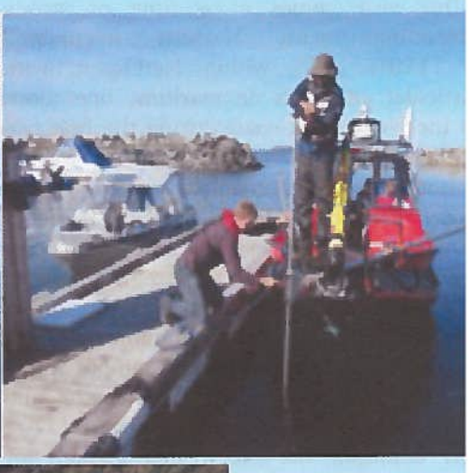
In order to minimize the involvement of human operators, vehicles also have deliberative planning capabilities for stand-alone operations in remote locations.

At the same time, autonomous KTH vehicles, as well as MR surface vehicles, were converted to autonomous operation.

With all the elements in place, the second week started with a simulacrum of tracking of marine animals, through acoustic positioning.

In the end, the success of the operatio corroborated the system's ability to maintain robust communications network and confirm its effectiveness in the simultaneous a coordinated operation of several autonomo vehicles in a remote environment.





AUV "Explorer-1" from FEUP-LSTS together with KV's "Anka" ASV (left). ASV converted MR's "Telemetron" with autonomous AUV launch device (right)

General map of NetOce operating zones during September 2016