

# ASPECTS IN USAGE OF UNMANNED SURFACE VEHICLE IN UKRAINIAN WAR

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**Abstract.** The paper examines the usage of various applications of unmanned surface vehicles (USV) in naval operations in the war in Ukraine. Based on the open-source data various types of attacks and chronological development of the use of USV in Ukrainian war have been analysed.

**Keywords:** unmanned surface vehicle; remotely operated system; Navy; Ukrainian war

## Introduction

The key geopolitical location of the Black Sea region has come to the forefront with the growing importance of regional political dynamics, infrastructure projects and energy security. The region is distinctly diverse and has faced radically new challenges in recent years. These include the problems caused by the war in Ukraine and their impact on EU-Russia-NATO relations, as well as the complications generated by the lack of effectiveness of the European Neighborhood Policy.

Current research on the wider Black Sea Area is primarily concerned with its enormous conflict potential. There are significant differences between the countries in a number of areas such as political system, development of market economy and economic potential, cultural, religious, social, and other particularities. There are several opposing external engagements and geopolitical orientations, provoked by the commitment of a number of countries to NATO and

the EU. On the other hand, are Russia's attempts to create alternative models for attracting the countries of the post-Soviet space, which it perceives as its own historical sphere of influence. A characteristic feature is that in terms of the concentration of "frozen" conflicts, unrecognised and partially recognised states, the region holds first place in the world.

The military conflict between the Russian Federation and Ukraine demonstrates how it is possible to change the military-political situation and international priorities within a relatively short period. Predictions about the possible outcome of the conflict are not clear given the conflicting and inaccurate information in many aspects. In this conflict, the role of psychological and information operations, and strategic communication has come to the fore. It is evident that even in a local conflict, although not on EU territory, the economic consequences for the Union will be greater than probably predicted.

Ukraine lost 75% of its fleet when Russia annexed Crimea in 2014. The rest of the Ukrainian naval platforms were destroyed in the first months of the Russian invasion of Ukraine in February, 2022. At that moment, it appeared that the Black Sea was becoming dominated by the Russian Navy, but by involving asymmetric warfare with the use of unconventional weapons and tactics Ukrainians successfully opposed the stronger opponent. In the course of hostilities, there has been extensive use of unmanned systems. This is the first major conflict in which USV and unmanned aerial vehicles (UAV) have played such a prominent role. Both sides use these systems for a variety of purposes, including intelligence, surveillance, reconnaissance, strikes, logistics, defence and electronic warfare.

### **1. Unmanned surface vehicle as a weapon system**

Unmanned systems are evolving in all aspects with several being key to their future use as one of the primary means of warfare (Karemov & Dimitrov 2009). These affect communications, information processes, on-board sensors, autonomy, size of the USV and not least the stealth of the platform. Despite the general trends in their development, each type of system has its specific characteristics and capabilities to develop.

An unmanned surface vehicle, also called sea drone, is a boat or vessel that operates without a crew on the surface of the water (Yonchev 2023, pp. 173 – 179). There are various levels of autonomy. Some of them use remote control and the latest models are completely autonomous surface vehicles (ASV). In the 20<sup>th</sup> century, USVs were used as remote-controlled target vessels and for mine-

sweeping purposes. Later they became more widely used for a range of purposes apart from the military sphere. Their use expanded in environmental monitoring and conventional payload transport. In last decades the progress in USV remote control systems and course-plotting technologies have bring to USVs that are remotely controlled from land or a nearby vessel operator. Some of USVs are with partially autonomous control, and other (ASVs) function fully autonomously. Modern uses for USVs include commercial transport, environmental monitoring, seafloor charting, weather observation, robotic research, surveillance, check-up of infrastructure, maritime operations (Mizokami 2019).

The design and construction of USVs is complex and challenging. The main purpose of platform is to maintain high speed in combination with hardly visible low profile, much smaller than boat operating with people. Many issues concerning mission requirements have to be taken into account and implemented for different types of unmanned surface vehicles: hull design, payload capacity, communications, power requirements, propulsion and maneuvers control. According to the mission there are diverse categories USVs ranging in size from few centimeters to 30+ meters, with displacements varying from less than a kilogram to hundreds of tons.

Nowadays, Navy USVs applications can be used in missions such as: surveillance, reconnaissance, intelligence, driven gunfire and missile target boats for naval exercises, armed escort, minesweeping and mine-hunting, surface warfare, anti-submarine, strike operations, asymmetric warfare, force protection, sea denial and strategic facility security. All that types of USVs can be operated remotely from command centers, transportable land/air vehicles and floating platforms or just started for their independent functioning.

Knowledge of the environment is vital and to achieve a familiar picture of the maritime environment and situational awareness in the sea domain during a naval operation unmanned surface systems are currently proving to be quite suitable. Other important type in Kamikaze USVs that is loaded with explosives and aims hitting infrastructure or warships to damage or destroy them. These USVs loaded with munitions have essentially function as kamikaze drones or loitering munition, which can wait passively around the target area and attacks only once a target is located, recognized and confirmed, while a remote-control operator still has an opportunity to cancel the attack. There are two main reasons why those types of USVs can be so hazardous to ships than airborne weapons: they strike the waterline and the larger weight of their explosive loads.

Effective use of unmanned surface systems is achieved through the application of various methods and tactics, techniques, and procedures conducive to in-

creased naval power. Much of the means of employing USV are still at a conceptual or theoretical level of development, and in the conflict in Ukraine their practical use and further development of the tactics associated with them is taking place.

## **2. Use of unmanned surface vehicle in combat naval operations in Ukrainian war**

Unmanned surface vehicles were involved in naval battle on 29 October, 2022 when Ukrainian armed forces executed an attack at the Sevastopol Naval Base. That raid revealed the warfare potential of surface drones, performing a swarm attack on Sevastopol with combined involvement of USVs and UAVs. It was completed the first operation in the history of naval warfare in which air and sea drones were used in a coordinated manner to engage an enemy naval fleet while stationed. According to the open source information, seven USVs were used in the raid with support of eight UAVs. Unmanned vehicles travelled 300 km undetected and reached the protected port Sevastopol and attacked naval base. The coordination was executed by satellite communication system Starlink. It was claimed that both Russian warships hit by relatively small USVs suffered slight damages. That ships were frigate and a minesweeper. The USVs employed in attack were 5.5 meters long with a range of 400 kilometers, a 60-hour endurance, a weight of 1,000 kilograms, a warhead of up to 200 kilograms, and a maximum speed of 80 km/h (Satam 2023). The military outcome of that raid for the protected harbour surpassed the direct loss because it was followed by the Russian Navy transition to protective mode in the bases. Innovative force protection measures and defences were fast involved and new procedures were added. Also there were much less Russian warships activities in the next months. It became obvious that Russian Navy is vulnerable in its naval bases and that affected to its slight withdrawal from sea to bases combined with growing defences and decreasing active operations for ships outside the ports.

On 11 November, 2022 Ukraine has declared a goal to build the world's first naval fleet of drones with the support of a crowdfunding initiative "United24" (Galushko 2023). Soon after that a second USV raid followed in mid-November at night in Novorossiysk, also in the Black Sea but much further than Sevastopol. Despite, some Russian media provided contradictory information and denied the attack, these new examples of modern naval warfare have attracted attention of experts. Novorossiysk is a major naval base and oil terminal at 420 miles from Odesa and it is quite further than Sevastopol. Until that time, it was regarded as out of range of Ukrainian attacks.

After January, 2023, American company SpaceX limited the licensing of its Starlink satellite-internet communication equipment, rejecting direct military input on weapon systems. The restriction limited Ukrainian operations with unmanned surface vehicle. Meanwhile, the Russian Navy improved its capabilities of using small Kamikaze USVs and on 10 February, 2023 executed an operation by successfully attacking a bridge. A Russian drone boat packed with explosives smashed into a key Ukrainian bridge – a road-rail Zatoka Bridge across the Dniester estuary in the Odessa region, a strategic link between Ukraine and Moldova (Stewart and Oliver 2023). At that time, the prospective for wider usage of USVs to influence the outcome of war remained debated. It was considered that because of both physical limitations on current equipment and evolving counter-USV capabilities could render these vehicles vulnerable.

The third such type attack was executed on April 24, 2023, but this time involved only two USVs. One was destroyed while the second exploded itself without causing any damage (Satam 2023). The 2022 attacks took place in day hours when the visibility was good, but the last one from April 23 was done at night, indicating the Ukrainians had leveled up their capabilities.

On 24 May, 2023 “Ivan Khurs” reconnaissance ship was attacked from USVs in international waters around 70 nautical miles north of the Bosphorus Strait. The ship was protecting the TurkStream and Blue Stream gas pipelines at the time of the attack. Russia’s claim of destroying all three sea drones before reaching the ship, but leaked video shows that she was seemingly hit (Ozberk 2023).

Tensions raised in the Black Sea after Russia proclaimed in July, 2023 withdrawing from the Grain Initiative and started offensive raids with drones and missiles on Ukrainian ports on the Black Sea coast and on the Danube River, destroying tens of thousands of tons of Ukrainian grain. In response, on July 17 it was executed an attack against Russian-built Kerch strait Bridge connecting Crimea to the mainland. Ukraine’s Security Service (SBU) has claimed responsibility for a raid that damaged highway of the bridge and killed two civilians. The sea drone, called “Sea Baby”, was produced in Ukraine. Two of that type were loaded with 850kg TNT and used against bridge (Sabbagh 2023). Moreover, during the night of August 3 – 4, a Russian naval ship, “Olenegorsky Gorniyak”, was seriously damaged in a Ukrainian sea drone attack on the base at Novorossiysk. The 113-meter long Russian navy landing ship had been hit by a USV loaded with 450 kilograms of TNT (Waterhouse & Armstrong 2023). The vessel had to be towed ashore because it could not move under its own power after being damaged. “Olenegorsky Gorniyak” was the largest naval vessel damaged

since the sinking of the Moskva in April, 2022. On the next day after USV attack was damaged the Russian SIG oil and chemical tanker, suspending traffic and ferry transport services in the area. The tanker which owner is St. Petersburg-based company “Transpetrochart” was hit as it was approaching the Kerch Strait and that cause temporarily interrupting of traffic on the strategic bridge linking Crimea to Russia. It was announced that these drones are manufactured at a cost of \$250,000 each. They use two impact detonator taken from Russian bombs. With a length of 5.5 metres, they have a camera to allow a human to operate them (Zafra & McClure 2023). Given their relative low cost, compared to missiles or bombs, they can be deployed in a mass attack. Their low profile also makes them harder to hit.

Repeated Ukrainian attacks using sea drones have forced Russia to build up the security at the entrance to the military port of Sevastopol and around its warships based there. Measures include the addition of nets, pontoons and barriers, as well as the deployment of dolphins trained to detect enemy divers.

The conflict in Ukraine rapidly moved to the eastern coast of the Black Sea with an attack on the port of Novorossiysk by Ukrainian naval surface drones on August 4 (Grynszpan & Jégo 2023). The strike on this port, which integrates a military base, commercial facilities and an oil terminal, damaged a warship and interrupted shipping traffic for several hours. That commercial port is important for wheat and oil exports of Russia and by targeting it these important trade lines could be interrupted. The attack in Novorossiysk emphasizes Ukraine’s growing USV capabilities in the Black Sea battleground. Additionally, an unmanned Ukrainian speedboat was spotted near a Russian gas platform in the Black Sea on August 21, 2023. It was destroyed by a Russian Sukhoi Su-30SM fighter jet by firing a 30 mm automatic gunfire.

On August 24, 2023 Ukraine announced the establishment of the first in the world specialised USVs unit – 385<sup>th</sup> Separate Brigade. The initial goal was to assemble a “mosquito fleet” of 100 medium and small size USVs, whose tasks will include: protecting ports and territorial sea; patrolling the coastal area; preventing enemy warships from leaving their military bases; defending merchant vessels from possible attacks; accompanying naval operations; other military missions, surveillance and reconnaissance (Galushko 2023). The creation of a unit committed to a type of warfare which fundamentally didn’t exist 1.5 years ago is one of the significant marks of the changes we are witnessing in naval warfare.

It was reported that in the beginning of September 2023 Russia have sank barges as underwater barrier to protect the Crimean Bridge from south direc-

tion against Ukrainian USVs (Gavin 2023). The move came after Ukraine's Aug. 29 – 30 attempts to land a detachment of special operations forces on the coast of Crimea. Russian aircraft damaged four high-speed military boats carrying landing groups of Ukrainian special operations forces with 50 individuals. The landing was supported by unknown number of USVs attacking near Sevastopol Bay and used to deceive about the true direction of landing operation. Following that, on 1 – 2 September, 2023 three Ukrainian USVs attempted to crash into the Crimea bridge and were destroyed.

The largest attack on Sevastopol since the beginning of the war was executed on September 13, 2023. Ukraine attacked Crimea with missiles and sea drones, targeting Sevastopol base. In the strikes were used 10 missiles and 3 USVs. Seven of the missiles being shot down and the naval drones being destroyed by a Russian patrol vessel. Nevertheless, the raid damaged Large landing ship and a submarine that were in a ship repair dock in the port of Sevastopol (Sutton 2023).

Ukraine's ability to potentially reach with unmanned speed vehicles the Russian Naval bases and ships operating away from Ukrainian territory suggests that the country has completed considerable progress in its drone technology. At the same time Russian Navy in video clips demonstrated their defensive measures to counter such threats. Russia's increased ability to recognise, track, and counteract these comparatively smaller, faster-moving boats highlights its readiness to counter unconventional naval threats.

With the use of unconventional weapons and tactics such as USVs, anti-ship missiles and sea mines, Ukraine has managed to perform significant raids and keep distant superior naval force through asymmetric warfare. Ukraine's ability to launch long-range attacks displayed it's growing offensive capacity. Development of unmanned systems during the Ukrainian war indicate that future conflicts will likely combine different versions of the unmanned vehicles and different tactics for their usage. For example, dipping slightly below the surface just as the attack occurs and only the camera to assist in control. There may also be variants combining a flight phase and homing, including with options to go over barriers in front of the port. Probably future attacks will also include underwater unmanned vehicles, which are inherently stealthier than USVs. The use of unmanned vehicles supports the sustainment and growth of force capabilities in maritime operations. The joint use of unmanned and manned assets, as well as the group use of UAVs, has been found to be more effective than single use, respectively.

The new Ukrainian capability with USVs is proceeding the trend of changing the balance in the naval war. This process shows that relatively small fleet

could oppose much superior rival by constantly involving new combined tactics with unsymmetrical usage of swarms consisting of small fast moving and manoeuvrable vehicles like USVs and UAVs, combined with missile hits. The technical characteristics of the USV have been identified as a major factor in the choice of method for their use in naval operations.

### **Conclusions**

1. Although the unmanned surface vehicles raids remain covered in contradictory claims, it demonstrates the evolving nature of naval combat, the role of unmanned vehicles, and the rising risks involved in the Black Sea region's geopolitical tension.

2. The complex maritime battlespace allows for the future upgrade and diversification of tactics through the use of a combination of fast and manoeuvrable small vessels and unmanned vehicles simultaneously with usage of missile strikes, electronic warfare and deception tactics. The use of USVs in the future armed conflicts could have wider implications for sea security. If they are indeed effective and become more widely used, they will probably challenge traditional naval power structures and force changes in naval defense strategies worldwide. A wide horizon is opening up for the joint use of remotely operated systems - surface, underwater, airborne and land-based, in combination of their advantages for the specific environment and task. Used in a swarm and with appropriate joint command and control by an AI system they are likely to be the basis of naval operations tactics in the future. In a number of cases, the use of unmanned systems allows the solution of tasks impossible to solve with manpower, while preserving the life and health of personnel.

3. It calls into question the need to maintain a costly fleet of large platforms instead of one built with a majority of lower cost unmanned systems. The Bulgarian defence industry has the potential to produce USVs at relatively low cost. The use of small USVs is more affordable for fleets such as the Bulgarian Navy, as they help to optimize security and defense costs while supporting successful mission accomplishment. The Bulgarian Navy can benefit from the implementation of unmanned systems in maritime operations to acquire and develop new capabilities. The implementation of unmanned systems in the Bulgarian Navy should be based on a detailed cost-benefit analysis.

4. The diverse of narratives presented by Ukraine and Russia emphasise the nature of information warfare, where both side aims to impact opinions through their description of events. By using USVs and showing results from



their attacks in videos, news and social media or declaring absents of damages each side claim to be telling the truth. The truth often lies somewhere in between, but that is a good example of ongoing cognitive warfare efforts from both sides.

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