

## THE USE OF UNMANNED SYSTEMS IN MARITIME CONFINED SPACES

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*Unmanned systems, commonly referred to as drones, are widely used for surveillance, research, protection of military and civilian targets, search and rescue, and are becoming an increasingly important part of the maritime domain as they are used to execute tactical combat actions in air, surface and sub-surface combat environments. The successful use of unmanned systems in tactical combat actions in the war in Ukraine is leading to the rapid innovations in this field, which also implies the adoption of new tactics and strategies for their use in combat. In this article we have analysed the use of drones in the conflicts in the Black Sea and the Red Sea in order to highlight the importance to be given to the development of this field, especially for the limited maritime spaces, where the relatively small distances between targets represent a good opportunity to operate unmanned systems. The use of unmanned systems in maritime confined spaces covers a wide range of missions with the advantage of using them over a long period of time, at relatively low cost, and without jeopardizing human resources.*

*Keywords: drone; combat environment; tactical combat actions; maritime space; lines of communication;*

### INTRODUCTION

The success of the use of unmanned systems in the military conflict between Ukraine and the Russian Federation and in the actions of the Houthi rebels in the Red Sea against merchant ships has generated increased interest from the armed forces of countries in the vicinity of the conflict zones, but also from countries that have realized that in future conflicts, the effectiveness of strikes must be increased at the lowest possible cost and with limited exposure of human resources. The capabilities of unmanned systems are improving exponentially due to technological progress, becoming more affordable, which means that more potential adversaries have access to this technology, extending a wider range of asymmetry in tactical actions conducted in air, surface and subsurface combat environments. The research methods I will use in this paper are predictive, as this field of unmanned systems is in a constant state of flux, and the case analysis derives from the use of these air and naval unmanned systems in conflicts in the Black Sea and Red Sea.

The strategy of using unmanned systems/drones in confined maritime spaces, such as enclosed or semi-enclosed seas, differs considerably from the use of these systems in the open ocean, the determining factor being space, an element that must be considered in terms of geographical setting in relation to the maritime littoral space, size and configuration of the coastline, hydrographic and oceanographic characteristics, degree of industrialization of coastal areas and size of coastal urban areas.

### SPECIFIC CHARACTERISTICS OF MARITIME CONFINED SPACES

In limited maritime spaces, it is a strategic challenge for a littoral nation to conduct its own naval operation. Manoeuvring space depends on the length of maritime boundaries, the size and characteristics of the water surface, international agreements and the size of the fleet. A country's naval power in enclosed and semi-enclosed seas is influenced by the configuration of the coastline, the number and characteristics of ports, the possibilities for exploiting natural resources, economic development and technological progress. The term enclosed or semi-enclosed sea means "a bay, basin or sea surrounded by more than one State and connected to another sea or the ocean by a narrow passage or formed wholly

or mainly by the territorial seas and exclusive economic zones of several States” (UNCLOS, United Nations, p. 53).

The military analysis of maritime confined spaces can be based on spatial, action, temporal and informational criteria (Nistor, Scipanov, 2021, p. 27). These criteria were established based on the distance to targets, the intensity of military actions, reduced action times, speed of action, as well as real-time realization of the Recognized Maritime Picture/RMP. The physical characteristics of the littoral zone and the open spaces between localities determine the organization of the littoral defence through the positioning of forces and assets. In this context, Professor Milan Vego of the US Naval War College, Newport, Rhode Island, states that: *“future wars at sea will predominantly be fought near the littoral”*, which leads us to the rather high probability that these wars will be fought in maritime confined spaces, such as enclosed or semi-enclosed seas (Vego, 2007, p. 14).

The maritime spaces in the coastal zone provide, to a large extent, the necessary conditions for the use of fast surface ships, aerial drones, naval drones and underwater drones, mainly using swarming tactics, attacks from several directions in order to gain control of the sea or to deny the sea in the maritime space in question.

The maritime space controlled by a naval power becomes a dynamic factor from the moment naval tactical actions at sea are initiated. It is enlarged by actions on the enemy, forcing him to restrict the area of operations, or it can be reduced if the enemy is superior in quality and quantity.

The Black Sea has access to the Planetary Ocean through the Turkish Straits (Istanbul and Çanakkale). It is thus considered a semi-enclosed sea, with an area of 423,000 km<sup>2</sup>, with a maximum east-west length of 687 Nm (nautical miles) from the shore of the Bay of Burgas (Bulgaria) and the mouth of the Inguri River in Georgia, and a minimum width at the meridian of the southern tip of the Crimean Peninsula (Cape Sarici) of 142 Nm. (Pontic Itineraries/Naga Sea). The maximum depth of the Black Sea is 2,212 m, with an average depth of 1,197 m (Vespermeanu, 2005, p. 29), compared to the Baltic Sea, which has, on about 60% of its surface, a depth of less than 150 m, and the North Sea, with an average depth of 100 m. To give a more detailed picture of the size of the semi-enclosed seas, it should be noted that the Baltic Sea is 920 m long and 105 m wide, the North Sea is 700 m long and 420 m wide at its widest, and the Mediterranean Sea is the largest in terms of surface area – 2,500 m and with a maximum width of around 1,000 m (Ib.).

The characteristics of the seas presented above lead us to the conclusion that the employment of considerable forces in confined sea spaces most likely does not ensure that surprise will be achieved, but the use of aviation and unmanned

systems can achieve surprise and gain control of the sea for a certain period of time. Thus, the use of unmanned systems in confined maritime spaces can limit or even prohibit the enemy’s use of large ships such as destroyers or frigates, thus increasing the likelihood of military action as close to the enemy shore as possible.

In enclosed and semi-enclosed seas, water depth is the main criterion in the use of submarines, since the transparency of the water at certain time of the day makes it possible to detect a submarine in the air at depths of more than 50 meters during daylight. Both aviation and unmanned aircraft/UAV (Unmanned Aerial Vehicle) can be successfully used to carry out aerial surveillance of maritime areas.

The transmission of sound through water in shallow seas is strongly influenced by the characteristics of the underwater relief and thermal gradients in the surface layers, therefore it is necessary to know the climatological factors (wind, waves, air temperature, water temperature, precipitation period, cloudiness, fog) for the efficient use of surface and underwater sensors on board a ship. From the analysis of depth, salinity, water transparency and submarine relief, it is possible to create a picture of the forces and means that can act in such a maritime space.

I believe that in confined maritime spaces, electronic warfare, limited tactical naval actions, short- and medium-range vectors, and the use of all types of unmanned systems in combat environments are predominantly employed to obtain, maintain/contest sea control. Economic objectives and military objectives of tactical or operational level are primarily targeted, so that the achievement of these objectives will lead to the fulfilment of the strategic objective.

The relatively small distances between the combatant countries bordering a limited maritime space may facilitate certain surprise tactical naval and tactical air actions by the numerically inferior side against enemy naval and land targets with a high probability of success. The actions of Ukrainian special forces against land or naval targets belonging to the Russian Federation, using unmanned air or naval systems, validate the hypothesis that technological development and rapid adaptation of combat tactics to new situations in the theatre of operations is a viable solution today, and in the near future the role of unmanned systems will constantly increase.

Of the major naval powers, the Russian Federation is in the most unfavourable position, says Geoffrey Till, in *A Guide for the Twenty-First Century*, as the Black Sea, the Baltic Sea and the Sea of Japan exits are controlled by traditional adversaries. In this regard, he quotes Russian Admiral Sergey Georgiyevich Gorshkov, former commander of the Soviet Union Navy, who emphasizes that: *“the difficulty for Russia,*

as a maritime power, lies in its geographical position, a position which calls for the existence of an independent fleet capable of operating in all four possible maritime theatres of operations". (Till, 2013, p. 114) At present, the Russian Federation has favourable access to the Planetary Ocean through the Barent Sea and the Sea of Kamchatka, areas where it has major naval bases.

In support of the claim that the Russian Federation does not have free access to the Planetary Ocean through the Black Sea comes Turkey's decision in February 2022 to ban warships belonging to the Russian Federation and Ukraine from transiting the Turkish Straits on the basis of the provisions of the Montreux Convention, as a result of the armed conflict between the Russian Federation and Ukraine. The Montreux Convention gave Turkey the right to militarize the straits area in a situation of armed conflict (Moraru, 2011, p. 7).

The integration of Finland and Sweden into the North Atlantic Alliance/NATO has turned the Baltic Sea into a sea surrounded, for the most part, by Alliance member countries, thus leaving the Russian Federation with only the enclave of Kaliningrad and the eastern part of the Gulf of Finland.

The Black Sea is the maritime space surrounded by the coasts of three North Atlantic Alliance member states (Romania, Bulgaria and Turkey), one aspiring NATO member (Georgia) and the two countries in armed conflict, the Russian Federation and Ukraine. This maritime space provides an important corridor for the transportation of goods from the European Union to Asia, the transportation of cereals from Ukraine to Africa and, possibly, for ensuring energy security for the riparian states or, at least, reducing energy dependence on the Russian Federation (Cioroaba, 2024).

From the above it can be concluded that, in maritime confined spaces/enclosed or semi-enclosed seas, unmanned systems can be used to execute a wide range of missions in all environments (air, surface and sub-surface water).

The use of unmanned systems in maritime confined spaces is favoured by the following characteristics:

- relatively small distances between targets;
- possibility of enemy surprise;
- possibility of executing attacks from several directions;
- real-time recognized maritime picture;
- possibility to accurately assess the effect on the target;
- possibility of combining air, land, naval strikes with strikes executed by unmanned systems;

- particularly high operational effort to combat threats generated by unmanned systems;
- the manufacturing costs are relatively low for unmanned systems compared to the costs incurred for the manufacture of conventional military equipment and munitions (airplanes, ships, tanks, missiles, torpedoes, projectiles etc.).

## SHAPING THE OPERATIONAL ENVIRONMENT IN MARITIME CONFINED SPACES USING UNMANNED SYSTEMS

In this chapter I will highlight how unmanned systems can shape the operational environment by analysing some of the military actions deployed in the maritime space of the north-western Black Sea by the Russian Federation and Ukraine.

The Russian Federation's aggression against Ukraine has turned the northern Black Sea into a maritime space where both combatant countries are trying to exert control over the sea. By the exercise of this control is meant "*the ability to use a part of the ocean/sea and related airspace for military and non-military purposes and to prohibit the enemy from using this area for a period of time*" (Vego, 2016, p. 26).

For Ukraine, it is vital to ensure freedom of navigation for its own and neutral merchant ships, so that grain exports can take place, and to disrupt the sea lines of communication of vessels belonging to the Russian Federation. By the use of the phrase *sea lines of communication* is meant "*ports and navigable routes between ports with specific navigational arrangements and transport vessels using these routes*". (Hanganu, 1998, p. 194). The Russian Federation aims to block Ukrainian grain shipments and to occupy favourable positions at sea from which to launch missile attacks on the Ukrainian coast.

As early as 24 February 2022, the date of the invasion of Ukraine by the Russian Federation, the Russian Black Sea Naval Forces had more and far superior ships in terms of technical and armament equipment. Apparently, gaining and maintaining sea control in the northern Black Sea area was not a problem, as the Ukrainian Navy focused on planting mine barrages in the littoral zone and deliberately sank the largest warship in its inventory in order to prevent it from being taken over by the Russians. In the first part of the armed conflict, the Russian Navy gained sea control in the northern Black Sea area and the Russian Naval Forces even occupied the Snake Island (an island that belonged to Ukraine) on 24 February 2022, and started to notify on VHF Channel 16 (international emergency channel) all merchant ships that the Russian Federation was conducting a counter-terrorism operation in the Black Sea and all merchant ships between the Ukrainian port of Odessa and the Danube's spillway into the Black Sea to move to the Istanbul Strait (Pedrozo, 2022, p. 17).

The Ukrainian ambassador in Ankara calls on Turkey to close the Turkish Straits to military vessels belonging to the Russian Federation. On 28 February 2022, Turkey's foreign minister, using the provisions of the Montreux Convention, announced that Turkey was closing the straits for all warships except warships returning to ports of permanent deployment. Non-littoral states were announced not to send warships in the Black Sea (Ozberk, 2022).

As a result of this decision, NATO ship groups have also not received Turkish approval to enter the Black Sea to participate in naval exercises organized by the naval forces of the Black Sea littoral states members of the North Atlantic Alliance. In this context, the Black Sea has become a closed sea to any NATO initiative to send military vessels to the region to ensure the protection of merchant ships on the sea lines of communication. Tactical sea combat actions between the Russian Federation and Ukraine began to be conducted asymmetrically through the use of sea drift mines and unmanned systems. In order to minimize the risks of mine hazards on sea lines of communication, Romania, Bulgaria and Turkey concluded a cooperation agreement, on 11 January 2024, on the Black Sea mine clearance through the creation of a Black Sea Mine Countermeasures Task Group (MCM Black Sea) (Dincel, Turuk, 2024).

Unmanned systems have been developed by Ukraine since the invasion of Crimea by the Russian Federation in 2014, with successful designs being manufactured in series production and delivered to the armed forces (Samus, 2024).

The concept of *asymmetric combat* was adopted by the Ukrainians as a result of the quantitative inferiority of combat forces and means compared to the capabilities of the Russian Federation. By making extensive use of unmanned systems/drones for surveillance, research, reconnaissance and attack, the Ukrainian Naval Forces have been able to effectively counter the combat power of the Russian Federation's Black Sea Fleet.

At the beginning of the conflict, in order to limit the access of Russian Federation ships to certain maritime districts, Ukrainian Naval Forces planted mine barricades along the shoreline, thus denying access to a maritime space where Ukrainian Naval Forces did not have control of the sea.

Those defensive measures were only a part of the concept of action, "*defence not being an absolute state of waiting*" (Clausewitz, 1993, p. 634), followed by attacks against Russian Federation ships with the use of littoral-ship missiles, air and sea drones on the principle "*the whole art of war consists in a well-organized defence followed by swift and daring attacks*" (Cutts, 1938, p. 21).

In the area of maritime drones, the Ukrainian Naval Forces have developed and perfected various unmanned systems that can operate at the water's surface, over considerable distances, at high speeds, equipped with explosive charges that can cause extensive damage to Russian surface vessels and even sink them. The most commonly used surface drones, Unmanned Surface Vehicle/USV, by the Ukrainian Navy or Ukrainian special services are Sea Baby and Magura V5. In order to get a picture of these unmanned naval systems it is worth mentioning that Sea Baby can develop a speed of 50 knots, approximately 90 km/h (1st -1,852 km/h), can operate at a range of 540 nautical miles and has on board a quantity of 850 kg of explosives, while Magura V5 develops a speed of 2 knots, range of 450 nautical miles, and is equipped with 320 kg of explosives (Collective-1, 2024, p. 12).

Ukraine's combined use of Unmanned Aerial Vehicle (UAV) and Unmanned Surface Vehicle (USV) surface-to-ship missiles has significantly reduced the ability of the Russian Federation's Black Sea naval forces to utilize their capabilities in the north-western Black Sea.

The sinking in April 2022 of the destroyer *Moskva*, the flagship of the Russian Federation's Black Sea Fleet, using anti-ship missiles, marked the first resounding success of Ukrainian Naval Forces. It was followed by the sinking of a large number of Russian military vessels through repeated surface and aerial drone strikes on port facilities in Russian-occupied Crimea. The Russian Kilo-class submarine, Rostov-on-Don, was struck and sunk in the port of Sevastopol using a combination of missiles and unmanned systems (Grady, 2024). Repeated actions against naval vessels and port facilities in Crimea prompted the Russian Navy leadership to make the decision to redeploy several warships from the Russian ports of Sevastopol to the ports of Novorossiysk and Feodosia.

The execution of the strikes on Crimean port facilities has diminished the Russian Federation's ability to maintain and repair damaged warships and submarines so that the Russian Black Sea Fleet is likely to have a reduced number of naval tactical actions in the coming period. The loss of sea control in the north-western part of the Black Sea precludes the possibility of launching an amphibious assault on the Odessa region, an objective of strategic importance for both combatant countries.

Although the Russian naval blockade of the northern Black Sea has been lifted, threats to trade on sea lines of communication are still ongoing through Russian drone and missile attacks against Ukrainian grain merchant ships and Ukrainian port facilities.

The Russian Federation and Ukraine are engaged in a technological race to secure massive production of unmanned systems while improving the technology used to manufacture them in order to increase their efficiency and target effectiveness. This armed conflict has demonstrated that unmanned systems are an essential capability for shaping the operational environment due to their use in tactical actions specific to all combat environments.

The use of unmanned systems in tactical actions by the combatant sides has shaped the operational environment in the northwest Black Sea generating the following effects:

- the Russian Federation has had to redeploy its warships from the port of Sevastopol;
- the presence of Russian Federation naval vessels in the north-western part of the Black Sea has been considerably reduced;
- the possibility for the Russian Federation to carry out maritime interdiction actions on the Ukrainian coast has been reduced;
- the transportation of Ukrainian grain is affected, leading to an increase in world food prices;
- the Russian Federation is denying Ukraine access to gas and oil resources in the Black Sea;
- maritime communication lines in the north-western part of the Black Sea have become dangerous for navigation.

### THE IMPACT OF THE HOUTHİ REBELS' USE OF UNMANNED DRONES

As of November 2023, the Red Sea, one of the most important international cargo transportation routes from the Mediterranean Sea to the Indian Ocean, has become an unsafe maritime space for navigation as a result of repeated attacks with missiles and unmanned aerial systems executed on merchant ships by Houthi rebels. The Islamic fundamentalist movement in northern Yemen has begun launching a series of attacks using drones and rockets against merchant ships carrying goods to and from Israel. The Houthis claim that their actions are a response of solidarity with the Palestinian people and to protest Israeli military actions in Gaza (Ritter, 2024).

Amid the anti-Israel ideology, the launching of attacks on merchant ships transiting the Bab el-Mandeb Strait has disrupted shipping in the Red Sea, causing many shipping companies to abandon this trade route and choose a longer and more expensive one around the African continent via the Cape of Good Hope.

Redirecting merchant ships via the Cape of Good Hope entails an estimated 10 to 14 days longer transit, which increases transportation costs, maritime insurance, disrupts global supply and increases inflation (Economica.net, 2024).

The Red Sea is a semi-enclosed sea with a length of 1,100 nautical miles and a maximum width of 190 nautical miles. It is a shallow sea, the average depth is 490 m, about 25% is less than 50 m deep (Collective-2, 2024, p. 1). The Red Sea is connected to the Mediterranean Sea through the Suez Canal and the Indian Ocean through the Bab el Mandeb Strait, being the most important line of communication linking Europe to the Middle East and Asia. The Bab el Mandeb Strait is a narrow strait between 26-32 km wide and 112 km long and is the key to controlling shipping between Europe and Asia. The International Maritime Organization/IMO estimates that about 25% of global seaborne cargoes pass through this route, mainly crude oil and petroleum products from the Persian Gulf to Europe.

The geostrategic position of the Red Sea provides the Houthi rebels with maritime space where they can carry out missile and unmanned missile system attacks against merchant ships, creating a security crisis in the region, with the aim of promoting their Islamic revolution, anti-Israel, anti-American ideology, and to control the region by destabilizing the security environment.

In response to attacks by Houthi rebels, naval forces belonging to the United States of America and Great Britain have been deployed in the Red Sea. The US Navy has been executing response actions in self-defence since December 2023 following an attack by Houthi rebels on a merchant vessel.

On 18 December 2023, US Secretary of State, Lloyd Austin, announced the formation of a coalition of 20 states and the launch of Operation *Prosperity Guardian* to protect merchant ships transiting the Red Sea. Operation *Prosperity Guardian* brings together several countries such as the USA, UK, Canada, Bahrain, Italy, the Netherlands, Norway, Seychelles, Spain to address the challenges of the Red Sea security environment in order to ensure freedom of navigation in the Red Sea for all merchant vessels and enhance regional security and prosperity (Defense Romania, 2023).

The European Union, on 29.01.2024, took steps to launch an operation in the Red Sea, *EUNAVFOR ASPIDES*, in close cooperation with the coalition maritime operation *Prosperity Guardian*, with the aim of protecting maritime security on the main shipping lanes in the Bab el Mandeb Strait, the Strait of Hormuz, the international waters of the Red Sea, the Arabian Sea and the Persian Gulf. Operation *EUNAVFOR ASPIDES* was launched on 19 February 2024, on the occasion of the meeting

of the Foreign Affairs Council of the European Union (Agerpres, 2024). Romania has committed to contributing to the coalition maritime operation *Prosperity Guardian*, with staff officers, within the command deployed on the territory of Bahrain, after the legal status of Romanian military personnel on the territory of this state is settled (Juridice.ro, 2024).

The attacks by Houthi rebels on maritime lines of communication in the Red Sea have prompted a collective effort by the international community to support freedom of navigation and eliminate the danger posed by the use of ballistic missiles and unmanned aerial and naval systems. The actions of the Houthi rebels are designed to provoke a strong response from regional actors and those with economic interests in the region, internationalizing the conflict by challenging the influence of the United States of America and Israel in the region. By escalating the conflict, the Houthi rebels are convinced that they have little to lose, relying on their resilience and adaptability to military pressure and the military support they receive from Iran. The Houthi leader, Abdul-Malek al Houthi, has stated that they are prepared for the introduction of unmanned underwater systems, which entails a strategic shift aimed at improving their ability to strike commercial and military vessels in the Red Sea (Feierstein, Alasarar, 2024).

The use by Houthi rebels of unmanned systems in their actions against merchant ships in transit through the Red Sea has generated a number of effects with economic and military impact as follows:

- the disruption of shipping through the Red Sea with immediate effect on global supplies, increased prices of commercial goods and maritime insurance;
- significant military, financial and diplomatic efforts by the international community to maintain freedom of navigation in the Red Sea by forming a coalition and launching Operation *Prosperity Guardian*;
- the launch by the European Union of Operation *EUNAVFOR ASPIDES*, with the aim of protecting the maritime security of the Red Sea lines of communication;
- the escalation of the conflict in the Middle East region, which requires the maintenance of a considerable military presence in the region and, therefore, special financial efforts.

The effects of the use of ballistic missiles and unmanned systems by the Houthi rebels are not only economic, but also political and social. The strategic calculus now involves not only a military response but also diplomatic efforts to maintain regional

stability. The implementation of the decisions of international organizations to sanction Houthi supporters can stop the flow of weapons and advanced technology to the Houthi rebels, and thus it would become possible to reduce attacks and intercept the vectors launched at commercial ships.

## CONCLUSIONS

The extremely dynamic development of modern technologies has influenced many fields of activity, with drones/unmanned systems becoming a key sector for research and deployment of artificial intelligence.

An important area for the use of new developments in innovative technologies and research remains the military segment. The war in Ukraine and the conflict in the Red Sea highlight the importance of globalization and the development of modern technologies.

Unmanned systems are likely to play a decisive role in the warfare of the future in order to achieve success and conduct military actions in all combat environments. This statement is supported by the main characteristics of unmanned systems:

- Unmanned systems prove their efficiency through their simplicity of construction and the multitude of missions for which they can be configured;
- Mission complexity is directly proportional to the degree of technological development;
- Multi-functional unmanned systems allow easy adaptation of the equipment to the recipient's requirements, while retaining the freedom to introduce new innovations to improve efficiency and increase range of travel.

Enclosed and semi-enclosed seas are the ideal place where unmanned systems can operate with high efficiency, due to the small distances between targets and the possibility to operate from multiple directions.

One of the great advantages of using unmanned systems in confined maritime spaces is the flexibility to use multirole capabilities.

Unmanned systems can be configured for a variety of missions such as:

- naval surveillance;
- vessel traffic monitoring;
- search and rescue;
- direct action against commercial or military vessels.

In the future, it is possible that fleets of autonomous merchant ships will be sailing on the maritime communication lines, which will open a new chapter in the field of maritime transportation and also in the military field. Thus, the safe transit

of merchant ships on the sea lines of communication can be ensured by unmanned military naval systems, thus eliminating the exposure of the human factor to various dangers generated by the changing security environment.

Unmanned systems will probably not solve all situations generated by an armed conflict, but they can contribute effectively in several areas to gaining advantages over the enemy.

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