Crimson Publishers
Wings to the Research

Mini Review

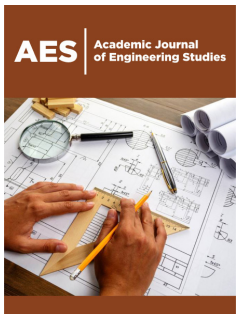
Underwater Mine Detection Using Autonomous Underwater Vehicle

Nedelcu AT[1]*, Faităr C[2] and Buzbuchi N[2]

[1]Mircea celBatran Naval Academy, Faculty of Navigation and Naval Transport, Romania

[2]Maritime University of Constanta, Faculty of Naval Electromechanics, Romania

ISSN: 2694-4421



Abstract

Nowadays, the freedom of movement regarding people and goods represent one of the fundamental values of the European Union. Safety and security is a prior condition regarding the development of the maritime transportation system, offshore industry and prosperity for coastal states.In this paper are presented a symbolic pattern analysis regarding the research methods and sides can sonar images from underwater vehicle for detection of different objects in the underwater environment. Using the underwater vehicles, the mission time is substantially reduced. Immediately after scanning the seabed in the intended area, the underwater contacts observed on the scan will be analyzed and interpreted, then, after confirmation that one of these contacts is a sea mine, mission-specific procedures will be implemented.

Keywords: Underwater Vehicle; Diver; Mines

***Corresponding author:** Nedelcu AT, Mircea celBatran Naval Academy, Faculty of Navigation and Naval Transport, Romania

Submission: September 09, 2020

Published: November 24, 2020

Volume 1 - Issue 4

How to cite this article: Nedelcu AT, Faităr C, Buzbuchi N. Underwater Mine Detection Using Autonomous Underwater Vehicle. Academic J Eng Stud. 1(4). AES.000519. 2020.
DOI: 10.31031/AES.2020.1.000519

Introduction

In the Black Sea, our country has a shore with a length of over 200km and a continental shelf with an area of over 20,000km^2 under investigation for the capitalization of biological and mineral resources. Carrying out research to establish the existence and possibilities of capitalizing on these resources requires solving the problems of human sinking underwater at great depths, for a long time and creating means for underwater work, aspects that are the subject of the research subprogram launched in Romania by:

A. Romanian Institute of Marine Research;

B. Diving Center;

Mine Hunting

Mine hunting involves the complex action of combat divers equipped with equipment and technical tools that allow the search, discovery and classification of anchored mines and improvised explosive devices [1]. The equipment we refer includes optical and hydroacoustic detection means based on the use of divers, aviation and helicopters, remote or autonomous control vehicles equipped with TV cameras. Hydro chargers with bow ship action can be mounted either on the keel or towed to different depths and have the following characteristics:

A. Have two operating frequencies, one for detection and another for cataloging;

B. The detection distance (A) is determined by the wavelength of the hydro locator and the selected search profile. The search profiles are designed to hydro-acoustically probe the seabed and/or the volume of water and are made by automatically moving the transducer on the azimuth, which represents the central direction on which the ship is moving;

C. The probability of detection (B) of mines and improvised explosive devices is dependent on the environmental conditions, being necessary to define it exactly and also the influence of its components on the mine hunting.

Based on these two elements, is determinate the width (D) of the pass on which the search is performed with the hydro locator, taking into account: The values A and B, the desired percentage of demining and the value of the navigation error. Side-looking hydro locators are usually included (mounted) in remote-controlled vehicles and move above sea level at a constant height [2]. Trailed side-scan sonar allows general and detailed surveillance, but accurate analysis is only possible if the geographical position of the seller and the towed vehicle is known precisely.

Underwater Vehicles

The danger represented by marine mines and Improvised Explosive Devices (IEDs) inside port aquariums is increasingly considered a new type of threat to modern fleets.

To counter this type of threat, two systems are implemented, namely:

1. A surveillance and research system in the area of interest with the help of TV cameras and hydro location located on a telerobotic vehicle (R.O.V.), for the investigation of shallow and very dirty waters from the port aquariums;
2. A system equipped with TV cameras installed on an R.O.V. intended to investigate the living work of ships in port.

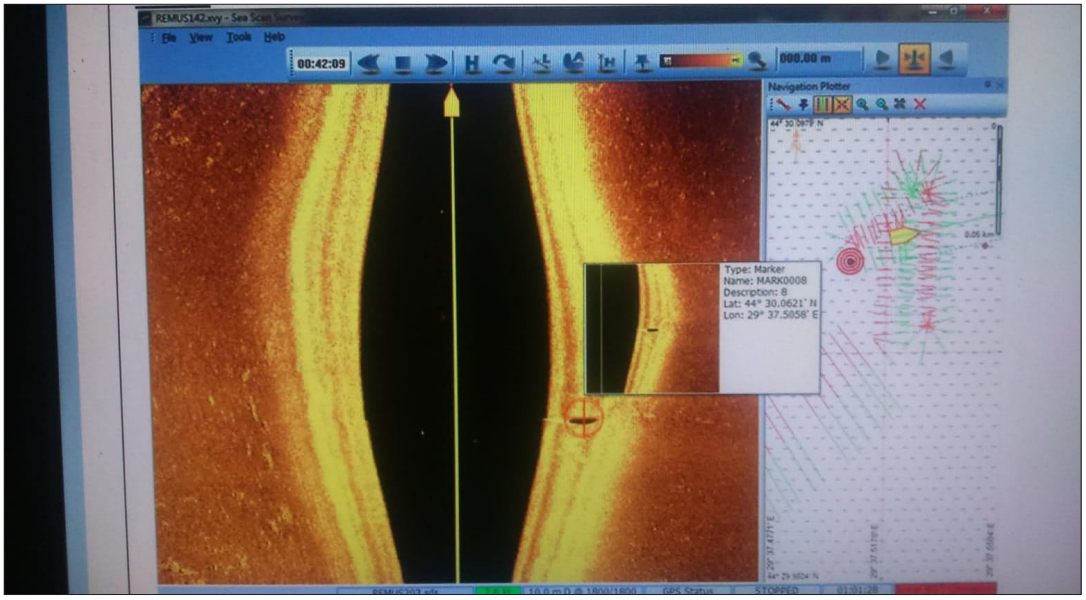


Figure 1: Underwater contact detected using autonomous underwater vehicle-imagine collected by naval divers.

The existence or threat of marine mines and improvised explosive devices can be well highlighted by scanning the seabed with high-resolution sonar where mines launched on the bottom appear on the AUV scan as extensive light spots accompanied by acoustic shadows (Figure 1). If the structure of the echo / shadow type is analyzed by the eye of a specialist in the field, he can confirm the existence of the mine or even its type [3]. Regarding this, in general, in the situation of receiving a search mission, and neutralization of marine mines by EOD divers, the area of interest is operated with the help of AUVs. The use of AUVs in marine mine search actions substantially reduces mission time. Immediately after scanning the seabed in the intended area, the underwater contacts observed on the scan will be analyzed and interpreted, then, after confirmation that one of these contacts is a sea mine, the procedures for neutralizing or destroying the mine will be implemented

In usually shallow aquariums, sonar platforms are limited in maneuver, which means that research can only be carried out with portable sonar by divers in small boats such as bombers. In turn, telerobotic vehicles of the R.O.V. or autonomous underwater vehicles (AUVs) are considered to be some of the most suitable platforms, as they remove the danger posed by the approach of the boat or the diver to the mine and, due to its robustness, can easily carry a target destruction system. discovered, either by destruction or by explosive charges planted near sea mines [4,5]. The Figure 2 shows the monitor of the mission bakery console with autonomous underwater vehicle. Autonomous underwater vehicle with side scanning, autonomous with the help of which divers scan the seabed in order to search and identify underwater objects. A scan for a mission is displayed on the monitor. This scan remains recorded in the database and can then be downloaded to your laptop or wireless system. A contact is displayed on the scan, as well as the contact coordinates. After viewing the recording, divers perform dives to confirm contact [6,7]. For example, in this case, a pit is discovered on the seabed: the black part of the image represents the shadow of the object in the water. The larger the shadow, the larger the object.

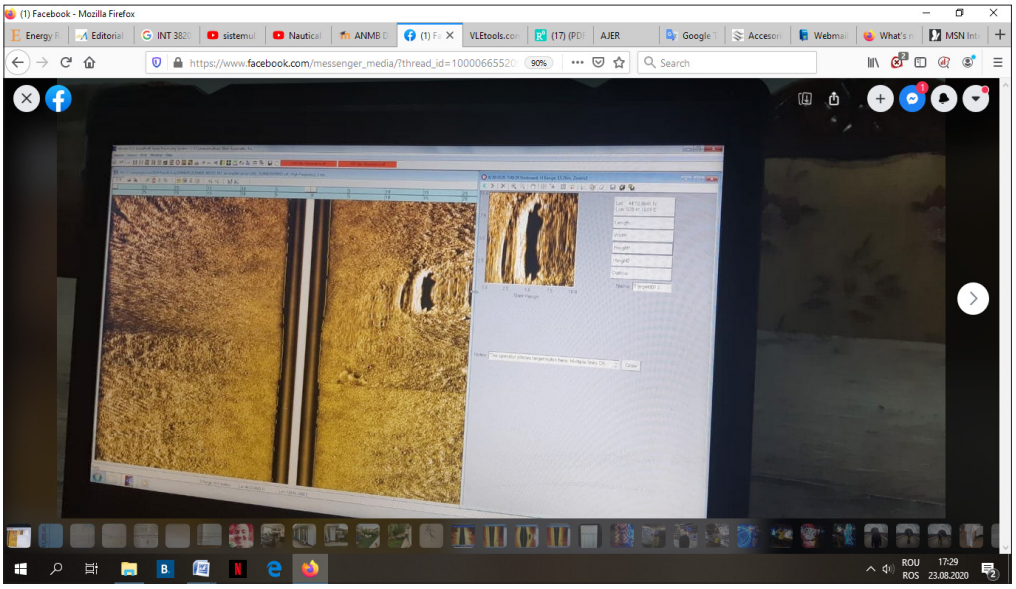


Figure 2: AUV seaside scanning.

Conclusion

Safety and security are required as an initial condition for the development of the maritime transport system, offshore industry and prosperity for the states bordering the planet's ocean. The offshore safety and security environment (TTW) in sea/ocean states is changing its characteristics. The status of any military action in the contiguous zone and in the Exclusive Economic Zone (EEZ) is becoming increasingly sensitive. Nowadays, the use of naval mines requires adequate reflection, so that they correspond to regional security trends. It is essential that mine action be carried out in compliance with the international law governing this. Determining the Rules of Engagement (ROE) for naval forces in offshore states is another step in determining the use of marine mines. The corresponding ROE summary supports the achievement of military mission objectives in accordance with the requirements of the United Nations Convention on the Law of the Sea (UNCLOS-82) and the Law on Armed Conflict (LOAC) on human rights.

References

1. Sekimizu K (2012) A concept of a sustainable maritime transportation system. International Maritime Organization, pp. 6-17.
2. (2017) Energy, transport and environment indicators (2017th Eds.). Publications Office of the European Union, Luxembourg, Europe, pp. 92-139.
3. Escámez S (2010) Free movement of goods. Guide to the application of treaty provisions governing the free movement of goods. Publications Office of the European Union, Luxembourg, Europe.
4. Goulielmos AM, Anastasakos AA (2005) Worldwide security measures for shipping, seafarers and ports: An impact assessment of ISPS code. Disaster Prevention and Management 14(4): 462-478.
5. Fleck D (2001) The handbook of the law of visiting forces, Oxford University Press, pp. 512-522.
6. Arribas G (2010) International law aspects of the EU's security and defense policy, with a particular focus on the law of armed conflict and human rights. Netherlands International Law Review 57(3): 507-510.
7. Best G (1997) War and law since 1945. Oxford University Press, UK, pp. 288-293.

