



DOCTRINAL APPROACH TO GAIN SEABED CONTROL – THE CASE OF BLACK SEA SECURITY

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The paperwork examines the complex seabed environment to emphasize the importance of gaining seabed control as part of the broader maritime security. The article demonstrates the importance of researching what the concept of “seabed warfare” means to suggest some directions for the seabed warfare doctrine alone or as part of a naval doctrine. The research aims at identifying the key directions necessary for achieving seabed control and its potential to integrate seabed warfare concepts into the naval doctrine. Therefore, the first part of the article highlights the geophysical, military, and economic characteristics of the seabed environment relevant to seabed warfare. The second part of the paper aims to provide some directions for obtaining seabed control, and a classification system for seabed warfare operations.

The novelty of the article lies in the identification of the seabed control directions and the opportunity to integrate the seabed control concept into the Romanian Naval Forces doctrine.

Keywords: *seabed warfare; naval doctrine; maritime control; seabed surveillance; underwater operations.*

Introduction

Considering the concern of the main Euro-Atlantic and regional actors regarding the security of the maritime borders, there is an inherent need to broaden the contribution of member states to strengthening the protection of the Black Sea. A

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less addressed component at the community level concerns seabed security. Due to the depreciation of maritime security in the Black Sea region, it is appropriate to pay more attention to this domain. Thus, in this article the research is directed towards the seabed security field. In the authors' opinion, seabed security is a component of maritime security that presupposes a more detailed control of the underwater environment, in terms of the control and safe exploitation of seabed opportunities. From this perspective, it can be considered appropriate to address the issue of seabed security as part of a Black Sea security strategy. Moreover, it is necessary to review the doctrine of the Euro-Atlantic naval forces, including the Romanian Navy doctrine in the seabed warfare approach, considering the new security challenges with effects on actions in the tactical environment.

The study tackles several key objectives, namely to identify the directions necessary to gain effective seabed control and explore the potential to integrate these concepts into Navy doctrine. These objectives are vital for enhancing the capabilities of the Romanian Navy and ensuring that they are prepared to face contemporary and future maritime challenges. The article provides a roadmap for integrating seabed warfare concept into the Romanian Navy doctrine. The insights and recommendations presented in this study can play a pivotal role in modernizing maritime strategy, enhancing operational capabilities, and ensuring the continued security and control of the Romanian Navy in the increasingly contested maritime environment.

A thorough analysis of strategies in the field of seabed security has been carried out, with a focus on the approaches of some EU states, but not only, those with advanced concerns in the field, such as England, France, or Italy, so that these approaches can constitute an inspiration model for a seabed security strategy for Romania. The result of this analysis identifies some conclusions that will emphasize common elements and the differences in the points of view of the schools of thought on seabed security. Moreover, the expectation is to identify, if any, specific characteristics of the concept in order to take over and apply it in the particular case of the seabed security of the Black Sea.

The first part of the article provides a brief analysis of the seabed environment, focusing on the characteristics that are most relevant to seabed warfare. It discusses the unique physical, geological, and ecological aspects of the seabed that impact military operations, including terrain features, resource distribution, and potential hazards. This section lays the groundwork for understanding how the seabed environment can be both a strategic advantage and a challenge in underwater combat scenarios.

In the second part, the paper outlines three strategic directions to follow in order to achieve effective seabed control. These directions encompass technological advancements, tactical approaches, and policy recommendations. Each direction is



explored, offering insights on how modern naval forces can leverage new technologies and methodologies to dominate the seabed and ensure security and superiority in this domain. The discussion includes examples of current technologies and future developments that could play a critical role in seabed control.

The final part of the article presents the inductive definition of seabed security and seabed warfare in terms of maritime environment control. These conceptual definitions will offer an understanding of a context in which the Romanian Navy should plan, execute, and integrate actions into seabed warfare. The goal is to seamlessly incorporate seabed warfare into the existing naval doctrine, ensuring that it becomes a core component of Navy capabilities.

The novelty of this article lies in its innovative approach to identifying the key directions necessary to achieve seabed control and its potential for integrating these concepts into the Romanian Navy doctrine. By providing a clear framework and some actionable recommendations, the article not only advances the theoretical understanding of seabed warfare but also offers practical steps for enhancing the operational capabilities of the Romanian Navy. This integration represents a significant step forward in developing seabed warfare principles, defining a modern maritime strategy and ensuring maritime security in the increasingly contested underwater domain.

1. The Seabed – a Complex Environment

Considering the geographical complexity of the Black Sea in the vicinity of the Romanian coast, concerning the existence of various critical infrastructures such as submarine cables (communication cables), and gas or oil pipelines from maritime drilling platforms, it is necessary to pay more attention to the security of the maritime area, and implicitly on the seabed. Beyond that, if we look to the future and take into account the projects in different stages of development or implementation, such as wind and hydro fields, aquaculture farms, and submersible platforms, the issue of seabed security is topical with projection to the near and distant future alike.

If it is taken into account that from a military point of view, the continental shelf is part of the area of responsibility of the Romanian naval forces, a delegation of competence for a new mission of the naval forces, ensuring seabed security, is foreshadowed.

For the development of the research, geophysical, military and economic descriptors and indicators were used, with the help of which the identification of some particularities of the seabed environment was followed, so that later it could be possible to identify ways to control the security of this environment.

Firstly, in terms of geophysical structure, the seabed encompasses vast areas of different depths. These depths can range from shallow coastal regions to deep



trenches. Depth variations are influenced by factors such as continental shelf width, tectonic activity, and sea currents. Coastal areas tend to have shallower depths, while offshore regions can be significantly deeper. The depth of the seabed has important implications for marine life, water circulation patterns, and human activities such as shipping, fishing, and resource exploration. The composition of the seabed varies widely depending on factors such as location, geological history, and sedimentation processes. In coastal areas, the seabed may consist of sandy beaches, rocky outcrops, or muddy estuaries. Offshore regions often feature sedimentary deposits, including mud, silt, sand, and gravel. These sediments accumulate over time through processes such as erosion, deposition, and biological activity. The composition of the seabed can also be influenced by human activities, such as dredging, mining, and pollution, which can alter sediment dynamics and ecosystem health.

Secondly, analysing from the military point of view, the seabed, due to its inherent characteristics, introduces a new tactical framework associated with a form of ambiguity. This comes from the challenge of operating a vast, obscure, and scarcely accessible domain but also from the dares of monitoring it. These challenges regarding the underwater operations are also detailed by the Istituto Affari Internazionali – a famous Italian think tank (Calcagno Elio 2023). After studying some of the literature on this subject, it can be stated that, being so difficult to operate in this environment due to pressure, visibility, lack of technology, and so on, a precarious exercise of authority arises. The inherent characteristics of this environment, coupled with limited monitoring resources, foster secrecy and render actions challenging to define. The nature of this environment encourages concealment and makes attributing actions difficult. Hybrid strategies may consequently arise, intertwining clandestine commercial, scientific, and military activities that defy easy attribution (Parly 2022). Consequently, the military domain must pay more attention to the seabed security domain and identify the most appropriate measures to control the activities on the seabed. This aspect would include active actions toward the objective but also a doctrinal approach, including the development of combat capabilities in the field (Clark Bryan 2020). Thus, seabed warfare is foreshadowed as an independent domain in the underwater warfare domain.

Finally, economically, the seabed offers countries bordering the seas some unique opportunities for industry and development. The seabed holds valuable resources such as oil, gas, minerals, and even marine life. Extracting these resources requires advanced technology and major investments. In addition, exploiting these resources often involves navigating complex regulatory frameworks and international agreements. Exploitation of seabed resources can have significant environmental consequences. Activities such as deep-sea mining can disrupt fragile ecosystems, damage habitats, and affect marine biodiversity. Balancing economic interests with environmental concerns requires thorough assessments and mitigation strategies,



which can add complexity and cost to seabed operations. Developing and deploying the infrastructure required for seabed operations, such as drilling platforms, oil and gas pipelines, cables, etc., requires sophisticated engineering and logistical expertise. Having these arguments regarding the economic value of the seabed, we can emphasize the importance of managing the control of this environment and maintaining its security.

In summary, after a short description of the geophysical structure, military, and economic point of view, it can be stated that the seabed is a complex environment. Understanding those characteristics is essential for managing seabed control. The challenges of operating underwater were also presented, including limited visibility, extreme environmental conditions and the potential for hybrid events. The economic importance of the seabed cannot be neglected due to development opportunities. This is the starting point from which to affirm the Navy's role and the chance to develop seabed warfare capabilities.

2. Seabed Control as Part of Maritime Security

The previous sections constitute the base for establishing the way in achieving the control of the underwater domain; its complexity dictates the roadmap from planning to conduct naval operations in this unique environment. The seabed control could be defined as the ability to assert influence and sovereignty over the underwater domain which is important for protecting national interests, securing maritime borders, and ensuring access to strategic resources (Carr Christopher J. 2018). Starting from the definition of seabed control, a definition of seabed security can be formulated.

Seabed security definition

It is the authors' opinion that seabed security is a component of maritime security which involves a more detailed control of the underwater environment, in terms of seabed infrastructures control and the safe exploitation of seabed resources.

Next, in order to define the concept of "seabed warfare", an introspection is required on the challenges of the naval forces in this field. The Romanian Navy interest zone includes the underwater domain but is there a well-defined doctrine as to seabed warfare?

Not being a dedicated one, and as a result of studying and analysing specialized works and articles related to this field, three directions have been identified and can be proposed, which certify that the Romanian Navy should consider the following to achieve seabed control:

- a) expertise of the seabed through the examination of physical characteristics;
- b) surveillance of the seabed and underwater environment;



c) conduct operations on, from, and towards the seabed.

Considering the complex physical attributes of the submarine domain (Sava 2024) - an inherently opaque, challenging to access, expansive, and largely uncharted environment - the resolution to these three operational needs must be formulated within a well-defined spatial framework. This framework should align seamlessly with the perceived threat level and the capabilities and effectiveness of our resources.

In the following section, will be illustrated the significance of each proposed direction in achieving effective seabed control. By delving into the tactical importance and specific advantages of each approach, will be demonstrated how they collectively contribute to the endeavour's overarching goal. Understanding these directions will not only clarify their roles but also highlight their synergistic effect in securing the underwater domain. As they address various aspects, each proposed direction is crucial for this endeavour.

In terms of the expertise of the seabed examination of physical characteristics, acquiring a comprehensive understanding of the seabed and its immediate surroundings is a fundamental prerequisite for ensuring safety, autonomy, and effectiveness in maritime operations. Beyond underpinning our sea control capabilities, this crucial comprehension of the environment is integral to a broader strategy aimed at readiness for threat assessment, establishing response strategies, and enhancing the efficacy of defence. Therefore, advancing our knowledge of the seabed entails honing our capacity to measure, characterize, and analyse the physical parameters of the underwater environment.

Understanding what the seabed is necessitates the capability to keenly identify any magnetic or electromagnetic anomaly within and upon it. Magnetic or electromagnetic detection techniques, relying on contrasts in magnetic and electrical resistivity, show potential and merit development to effectively onboard sensors. Enhancing magnetic mapping and detection methods for man-made objects ought to be a priority for the Maritime Hydrographic Directorate.

In terms of seabed and underwater environment surveillance, to uphold the operational freedom of our forces and protect Romanian national interests, notably including the defence of our vital submarine infrastructures, it is imperative that during peacetime to independently identify and characterize any human underwater activity on the seabed. We consider it self-evident, as it is emphasized in specialized works (Scipanov 2020), the importance of permanent surveillance of the underwater environment in times of peace, crisis, or war.

Consequently, there is a need to enhance our capacity to monitor, detect, and precisely locate potential threats present on the seabed (such as mines, sabotage explosives, fixed or semi-fixed surveillance networks, etc.), which could obstruct the freedom of operation of our armed forces or compromise critical infrastructure



integrity. To ensure effectiveness, credibility, and alignment with our national aspirations, the seabed monitoring capability in question must closely align with our national interests.

Seabed monitor operations will depend on deploying a range of complementary assets, including hull-mounted or towed sonar, unmanned underwater and surface vehicles, as well as sonobuoys. These assets can be launched from specialized naval and air-maritime platforms to cover a vast bathymetric range, spanning from shallow to deep waters. Given the diverse bathymetry of the areas of interest previously mentioned, the capability to operate at depths of up to 2,000 meters aligns with our commitment to maintain the operational freedom of our forces and contribute effectively to the monitoring and protection of submarine critical infrastructure and national interests. Achieving accurate detection and classification of small devices in deep waters, such as attack vehicles, listening devices, or acoustic sensors, necessitates precise measurement capabilities that can only be achieved with underwater vehicles (AUVs, ROVs) operating in close proximity to the seabed and equipped with accurate sensors (Clark 2015).

Analysing the opportunity of establishing an underwater surveillance network positioned on the seabed serves multiple military purposes: safeguarding maritime approaches, bolstering force projection endeavours, and deterring potential enemies (Marcus Solarz Hendriks 2024). This capability can be achieved through a combination of fixed, semi-fixed, or mobile devices – such as seabed antennas, surveillance equipment, AUVs, and gliders – strategically distributed and configured based on operational requirements, environmental factors, and threat assessments (Johannes Peters 2021). Evaluating the feasibility of deploying an underwater surveillance system in our maritime approaches and integrating it with existing anti-submarine warfare assets (such as surface ships, mine countermeasure capabilities, and anti-submarine aircrafts) underscores our commitment to enhancing maritime security. Before committing to such a sophisticated military asset, comprehensive technical and operational studies are essential to master the underlying technologies and evaluate their acoustic detection capabilities. Beyond bolstering anti-submarine defences, this capability can contribute to a broader strategy of safeguarding national interests and enhancing resilience by enabling continuous monitoring and early warning of potential threats to our submarine critical infrastructure.

The primary focus of seabed warfare should be on the following area:

- territorial waters;
- the Romanian EEZ;
- any operational area (important for the freedom of action of Romanian forces and safeguarding our national interests).

If from a military point of view, the continental shelf is part of the area of responsibility of the Romanian naval forces, a delegation of competence for a



new mission of the naval forces, the seabed warfare, ensuring seabed security, is foreshadowed.

In the view of the above, we can further formulate a structured definition of seabed warfare.

Seabed warfare definition

In the authors' opinion, seabed warfare represents the totality of the specialized fleet capabilities' action measures in the maritime environment, developing the ability to operate effectively at the bottom of the sea and deep waters, whether through presence, surveillance, proactive anticipation soft and hard measures, in response to risk and threats, employing a spectrum of actions, passive or active, ranging from discovery, classification, reconnaissance and attack to the infrastructures protection, retrieval and salvage of some objects or submarine vehicles.

Aligned with our national vision for maritime surveillance, the seabed warfare capabilities will enhance the operational capacity in maritime security ensuring the preservation of the Navy's freedom of action and the protection of critical infrastructure, primarily concentrating on the territorial waters zone and the Exclusive Economic Zone (EEZ).

The capability to operate effectively in the deep waters of the Black Sea aligns with the imperative to assert control over maritime domains and aligns with the advancement of underwater surveillance systems. As accessibility to the sea floor expands to include a wider range of actors operating at increasingly greater depths, it becomes imperative for us to explore deeper uses of undersea capabilities. Consequently, our capacity for deep-sea interventions must adapt to this evolving reality, emphasizing the importance of being able to conduct occasional operations directly from the seabed (Stöhs 2021).

It is the authors' belief that the three directions previously presented represent the essence of seabed control as part of the broader maritime security. To follow these directions, the Romanian Navy should consider acquiring the capabilities needed to be able to operate in this complex underwater domain. For this, it is necessary to take into account the doctrinal, knowledge, technological, financial resources, and specialized personnel aspects. Moreover, it is needful to integrate a vision of the necessary, existing, or developing capabilities. Given the actual state of the Romanian Navy, it is necessary to implement a resilience transformation plan.

Conclusions

In conclusion, it has been underlined the complexity and importance of the seabed environment from geophysical, military, and economic perspectives. By examining its intricate geophysical structure, conducting thorough military



assessments, and performing detailed economic analyses, it has been highlighted the multifaceted significance of this critical domain. This approach underscores the necessity of integrated military strategies to effectively manage and utilize seabed resources, ensuring both national security and economic prosperity.

Regarding the approach presented, new concerns arise among the decision-makers in maritime security regarding the development of a new strategic security direction in the field. Starting from this direction, the Romanian Navy will be forced to act on two forecasting levels. A doctrinal one, which will enable dedicating a special chapter for seabed warfare and a chapter for developing capabilities to action in the field. A capability development one, with a careful analysis of the need to develop the future capabilities of the Romanian Navy is suggested, as well as the training of specialized personnel who can operate these capabilities.

Therefore, based on the complexity of the underwater domain, the three proposed directions encapsulate the core elements of seabed control within the context of broader maritime control. Embracing these directions necessitates that the Romanian Navy equip itself with the requisite capabilities to effectively operate within this intricate domain. This entails a holistic approach encompassing technological advancements, robust knowledge acquisition, and investment in skilled human resources. Given the current state of the Romanian Navy, a comprehensive transformation plan must be implemented to address these evolving requirements. Such a plan should prioritize the enhancement of technological infrastructure, the expansion of specialized expertise, and the cultivation of a proficient workforce capable of navigating the complexities of seabed operations. By undertaking this transformative endeavour, the Romanian Navy can position itself as a formidable presence in safeguarding national interests and contributing to regional maritime security.

To achieve the performance to conduct all three functions mentioned in the last part of the paper, the Romanian Navy has to follow a large endowment program. Examples of modern equipment that the Navy should consider acquiring can be hydrographic maritime drones that can carry multiple sensors for underwater research and surveillance, mine warfare systems with the ability to detect, classify, localize, identify, and neutralize drifting mines, midget submarines that can infiltrate into the enemy area of interest and collect data, medium size diesel-electric submarines for intel ops and attack potential enemies and (semi-)fixed seabed surveillance sensors.

As the importance of the seabed continues to increase, questions arise regarding its role within multidomain operations. While the seabed is not a discrete compartment or domain in itself, it represents a new and potentially contentious arena for conflicts, demanding vigilant monitoring and specialized strategic planning.

Integrating the subject of seabed security and seabed warfare into the overarching doctrine of naval forces extends beyond mere recognition and description of operations, as previously outlined. It requires the development of a distinct body



of doctrine that outlines the framework, principles, and tools essential for effective naval operations in this unique environment. This doctrine must remain adaptable to ongoing technological advancements, addressing critical areas such as submarine communications, energy extraction, underwater vehicle utilization, and more. By doing so, the Navy can effectively navigate the complexities of seabed warfare and maintain strategic superiority in this evolving maritime domain.

We believe it is appropriate to affirm that the article achieved its intended objectives. Moreover, it goes beyond by not only advancing the theoretical understanding of seabed warfare but also by providing tangible steps for enhancing the operational and doctrinal framework capabilities of the Romanian Navy. This integration signifies a noteworthy contribution brought forth by this article.

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