



UKRAINE'S UNMANNED SURFACE VESSELS: IMPACTS ON SEA WARFARE

Ukraine's Unmanned Surface Vessels: Impacts on Sea Warfare

For almost two years now, the Ukrainian Armed Forces have been conducting a series of operations to counter Russian aggression by finding innovative and sometimes overly bold solutions. Speaking of high technology as such, starting in 2022, unmanned drones were the most dynamic sector of defence tech. As of the summer of 2024, there were more than 500 manufacturers of such equipment at various stages of development. Activities on the sea are no exception. The use of unmanned surface vessels has significantly changed the way we think about warfare at sea and, simultaneously, posed new challenges and prospects for their producers.

Reason of Necessity

At the initial stage of the full-scale invasion (in February 2022), the ratio of forces at sea was 12:1 in favor of the Russian Black Sea Fleet. Moreover, the actual protected zone was limited to 25 km in the northwestern part of the water area, as the key means of destruction were MLRS and artillery systems.

Today, the Ukrainian state does not have the financial capabilities necessary to develop separate means for the purposes of anti-ship, anti-submarine, and other activities. Moreover, the blockade of the Black Sea ports and the occupation of a substantial part of the Ukrainian coast only worsens the situation. This creates unique circumstances when it is important to find more accessible mechanisms to influence the current security situation further to ensure high-quality and long-term protection of a particular area. Under these conditions, maritime unmanned surface vehicles are a financially affordable way to ensure defence interests in conducting maritime operations.

Development: First Strike — First Announcement

The first ideas of creating such devices in the professional environment were voiced long before the full-scale invasion but were significantly delayed due to the political and economic conditions of the time. The active hostilities became a sufficient argument for investing in this type of technology.

Public information outlines the first start of the development of surface attack drones in the first half of 2022. For example, the Security Service of Ukraine officially dates the testing of the first such vessels to July of that year. The first such vehicles, according to various analysts, were created on the platform of marine vehicles (jet skis, etc.) using FAB-100 or FAB-250 crash bombs as warheads.

The first practical use was on September 17, 2022, when an attempt was made to strike the Russian Black Sea Fleet frigate Admiral Makarov, but the attempt was unsuccessful. Since then, various units of Ukraine's defence forces have conducted several successful operations against both static and moving targets in the Azov – Black sea maritime operation district. Among others, we highlight the attack on the Kerch Bridge on August 4, 2023, striking a number of enemy assets (including the large amphibious assault ship

Caesar Kunikov, the corvette Sergei Kotov, small missile ships Samum, Askold, Cyclone, etc.)

Current Situation

NATO's Maritime Operations Doctrine outlines three main forms of operations held during warfare: sea control, sea denial, and power projection. Ukraine, in turn, is widely using unmanned surface vessels (USV) to achieve the goals of sea denial and limited power projection.

Large naval groups often perform this type of combat mission, but in certain operational areas, despite their low cost (about 270 thousand US dollars) compared to other means of destruction, drones can perform identical functions. In particular, as of today, Ukraine is actively using or developing strike drones (both reusable and kamikaze), reconnaissance and surveillance drones. Relevant vessels are also capable of performing various electronic warfare tasks, transportation, and mine countermeasures. Moreover, the aim of combining these areas to create a full-fledged multi-purpose apparatus is seen in the future.

The widespread use of such vessels to strike at distances of up to 750 kilometers has led to a significant reduction in the presence of Russian warships in the Black Sea (from 40-50 daily in 2022 to 0-4 in 2024). At the same time, the key forces of the enemy group were redeployed from the occupied Crimea to the port in Novorossiysk (including newest ones, two frigates, four corvettes, and two submarines). According to the latest estimates, the advantage of the Russian Federation's forces at sea has significantly decreased to a ratio of 3 to 1. Moreover, the potential and use of the Black Sea Fleet forces is mainly limited to missile strikes (Kalibr missiles), and according to the Ukrainian Navy Commander, Vice Admiral Neizhpapa, enemy ships do not enter the northwestern part of the Black Sea (an area of about 25 thousand square kilometers).

As for now, three key types of unmanned surface vessels (Magura V5, Sea Baby, and Mamai) are most often mentioned in public space. However, this number is significantly higher, considering all existing modifications that private manufacturing companies mainly implement. Moreover, the Ukrainian state has been using various tools to help build up the capacities and industries involved in the industry. For example, the government-established Defence Tech «Brave-1» accelerator supports the Toloka unguided submarine, among other startups.

Thus, there is a tendency to find ways to adapt such vessels to various tasks, in particular by placing the missile systems on appropriate platforms, or by considering various solutions to counter air attacks. We can talk about attempts to use R-73 (AA-11 Archer) air-to-air guided missiles and machine guns with the necessary sensors. Nevertheless, as of today, the loss rate of such weapons reaches 50% of the used ones, most of which are due to the use of helicopter gunships by the Russians. Finding a solution to this problem is by far the most difficult challenge for manufacturers and developers. One of the potential resolutions is the intention to implement a variant of a unmanned submarine capable of submerging, which can serve to ensure both a security component and increase the level of damage to an enemy vessel by enabling to strike in more sensitive areas below the waterline. In this way, more sensitive and technological elements of the ship's equipment can be threatened.

Also, the design of the use of various types of lasers as an effective mechanism for countering various types of air threats is being actively discussed. This option may be the most effective and operate within a radius sufficient to protect the vessel.

Already today, such vessels are widely capable for the combat use of electronic and acoustic means. Different types of drones may have underwater and surface systems designed to detect and counter various types of enemy assets and tools.

The experience of combat operations in the lower part of the Dnipro riverbed (near Krynyk, etc.) and near Zmiinyi Island has once again emphasized the expediency of having unmanned platforms for transport and logistics tasks that can potentially be used to deliver supplies, transport personnel and evacuate the wounded. There are, among other things, developments being made for specialized units to quickly and efficiently deliver personnel to the combat zone.

Tactics of Combat Use

To successfully and efficiently utilize the full potential of unmanned surface vessels (USV), it is important to understand that this product, like any other means of destruction and combat missions, is primarily a tool intended to be used in conjunction with others. The Navy already has experience in conducting such operations, combining the use of maritime drones with aerial ones and cruise missile strikes. The first such coordinated attack is the operation aimed to destroy ships at the base of the Russian Black Sea Fleet on October 29, 2022. As a result of the attack, at least three Russian ships were successfully hit (including the minesweeper Ivan Golubets and the flagship Admiral Makarov, which was damaged).

In particular, the use of various elements of destruction against the infrastructure of the occupation forces on the Crimean peninsula perfectly complements the operational component, each time improving the ability to strike with other types of weapons.

In the potentially near future, the issue of adapting unmanned systems to integrated activities in the army will arise as part of the broader discussion on the topic of "mosquito fleet", concept proposed in 2013-14. The methodologically sound use of various forces and means at sea should become the basis for long-term deterrence of the enemy. Particular attention should be paid to the combination of different military formations in the context of the upcoming adoption of two modern corvettes and a number of auxiliary ships, including minesweepers. After the de-occupation of the Azov regions and the Autonomous Republic of Crimea, it is a coordinated system of coastal missile systems and surface forces that should serve as a guarantee of the protection of the state's maritime borders.

Pros and Cons

In addition to the aforementioned issues, vulnerabilities, and multifunctionality, there are a number of technical and operational advantages and disadvantages of such systems. As for the former, it is worth noting:

- **low visibility** - due to the "surprise" factor, an enemy unprepared for such an attack loses the initiative and may suffer maximum possible losses. It was

this factor that caused significant damage to a large part of the Russian Black Sea Fleet (according to experts, the number of affected ships reaches one third of the total).

- **maneuverability** - ensures the drone's survivability in the face of intensive work to destroy it by the enemy. Despite the high vulnerability of the analyzed vehicles to fire from ships and helicopters, it is maneuverability that can serve as a way to avoid such clashes.

As for the disadvantages, we note:

- **Relatively low speed** compared to other means of destruction (primarily cruise missiles) - such a drone reaches a speed of 40 nautical knots, which is about 20 m/s compared to 300 m/s for a missile. This type of a comparison is more appropriate than with the speed of surface platforms (ships, etc.) when it comes to understanding a drone as a disposable striking device that can be classified as an executive tool.
- **The need to constantly update targeting** - given the distance of 150 nautical miles from Odesa to Sevastopol, the time for a drone to cover the corresponding distance will reach 5 hours, which is enough for the target to cross a distance sufficient to avoid a lethal hit.
- **Control stability** - realizing (from the previous point) the importance of constant transmission of the control signal, it is worth noting the constant risk of losing communication with the operator and the command center.
- **Limited and segmented sectors of detection sensors** - the radius of such a sensor is about 10 kilometers, which greatly complicates targeting in changing conditions.

However, all of these characteristics vary significantly depending on the type of product, the variety of which was mentioned above. This diversity is a significant driver of progress with the belief in further adaptation to practically the best possible models.

Impact on Regional Understanding of the Sea Warfare

Speaking and analyzing the consequences of the use of this type of weapon, we cannot avoid the issue of changing perceptions of the nature of hostilities Azov-Black sea maritime operational area. Thus, the limited water area and shallow depths (for example, up to 50 m in the Northwest near oil fields) lead to the spread of conceptual ideas about the high vulnerability of expensive combat ships, given that their functions can be performed by other, cheaper and safer means in terms of risk to human life.

The growing tension in the region is forcing Ukraine's neighbors to study the experience of fighting the Russian aggressor, in particular of finding ways to neutralize the enemy's armed power. To this end, various scenarios for adapting the Ukrainian concept to their own conditions can be considered. Such as, for example, the use of smaller versions of kamikaze drones from ship-type platforms, or the creation of so-called "uterine launch platforms" capable of transporting and launching smaller and, accordingly, cheaper units.

The general trend of the development of unmanned weapons, including those for the maritime domain, among the states of the region focused on the military-industrial complex as a valuable component of their own economy has only intensified. For example, we can recall the presentation of the Turkish ULAQ KAMA drone in July 2023.

Moreover, returning to the NATO doctrine, in postwar conditions, in addition to “warfare and combat,” there is a crucial prospect for the use of complexes to ensure international security not only in the Black Sea but beyond it:

- USV can be used, in particular, to monitor the maritime environment to prevent illegal activities at sea, ensure freedom of navigation, and protect vital infrastructure (for example, we can talk about gas production platforms that international terrorists and/or aggressors may target).
- The potential for implementing multi-purpose vessels capable of detecting and defusing mines and explosive devices at depths of up to 200 meters at a distance of up to 100 nautical miles from the shore, which is relevant in the Black Sea.
- The potentially high effectiveness of such means for countering piracy in regions like the Gulf of Aden.
- The possibility of using such devices for faster and cheaper search and rescue operations. This means increasing the ability to establish the exact location of an accident.

Such capabilities can be especially decisive if they are adapted for use with modern technologies, such as (in a quite long-time perspective) artificial intelligence.

It is also interesting that the Russian side has attempted to use such developments. For example, in February 2023, a marine drone packed with explosives was used by the occupation forces to strike a bridge near the village of Zatoka, Odesa region, which is critical for the region's logistics.

Production Capabilities

As of today, the vast majority of production capacities in this industry are concentrated in the hands of private teams. Thus, the state is trying to ensure that the opportunities available on the market are utilized as efficiently as possible.

At the same time, there are no prospects for reducing the cost of this process, as most components (which make up a significant part of the cost of the device), such as microelectronics and various types of boards and sensors, are not produced in Ukraine and are purely imported.

Perspectives and Conclusions

Speaking about the combat experience of this type of platform, it is necessary to be both realistic (noting the Russian Navy's higher vulnerability compared to other possible adversaries due to the technical obsolescence of its equipment and weapons) and understand the high potential for the development of the relevant mechanism.

In particular, USV, can become a panacea that makes the use of shipboard platforms even more financially unprofitable or motivates the search for and development of countermeasures. Such mutual progress, in turn, will irrevocably change how we think about the water battlefield, as FPV drones have already changed the vision and approach to land operations.

Thus, USVs are cost-effective, efficient platforms for the entire range of maritime tasks. However, the effectiveness of such a vehicle varies significantly depending on the level

of enemy readiness and the architecture of the operational theatre. However, the most important factors will primarily be the training of USV personnel, the development of relevant doctrines, logistics, interaction with manned platforms, payload options, etc.

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