SNAKE ISLAND INSTITUTE

Operational Lessons from Ukraine for 21st-Century Naval Forces

Editor’s Note

This report is the product of months of research and direct collaboration with Ukraine’s special operations and naval units in the Black Sea. It documents how a nation lacking a traditional fleet forced the Russian Navy into retreat, a feat that should be impossible under every strategic framework taught in war colleges.

Ukraine has demonstrated that traditional assumptions about sea power—fleets, tonnage, and capital ships—no longer guarantee dominance. Distributed, attritable systems with precision targeting can deny sea control to conventionally superior forces at cost ratios that make traditional naval procurement look like organized waste. The implications extend beyond the Black Sea; the ability to integrate unmanned platforms into coherent strike campaigns can now deny even the largest adversary freedom of action.

For allies and partners, from the Baltic to the Indo-Pacific, this is not a theoretical exercise. The question isn't whether smaller nations can challenge naval powers anymore. Ukraine proved they can. The question is whether established naval powers can adapt their doctrine, procurement, and strategic thinking fast enough to remain relevant.

This study is deliberately comprehensive. It serves both as an operational record of Ukraine’s asymmetric campaign at sea and a forward-looking doctrinal assessment. Some readers will turn to the case studies; others to the strategic implications. Some readers will find value in the technical cases; others will focus on the strategic conclusions. Whatever your entry point, we encourage you to see this not just as Ukraine’s story, but as a blueprint for modern maritime forces facing peer threats.

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Director of Analytics

A special thank you to our partners at the **Ukrainian Council of Defence Industry** for their contributions to the sections on our maritime unmanned systems industry and emerging technologies.

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Executive Summary

Ukraine's Black Sea campaign provides the clearest operational record to date of how unmanned surface vehicles (USVs) can achieve strategic effects against a superior naval force. With no functioning fleet at the outset of the war, Ukraine employed USVs, special operations integration, and rapid industry–military adaptation to degrade Russia's Black Sea Fleet, limit its freedom of maneuver, and protect Ukraine's maritime approaches.

Key Operational Insights

- **Improvised to integrated operations:** Initial ad hoc strikes in 2022 evolved into coordinated, multi-axis attacks in 2023–24 that combined USVs, aerial drones, and precision fires.
- **Decisive engagements:** The sinking of the Ivanovets missile corvette (Jan 2024) and the destruction of the *Caesar Kunikov* landing ship (Feb 2024) demonstrated that coordinated USV strikes could eliminate defended, high-value targets.
- **Effects on Russian operations:** Over 20% of the Black Sea Fleet has been destroyed or disabled. Russia has withdrawn major vessels from Sevastopol, curtailed strike missions, and reduced logistical presence in contested waters.
- **Industry–military feedback loop:** Platforms such as *Sea Baby* and *MAGURA V5* were refined through continuous frontline feedback, demonstrating the feasibility of combat-driven naval R&D cycles measured in months rather than years.
- **Cost exchange:** Ukraine's campaign imposed favorable cost ratios, with relatively low-cost unmanned assets inflicting outsized damage on complex, high-value Russian vessels.

Implications for Allies

- **Doctrine:** Modern littoral operations can achieve sea denial without traditional fleets. Future naval doctrine must incorporate unmanned, distributed, and attritable systems as central — not auxiliary — capabilities.
- **Countermeasures:** Russia's reliance on ad hoc defenses (booms, nets, small-arms fire) proved inadequate. Counter-USV and integrated littoral defense should become priority R&D areas for NATO and partner navies.
- **Force design:** Small and mid-sized allies can leverage USVs to offset disadvantages in conventional tonnage, while larger navies should consider integrating USV squadrons to reduce dependence on high-value capital ships in contested zones.

Conclusion:

Ukraine's campaign has provided a rare, combat-tested data set on unmanned maritime operations. For the United States, NATO, and partners, the lessons from the Black Sea underscore the urgency of integrating USVs, strengthening countermeasures, and building faster industry–military innovation cycles into naval planning.

The Strategic Shift to Asymmetry

When Russia launched its full-scale invasion in February 2022, Ukraine confronted the maritime dimension of the conflict in a uniquely precarious position. The Ukrainian Navy, chronically underfunded and overlooked for most of Ukraine's modern history, had deliberately scuttled its flagship frigate *Hetman Sahaidachny* to deny its capture, leaving the country without a conventional fleet. Today, the half-submerged frigate in Mykolaiv stands as a stark reminder of the series of strategic missteps that shaped Ukraine's earlier approach to maritime security. Rather than enabling the development of a capable navy, political miscalculations and a set of international agreements constrained Ukraine's ability to build and modernize its fleet. Far from strengthening maritime security, these arrangements left the country with limited tools to deter or counter Russian aggression at sea — a dynamic that will be examined in greater detail later in this chapter.

The first of these was the Massandra Accords of 1993, which attempted to settle the future of the Soviet Black Sea Fleet. The accords envisioned a joint Ukrainian–Russian command until 1995, followed by a 50-50 division of the fleet, with each state forming its own naval forces. A joint command was to oversee the transition, while Russia was assured continued access to bases in Crimea. However, Moscow soon abandoned the principle of equal division, demanding a greater share of ships and infrastructure. The Ukrainian parliament never ratified the accords, but some of their provisions operated de facto until the next stage of negotiations.

Then, in May 1997, Ukraine and the Russian Federation signed a package of three interrelated treaties that regulated the division of the former Soviet Black Sea Fleet and the conditions of its continued presence in Crimea. The Agreement between Ukraine and the Russian Federation on the Status and Conditions of the Black Sea Fleet of the Russian Federation on the Territory of Ukraine [1], the Agreement between Ukraine and the Russian Federation on the Parameters of the Division of the Black Sea Fleet [2], specifying the distribution of ships and infrastructure, and the Agreement between Ukraine and the Russian Federation on Mutual Settlements Related to the Division of the Black Sea Fleet and the Presence of the Black Sea Fleet of the Russian Federation on the Territory of Ukraine [3], setting the financial terms of the deal, created structural vulnerabilities which institutionalized Russian military presence in Crimea until 2017. These agreements made Ukraine dependent on Russia for energy supplies and left it with an unevenly divided fleet, severely limiting Kyiv's capacity to build, modernize, and operate an independent navy. Ukraine agreed to transfer approximately 81.7% of the former Soviet Black Sea Fleet's ships to Russia, while key Crimean bases were leased for 20 years with an automatic five-year extension — including Sevastopol and others. Russia paid Ukraine $97 million annually for the lease of these bases, though the payments were offset through reduced gas prices — in effect linking the fleet's presence to Ukraine's energy obligations to Russia. As a result of the official division of the Soviet Black Sea Fleet in 1997, the Ukrainian Navy received 43 warships, 132 auxiliary vessels and boats, 12 aircraft, 30 helicopters, 227 coastal facilities, as well as other equipment, weapons, and ammunition - most of which, however, proved unfit for effective use. One of the principal bases of the newly formed Ukrainian Navy was located in Crimea. However, following its occupation in 2014, Crimea was transformed into a heavily militarized stronghold of the BSF.

A further turning point came in 2010 with the Agreement between Ukraine and the Russian Federation on the Stay of the Black Sea Fleet of the Russian Federation on the Territory of Ukraine, commonly referred to as the Kharkiv Agreements. Signed under President Viktor Yanukovych, the treaty extended Russia's right to station its fleet in Sevastopol until 2042 (with the possibility of prolongation to 2047) in exchange for discounted prices on Russian natural

1. Agreement between Ukraine and the Russian Federation on the Status and Conditions of the Black Sea Fleet of the Russian Federation on the Territory of Ukraine (1997). zakon.rada.gov.ua
2. Agreement between Ukraine and the Russian Federation on the Parameters of the Division of the Black Sea Fleet, (1997). zakon.cc

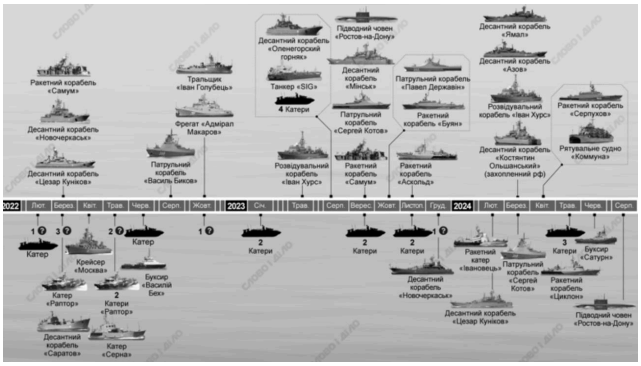
gas. While presented as an economic concession, the agreement deepened Ukraine's dependence on Russian energy supplies and entrenched Russia's military presence in Crimea beyond the original 2017 horizon.

In practice, the aforementioned documents institutionalized Ukraine's naval vulnerability: limited assets, aging equipment, and strategic dependence. All of this resulted in the fact that, by 1 January 2022, Ukraine's combat fleet was reduced to a minimal structure.

War Archive. Ukrainian fleet in March 2022

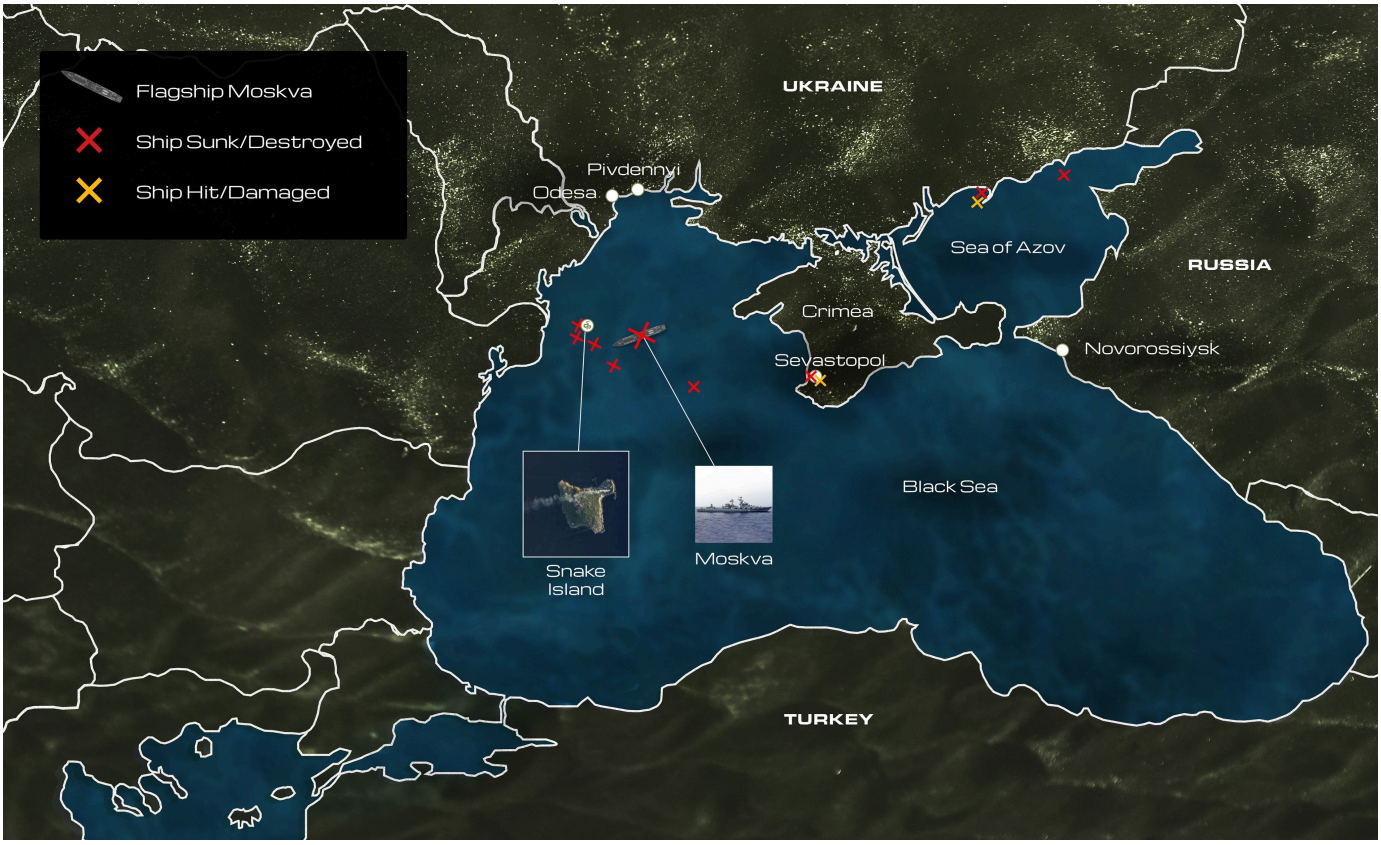
In all of these ships, the pressing concern was not merely their presence, but their ability to withstand — or repel — a Russian attack. During the division of the Soviet Black Sea Fleet in 1997, the most modern and capable vessels were allocated to Russia, leaving Ukraine with aging or obsolete platforms. Analysts describe Ukraine's inherited fleet as being in "deplorable condition," with many ships rendered inoperable or later scrapped — about 40% of warships and boats were lost between 1997 and 2004 due to wear and technical obsolescence [4]. Furthermore, between 2004 and 2013, a total of 24 warships and boats were withdrawn from the Ukrainian Navy due to age and limited resources for maintenance. In the same period, several large-scale naval programs inherited from the Soviet Union were also terminated. These included the Project 1164 *Slava*-class guided missile cruiser *Admiral Lobov* and the Project 1143.7 *Ulyanovsk*-class nuclear-powered aircraft carrier, both of which were over 70% complete at the time of Ukraine's independence. Successive Ukrainian governments opted to sell these platforms, citing their inconsistency with national defense doctrines and the prohibitive costs associated with their completion and operation. In turn, Ukraine launched a number of programs aimed at rebuilding naval capabilities, which included the construction and acquisition of new vessels as well as the modernization of existing corvettes, minesweepers, and missile boats. Nevertheless, the majority of these initiatives were constrained by chronic budgetary limitations. During its first decade of independence, the Navy succeeded in commissioning only a single new combat vessel — the Ternopil (U209), a Grisha V-class small anti-submarine ship. Against this near absence stood the Russian Black Sea Fleet, which fielded a potent mix of surface combatants, submarines, and amphibious units capable of enforcing blockade, supporting amphibious threats against Odesa, and conducting long-range missile strikes on critical infrastructure and urban centres. For instance, Russian Navy cruiser Moskva was the only Russian ship in the Black Sea that was armed with the long-range anti-air missile system S-300F, which allowed it to control skies not only over Snake Island, but almost from the western coast of Crimea to key Ukrainian southern ports due to a remarkable 90-kilometer range. This made the ship a key asset of air defense that had to assist in future amphibious landings. By any measure, the disparity suggested that Ukraine would be unable to contest the maritime domain. Yet over the following three years, Ukraine engineered an unexpected transformation of this balance. Through a sequence of improvisations, rapid adaptation cycles, and the operational integration of new technologies, Kyiv shifted the contest from a traditional confrontation at sea into an asymmetric campaign that steadily eroded Russia's initiative and culminated in the enforced withdrawal of major Russian assets from Sevastopol to safer harbours at Novorossiysk.

3. Agreement between Ukraine and the Russian Federation on Mutual Settlements Related to the Division of the Black Sea Fleet and the Presence of the Black Sea Fleet of the Russian Federation on the Territory of Ukraine (1997). https://zakon.rada.gov.ua
4. Çetiner, Y. (2024). From Stability to Asymmetry: The Ukrainian Navy. Overt Defense. overtdefense.com



Slovo i Dilo. Losses of Russia's Black Sea Fleet in the war against Ukraine until August 2024

To achieve this, Ukraine deliberately pursued a sea-denial strategy, relying not on parity of fleets but on coastal missile batteries, sea mines, improvised strike platforms, and increasingly the employment of unmanned surface vehicles (USVs). This approach enabled the gradual reopening of maritime corridors vital to Ukraine's grain exports and progressively constrained the Black Sea Fleet's ability to project power. By early 2024, the cumulative effect of repeated strikes and the persistent threat of drone attacks compelled Russia to relocate key units eastward, a strategic retreat underscoring the success of Ukraine's asymmetric posture.



Reported successful attacks - Black Sea 2022-2023

The mechanism of this success was rooted less in technological novelty than in organisational and societal capacity for adaptation under extreme pressure. RAND analysis stresses that the Ukrainian case demonstrates how low-cost uncrewed systems, when embedded in a rapid cycle of prototyping, battlefield testing, and iterative modification, can achieve operational effects once reserved for high-end precision munitions [5]. The financial underpinning for this process was similarly unorthodox: public crowdfunding initiatives, supplemented by state resources and private engineering talent, created a uniquely accelerated innovation cycle. In this manner, Ukraine began to assemble what naval analysts at the U.S. Naval Institute described as a "technological navy" — a force not defined by large hulls or traditional shipbuilding but by a distributed web of uncrewed platforms, coastal strike systems, and layered intelligence, surveillance, and reconnaissance (ISR) integration that could be fielded and scaled under conditions of economic duress.

For NATO littoral states such as Romania and Bulgaria, Ukrainian developments provide a practical template for cost-effective deterrence under the constraints of the Montreux Convention, the 1936 treaty that gives Turkey control over the Bosporus and Dardanelles and strictly limits the presence of non – Black Sea navies in the region.

For smaller navies outside the region, particularly in the Baltic and Indo-Pacific, they present a model of how denial strategies can be constructed without reliance on carrier groups or large fleets. Though we must be cautious to avoid oversimplifying through transposition; the confined geography of the Black Sea, its heavy littoral orientation, and the particular operational circumstances of the Russo-Ukrainian war are not easily replicated elsewhere.

What emerges from this trajectory is the recognition that naval warfare in the twenty-first century is undergoing a doctrinal rebalancing. The dominance of carrier strike groups and nuclear deterrence at sea — central to the late Cold War and its aftermath — is increasingly supplemented, and in some cases challenged, by swarming uncrewed systems, persistent ISR, and precision strike from platforms that are comparatively cheap, adaptable, and expendable. In this sense, the Black Sea functions not only as a regional battlefield but as a laboratory of future war, providing early indications of how naval doctrines may evolve under the combined pressures of technological diffusion, fiscal constraint, and geopolitical competition. Ukraine's asymmetric maritime strategy is thus both a national adaptation to existential threat and a global harbinger of change in the conduct of naval warfare.

5. Hvizda, M., Frederick, B., Laufer, A., Evans, A. T., Gunness, K., & Ochmanek, D. A. (2025). Dispersed, Disguised, and Degradable. RAND. rand.org

From Blockade to Breakthrough: Ukraine's Asymmetric Naval Warfare in the Black Sea

After the annexation of Crimea in 2014, Russia elevated the Black Sea Fleet into the linchpin of its regional strategy, concentrating its modernisation efforts at key Crimean ports: Sevastopol, Feodosiya, and Donuzlav [6]. It further gave Russia the opportunity to secure de facto control of the Kerch Strait and the Sea of Azov, and expand its effective coastline from 421 km to over 1,200 km, encompassing nearly 500 additional kilometers of Azov shore [7].

For Ukraine, the loss of a significant share of naval capabilities in 2014 - including nearly 75% of its ships and vessels - forced a strategic rethink. In the following years, the Ukrainian Navy began developing and implementing the concept of a "mosquito fleet". This concept provided the gradual expansion of the fleet, relying primarily on small but well-equipped boats.

War Archive. Key Russian military airbases and ports in the Black Sea

Since 2014, the Russian Black Sea Fleet has been expanded with three Admiral-series frigates (with three more planned but blocked by Ukraine's suspension of gas turbine deliveries after 2014), four Buyan-M missile corvettes, several patrol ships such as Vasily Bykov, and six submarines. The buildup also included stronger coastal defense forces and expanded naval aviation.

By February 2022, Russia held naval superiority both in the Black Sea and the Sea of Azov. Its strategy was clear: blockade Ukrainian ports, threaten amphibious landings, and support ground operations from the sea. With additional forces stationed in Novorossiysk and air power based across Crimea, the peninsula functioned as a "stationary aircraft carrier," securing control of both sea and air in the Black Sea theater.

Surface combatants. The Black Sea Fleet entered the war with three Admiral Grigorovich-class frigates (Project 11356R) carrying 8-cell UKSK launchers for Kalibr, several Kalibr-capable small missile ships (Project 21631 Buyan-M), legacy patrol/missile craft, and the cruiser Moskva (Project 1164) providing the only afloat area air-defense umbrella (S-300F Fort, ~90 km engagement).

Subsurface. Six Improved Kilo (Project 636.3) submarines, all Kalibr-capable, constituted the theater's quiet strike arm; Moscow publicized Black Sea submarine Kalibr launches by late April–early May.

Amphibious. In January–February 2022 Russia surged six additional landing ships from the Northern and Baltic Fleets (five Ropucha-class + one Ivan Gren) into the Black Sea, augmenting BSF's organic LSTs and creating credible lift for at least a reinforced battalion-to-regimental echelon per wave, depending on armor mix and beaching conditions. The surge, tracked daily via the Straits, was the visible lever behind the Odesa amphibious threat.

Coastal troops and missiles (Crimea). BSF coastal forces (notably the 11th Coastal Missile Artillery Brigade and 15th Coastal Missile-Artillery Brigade) fielded K-300P Bastion-P (P-800 Oniks) and Bal (Kh-35) shore-based ASCMs. With S-400 batteries emplaced in Crimea and an established coastal radar net (Monolit-B; supplementary surface-wave OTH such as Podsolnukh-E), Russia built a cross-domain A2/AD belt projecting 250–400 km over the north-western Black Sea — exact arcs vary by missile/radar geometry, but the effect was to push Ukrainian surface movement off the water and complicate NATO ISR presence.

6. Manaranche, M. (2020). Russia's Black Sea Fleet Completes the First Stage of its Modernization. Naval News. navalnews.com
7. Lewis, D. (2019). Strategic Culture and Geography: Russia's Southern Seas after Crimea. George C. Marshall European Center for Security Studies. marshallcenter.org

War Archive. Russian Black Sea Fleet in 2022

On February 24th, 2022, Russia's main goals on the Black Sea were to:

- **prevent any Ukrainian naval activity.** By blocking Ukrainian naval operations, Moscow aimed to isolate Ukraine's key commercial ports and remove any threat of Ukrainian naval interference with Russian logistics or amphibious maneuvers. This was also intended to impose a de facto blockade, crippling Ukraine's exports and leveraging economic pressure and food insecurity as tools of coercion. Ukraine transported around 90% of its grain exports by sea in 2021, covering about 18% of world maize exports, and 12% each for wheat and barley. That was a total dominance of the Black Sea, which effectively controlled all waters beyond the coastal engagement envelope of Ukraine's Defense Forces (roughly 25 km from the shoreline).

- **hold open sea lines to occupied ports in the Sea of Azov.** Maintaining uninterrupted sea access to Mariupol, Berdyansk, and other captured ports was critical for Russia's supply chains and troop movements. Open sea lines would allow the Kremlin to integrate these territories economically and militarily with the wider Russian war effort, reinforcing its hold on the occupied Azov coast.

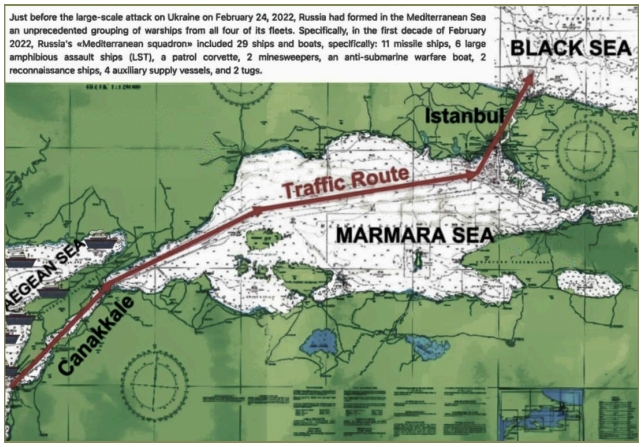
- **generate persistent land-attack strikes from the maritime domain.** By launching Kalibr cruise missiles from surface ships and submarines, Moscow could sustain pressure on Ukraine's infrastructure, energy grid, and command structures, projecting power far beyond the coastline. 225 Kalibr missiles were launched in just the first two months of the war.

- **preserve an amphibious option** that would fix Ukrainian maneuver brigades and force defensive investment along the coast, even if it were never implemented. This preserved amphibious option was intended to stretch Ukrainian resources, delay counteroffensives, and create uncertainty about where Russia might open a new front.

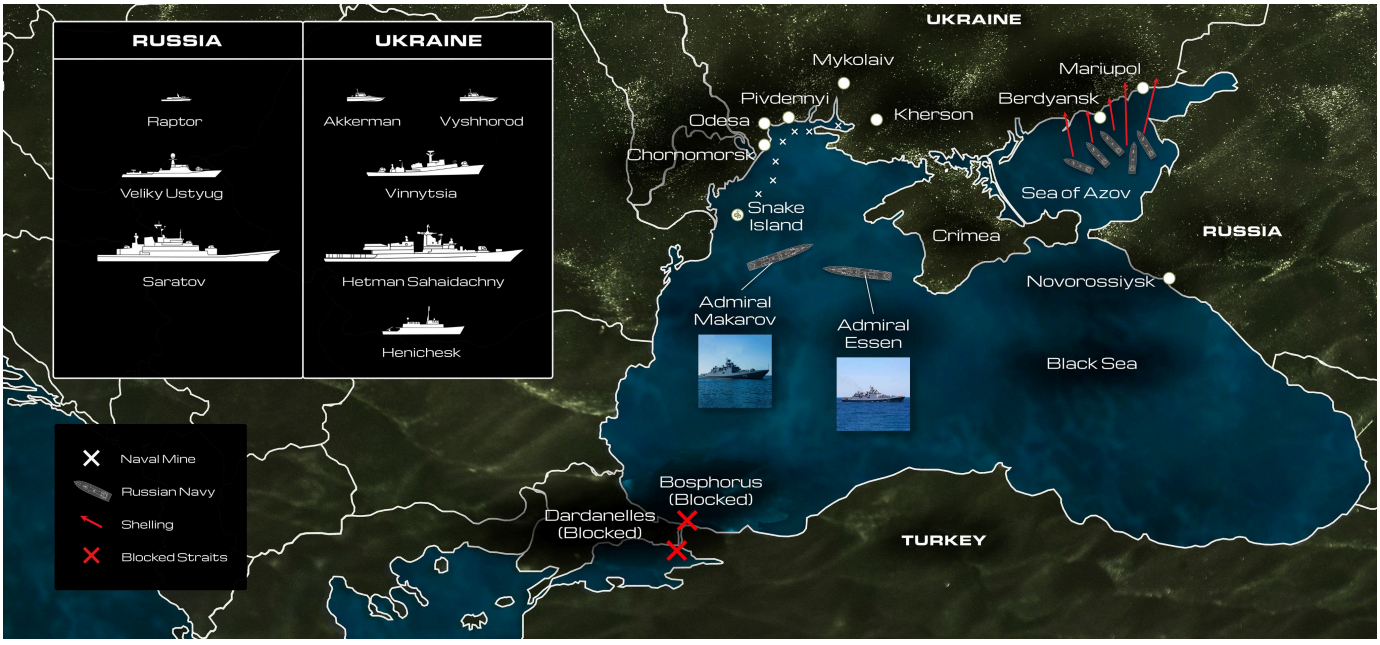
The desired practical effect was de-facto control: commercial traffic deterred or halted, Ukrainian naval activity suppressed, and Russia free to strike ashore and move when and where it chose. Early outcomes matched these aims: insurers designated the Black Sea/Sea of Azov "high risk" (February 15) [8], and port closures plus drifting mines and coastal warnings curtailed merchant navigation — a blockade in effect if not in formal legal terms.

The desired practical effect was de-facto control: commercial traffic deterred or halted, Ukrainian naval activity suppressed, and Russia free to strike ashore and move when and where it chose. Early outcomes matched these aims: insurers designated the Black Sea/Sea of Azov "high risk" (February 15) [8], and port closures plus drifting mines and coastal warnings curtailed merchant navigation — a blockade in effect if not in formal legal terms.

On the other hand, this closure also limited the involvement of Ukraine's partners in the naval dimension of the war. No allied warships could enter the Black Sea to provide direct support, meaning that Ukraine was left to fight exclusively with its own forces. This reality created both a vulnerability and an opportunity: deprived of external naval reinforcement, Ukraine faced the necessity of improvisation, which in turn spurred the rapid development of asymmetric tactics, such as the use of coastal missile batteries, uncrewed surface vessels, and precision strikes against Russian naval assets.



Russian warships blocked in the Aegean Sea. Unable to pass into the Sea of Marmara and, consequently, the Black Sea, these ships were prevented from reinforcing Russia's Black Sea Fleet from other theaters [11]



The Black Sea Battlespace: Spring 2022

8. Saul, J. (2022). London marine insurers add Russian, Ukrainian waters to high risk list. www.reuters.com
9. Convention Regarding the Regime of the Straits (Montreux Convention), (1936). cil.nus.edu.sg
10. Pedrozo, R. (2022). Closing the Turkish straits in times of war. Lieber Institute West Point. lieber.westpoint.edu

In the meantime, Russia's naval dominance in the Black Sea and the Sea of Azov had immediate and severe consequences for Ukraine's ability to maneuver and defend its coastline. First, the mere presence of Russian warships curtailed Ukrainian movement at sea, effectively locking down the country's naval options and enforcing a de facto blockade — not only through direct naval presence but also via strategic mine-laying. Since the invasion began, both sides have deployed hundreds of naval mines in the Black Sea to control access and deny port approaches. Many of these mines — especially those laid by Russia — began drifting from their moorings, creating widespread hazards for civilian and military vessels alike, prompting navigational warnings from NATO and disrupting Ukrainian grain exports.

Second, Russian naval assets provided platforms for sustained missile and artillery strikes against Ukrainian cities and infrastructure, extending the war's destructive reach far beyond the front lines. In the Siege of Mariupol, the Black Sea Fleet's fire support was instrumental. Russian warships bombarded the port city from the Sea of Azov starting late February 2022, intensifying pressure on defenders and aiding ground operations; in Berdyansk, a strategic logistics hub, rocket and artillery fire from naval platforms supported Russian advances ashore.

At the same time, missile strikes on Ochakiv Port degraded Ukraine's naval reconnaissance capabilities and eliminated important coastal infrastructure. Airpower from Crimea supported the wider southern offensive — pushing through Kherson and Enerhodar — with the objective of breaking through to Mykolaiv and ultimately Odesa.

Snake Island, a small but strategically located outpost near Odesa that controls key sea routes, quickly became a focal point. A Ukrainian garrison of about 80 soldiers refused to surrender, and despite heavy bombardment that destroyed all facilities, the border guards continued their defense. Russia brought in the cruiser Moskva, the patrol ship Vasily Bykov, Su-24 aircraft, and artillery, eventually capturing the island and turning it into a military base.

The Ukrainian rescue vessel Sapphire, which attempted to evacuate the garrison, was also seized by Russian forces.

Ukraine's already limited naval assets suffered further losses. In March 2022, the patrol boat *Sloviansk* departing from Ochakiv was attacked by a Russian Su-34 aircraft, which struck it with a Kh-31 anti-ship missile. Around the same period, Ukraine's only inshore minesweeper, *Henichesk*, was also destroyed by a Russian missile strike. Ukrainian forces responded on March 7, hitting a target at sea with MLRS fire, likely damaging the corvette Veliky Ustyug [12]. Soon after, Russian landing ships withdrew to Sevastopol, leaving only the frigates Admiral Essen and Admiral Makarov to patrol near Snake Island.

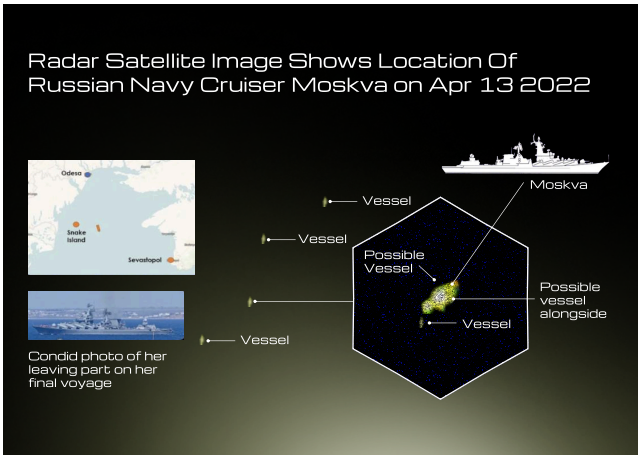
Meanwhile, the Sea of Azov has effectively been turned into an internal Russian sea. After imposing a blockade on Mariupol, which cut Ukraine off from maritime communications in the region, Russian forces attacked the port and damaged the Ukrainian naval boats Lubny and Kremenchuk. At the same time, Russian Raptor-class boats attempted to land sabotage groups through minefields. In response, Ukrainian forces employed a 9K111 Fagot (AT-4 Spigot) anti-tank guided missile, striking and damaging one of the Raptors [13]. This became the first recorded case of such a weapon being used against a naval target, forcing the Russians to retreat.

These losses underscored the overwhelming imbalance at sea. The first stage of the sea war showed a temporary stalemate. Russia controlled Snake Island and maintained a blockade of Ukraine's coastline. One of Moscow's goals was to threaten and prepare for a possible landing on the coast of Odesa. However, the operation was repeatedly postponed. Eight large landing ships stopped near Donuzlav, while Ukraine kept its remaining vessels under coastal defenses to avoid air and missile strikes. The missile boat Pryluky patrolled off Odesa, shadowed at a distance by Russian frigates in a show of pressure Beyond surface firepower, the Russian Black Sea Fleet also became a principal launch platform for Kalibr cruise missile strikes, with frigates, corvettes, and Improved

11. Deployment of Russian Warships in the Mediterranean as of November 1, 2023 BlackSeaNews (2023). www.blackseanews.net

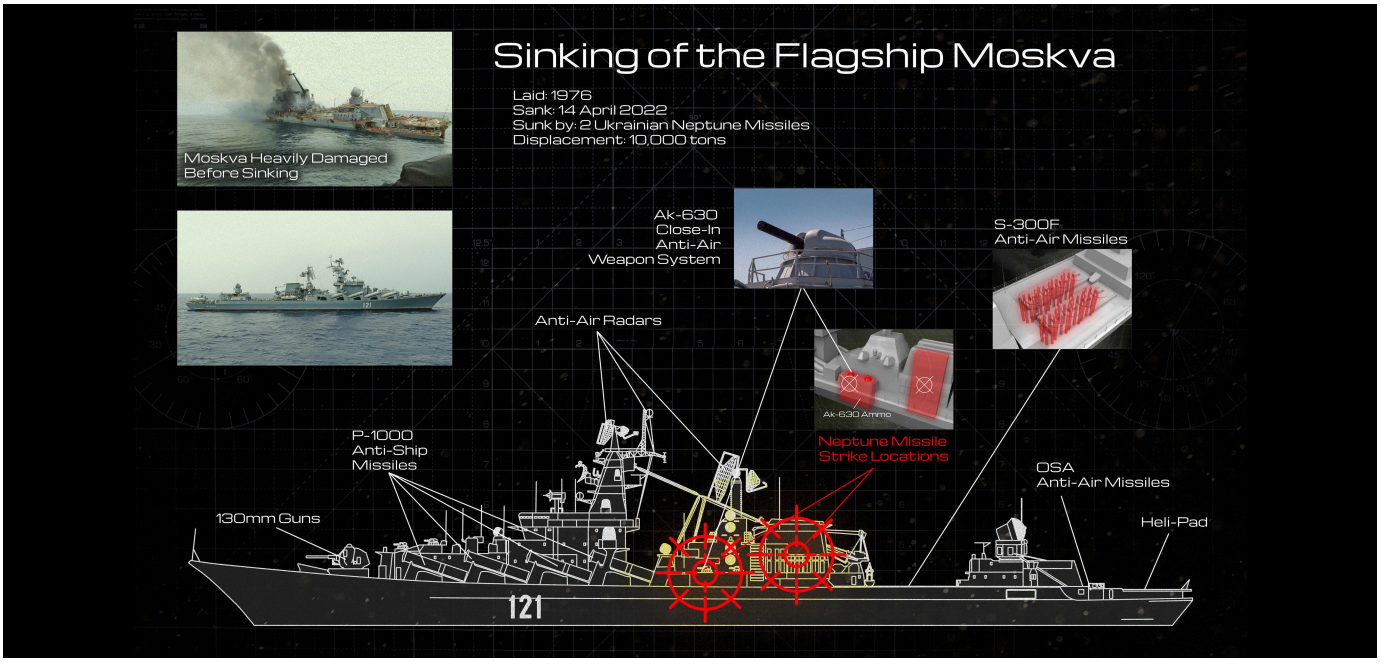
Kilo-class submarines firing salvos against critical infrastructure and urban centers deep inside Ukraine. This maritime-based missile campaign highlighted the dual role of the fleet: not only to deny Ukraine freedom of maneuver at sea but also to project destructive power far inland.

The shift in balance was marked by the destruction of the *Moskva* in April 2022 by domestically developed Neptune anti-ship missiles. While tactically significant, its larger impact lay in the demonstration that even Russia's most prestigious naval asset could be neutralised by Ukraine's indigenous capability, undermining Moscow's aura of invulnerability and signalling the vulnerability of traditional surface platforms to relatively low-cost strike systems.
The sinking of the Moskva demonstrated a fundamental shift in naval warfare: modern anti-ship cruise missiles can penetrate existing layered defenses and deliver catastrophic damage. The Ukrainian Neptune missile has a maximum range of approximately 280 kilometers (174 miles). At the time of the strike, the Russian cruiser — measuring about 600 feet in length — was positioned east of Snake Island, approximately 150 kilometers (93 miles) from Odesa and 90 kilometers (56 miles) from the Ukrainian coast, well within engagement range.



H. I. Sutton. Location of the Russian Navy Cruiser Moskva on April 13, 2022. **14**

The primary mission of the Moskva was to provide aerial defense over the maritime domain — especially protecting Snake Island and the approaches stretching from the Liman area to Odesa. Thanks to its sinking, Ukraine was finally able to regain control of Snake Island; until that moment, such an outcome would have been difficult if not impossible.



H. I. Sutton. Observed Damage to Russian Navy Cruiser Moskva. **15**

12. Defence Blog (2022). New photos show damaged Russian corvette after Ukrainian forces attack. defence-blog.com
13. Kushnikov, V. (2022). The russians confirm the damage to the Raptor-class boat near Mariupol. Militarnyi. militarnyi.com/en

Targeting efforts were supported by aerial reconnaissance carried out by Bayraktar TB2 drones, which provided critical targeting guidance for the Neptune missiles. What is particularly noteworthy is the mismatch between the missile's design parameters and its actual effect. The Moskva displaced over 10,000 tons, whereas the Neptune's 150-kilogram warhead was originally intended to disable or sink ships of up to 5,000 tons displacement — the cruiser was nearly twice as large as the class of targets for which Neptune was optimized. The fact that two missiles were sufficient to critically damage such a vessel underscores both the vulnerability of even large surface combatants and the potential of relatively light missile systems when combined with tactical surprise.

The cruiser's loss critically reduced Russia's long-range air defense coverage over the northwestern Black Sea, as it was the only Russian ship in the Black Sea that was armed with the long-range anti-air missile system S-300F, which allowed it to control a remarkable 90-kilometer range. In the absence of this protective umbrella, Ukraine was able to expand the tempo and effectiveness of precision strikes against Snake Island.

After the loss of the Moskva, Russia relied on medium vessels such as the supply ship Vsevolod Bobrov and the tug Vasily Bekh, even equipping the latter with a Tor air-defense system. On June 17, during a resupply mission, Vasily Bekh was struck by two Harpoon missiles supplied to Ukraine by Denmark; a Bayraktar drone recorded both hits, and the ship sank within minutes.

Center of Journalistic Investigations. A second anti-ship missile closes on the Russian tugboat moments after the initial explosion (TB2 Bayraktar footage). **16**

14. Sutton, H. I. (2022). OSINT Suggests Around Half Of Moskva's Crew Killed Or Injured. hisutton.com

Following the sinking of the Moskva, Ukraine intensified its campaign against Russian positions on Snake Island using a range of precision strike capabilities. Most notably, the Bayraktar TB2 UAVs were armed with MAM-C and MAM-L laser-guided glide bombs, which enabled highly accurate attacks on key targets such as command posts, air-defense systems, and naval vessels.

The Bayraktar TB2 is armed with a) MAM-C and b) MAM-L laser-guided glide bombs. Ukrainian Navy examples have c) infrared optics and d) Tualcom 'Anty' GPS-GNSS anti-jammer antenna. **18**

In early May 2022, TB2 drones played a decisive role in neutralizing several Russian assets:

- On 3 May, drones struck and destroyed a Strela-10 short-range surface-to-air missile system, followed by a Tor-M2 air-defense system shortly thereafter
- On 2 May, TB2s sank two Raptor-class patrol boats, marking a significant milestone as one of the first successful drone-enabled naval strikes
- On 7 May, a TB2 drone destroyed a Serna-class landing craft, which was transporting a Tor air-defense system to the island

The TB2's modular design and rapid deployability allowed Ukraine to penetrate Russian defenses without risking aircrew. These operations represented a pioneering integration of drone reconnaissance and strike with conventional air support, paving the way for future multi-domain employment of unmanned platforms.

This shift did not erase the underlying asymmetry, as Ukraine still lacked a conventional fleet, but it created space for adaptation. The liberation of the Snake Island, as well as the strike that sank the Moskva with a Neptune missile, along with successful Harpoon attacks on other ships, forced Russia to adjust its plans for the amphibious landings and to withdraw forces from the northwestern Black Sea, which in turn allowed for the signing of the grain deal. Nevertheless, Moscow continued to exploit the maritime domain by using warships and submarines as launch platforms for cruise missiles that struck Ukrainian cities month after month. This sustained pressure underscored the need for new solutions to compensate for the absence of a Ukrainian surface fleet capable of contesting Russian dominance — and it was under these conditions that uncrewed surface vessels emerged as the logical asymmetric response.

15. Sutton, H. I. (2022). Moskva Sinking: Images Reveal Once Powerful Russian Navy Ship On Fire. hisutton.com
16. Center of Journalistic Investigation. (2022). The Ukrainian Navy struck a tugboat of the Russian Black Sea Fleet, which was transporting military personnel and ammunition to Snake Island. investigator.org.ua
17. Orion Intel (2022). Neptune has a reported range of 280km and entered service with the Ukrainian Navy in 2021. The missile, launched from off-road 8×8 TELs, allows them to target naval vessels near Crimea and beyond. x.com/Orion__int
18. Sutton, H. I. (2022). Incredible Success Of Ukraine's Bayraktar TB2: The Ghost Of Snake Island. navalnews.com

Origins and Roles

Ukraine's turn to uncrewed surface vessels was not a side experiment but the center of gravity of its maritime adaptation. The choice of USVs followed directly from the country's initial condition: no viable surface fleet, contested air, and a hostile littoral, and from the strategic problem to be solved: deny Russia freedom of action in the Black Sea without incurring the sunk costs, time, and vulnerability inherent to rebuilding a conventional navy. Where legacy fleets manufacture coercive presence through massed hulls and layered defenses, Ukraine sought to impose risk on Russian operations near Crimea and beyond, to raise the operating costs of forward basing, and to keep open sufficient maritime access for export flows. In this context, uncrewed boats offered attritable precision, the ability to mass at low cost, and, critically, the political tolerance to accept losses while still climbing a learning curve that favored the faster adapter.

Ukraine's asymmetric naval war can be traced to a convergence of actors beyond the Navy itself. Ukraine's intelligence services — the Main Intelligence Directorate (GUR) and the Security Service of Ukraine (SBU) — assumed leading roles in conceptualizing uncrewed surface vehicles (USVs) as asymmetric strike platforms. Intelligence agencies, by design, operate with lighter institutional structures and greater autonomy, allowing them to test and deploy novel systems more rapidly. This dynamic reduced bureaucratic inertia and enabled faster adaptation, turning USVs into one of the most visible instruments of Ukraine's asymmetric campaign at sea.

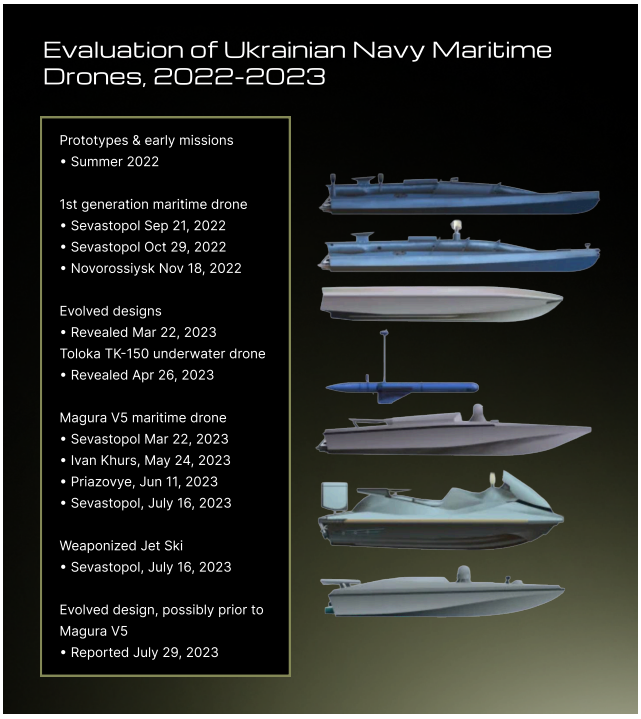
At the same time, it should be emphasized that, under Ukrainian legislation, the development and use of such weapon systems does not formally fall within the mandate of intelligence services. Their current involvement is an expedient response to the extraordinary conditions of war rather than a normative arrangement. Looking forward, responsibility for the development, procurement, and integration of maritime drones is expected to be transferred to the newly created Unmanned Systems Forces, ensuring institutional coherence and aligning practice with the legal framework.

As of today, there are more than 15 manufacturers of USVs in Ukraine. 3–4 manufacturers are particularly active, with systems already fielded by the Ukrainian Navy, GUR, and SBU. Two design lineages crystallized early and matured in parallel under different sponsors. MAGURA V5 emerged under GUR (Defence Intelligence) as a precision, open-water hunter: a compact, fast craft intended to reach out from Ukraine's coastlines and threaten warships at range, optimized for repeated production in small lots and progressive refinement across new versions. Sea Baby, developed by the SBU (Security Service), is a multi-role strike chassis conceived to deliver an outsized explosive effect against hardened infrastructure and high-value naval targets, with subsequent variants adding role flexibility rather than chasing a single exquisite performance envelope. The split is functional, not competitive: the former privileges reach, speed, and repeatability; the latter emphasizes payload, adaptability, and coercive messaging against bases, bridges, and large hulls.

What makes these boats consequential is not simply that they exist, but the way they address the specific problems Ukraine faces. First, they convert geography into advantage. In the Black Sea, large surface combatants have limited room to maneuver, and naval forces are confined to a relatively closed environment with predictable access routes, which makes them easier to target. At the same time, the effective deployment of these systems depends on overcoming a set of systemic challenges in their production. Current USV manufacturing is constrained by a shortage of highly specialized technical personnel, especially in subfields such as uncrewed subsurface systems, hydroacoustics, and sonar engineering. Low localization levels further complicate production, leaving manufacturers dependent on foreign components from China and Western States, often repurposed from other domains. Additional risks stem from the reliance on politically contingent decisions of foreign suppliers for critical systems, particularly in communications. Despite these hurdles, scaling production and refining designs remains a priority, as USVs offer a combination of strategic reach and economic rationality that

conventional vessels cannot match. Moreover, the fleet is concentrated in a relatively small range of ports, and can be easily detected by the adversary. Small unmanned craft can exploit these short distances and act with speed, gaining precious time in environments where large ships would be slow and unwieldy — conditions in which large surface combatants are structurally vulnerable and defenders saturable.

Second, USVs are economically rational for a state at war: each unit's loss is tolerable, yet any successful hit imposes costs on the adversary that are non-linear to the drone's price. Ukraine cannot match Russia's fleet in terms of size, diversity, and modernity. Naval drones offer a cost-effective way to threaten high-value warships or logistics vessels, forcing Russia to divert resources to defend against much cheaper platforms: on the night of January 31 to February 1, Ukraine's Unit 13 used six MAGURA V5 naval drones, costing about $1.64 million in total, to sink the Russian warship Ivanovets in the Black Sea. The corvette, valued at $60–70 million, was destroyed — demonstrating how unmanned systems can deliver losses nearly 40 times greater than their cost.

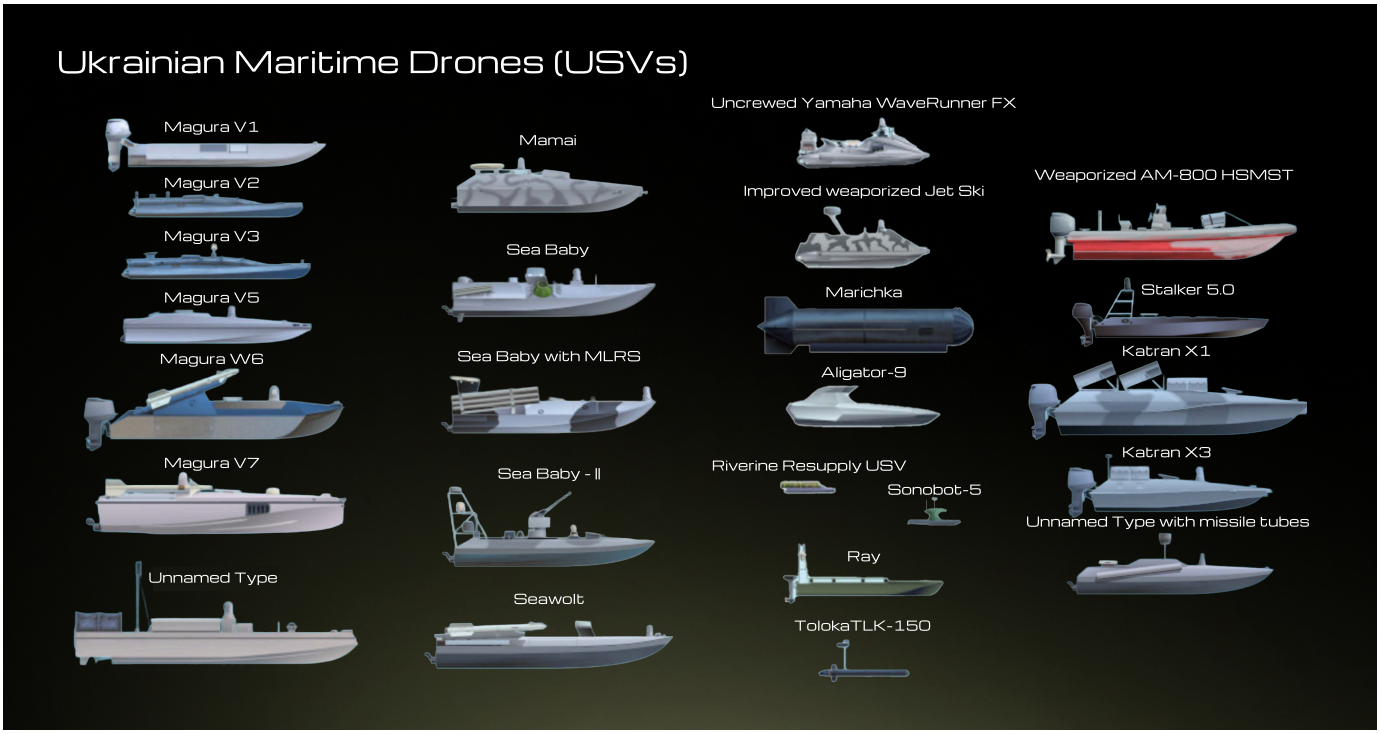


H. I. Sutton. Evolution of Ukrainian Navy Maritime Drones (2022–2023). **19**

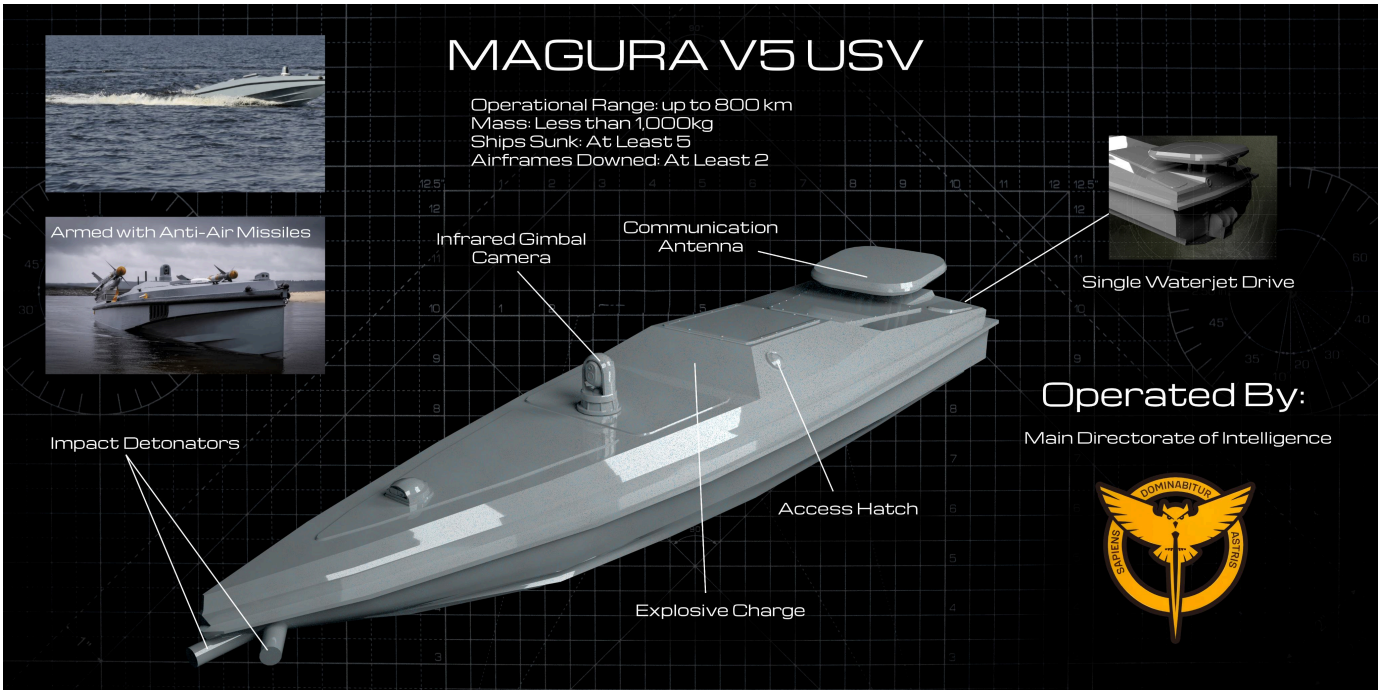
GUR. The Ivanovets is captured on video sinking stern first in the Black Sea. **20**

Specification	MAGURA V5	MAGURA V7 (Advanced Variant)
Length	5.5 m (18 ft)	longer (approx. 7.2 m)
Width / Beam	~1.5 m	Larger accordingly
Mass / Displacement	< 1,000 kg	< 1,300 kg
Speed	78 km/h (~42 kn) [cruise ~40 km/h]	Similar or slightly higher
Range	Up to 800 km	Up to 1,000 km
Payload Capacity	~300 kg (standard), up to 320 kg	Up to 650 kg
Armament Options	Explosive charge or R-73 "Sea Dragon" air-to-air missile	AIM-9 Sidewinder or gun module
Guidance	GNSS, inertial, visual systems	As V5, with autonomy improvements
Unit Cost	~$273,000 (per 385th Brigade data)	Not specified but possibly higher

19. Sutton, H. I. (2023). Evolution of Ukraine's maritime drone. hisutton.com



ArmyInform. Translate characteristics **21**



The Magura. **22**

20. GUR (2024). Ivanovets sunk in GUR special operation. t.me/DIUkraine
21. Magura V5: український морський дрон, що переписує історію війни на морі, 17 March 2025, armyinform.com.ua
22. Sutton, H. I. (2025). World First: Ukrainian Maritime Drone Shoots Down Russian Flanker Jet. navalnews.com

The first missions revealed the strengths and limits of the craft. In May 2023, three MAGURA drones attacked the reconnaissance ship Ivan Khurs. The Russians managed to destroy two of them, while the third approached the ship and exploded, but did not cause critical damage. According to the head of the GUR, Kyrylo Budanov, the first six months of missions were not successful. The most difficult task was to develop tactics, not technical capabilities, and it turned out that it was much more effective to conduct missions at night with a group of minimum 5-6 drones. By late 2023, attacks increasingly came in swarms of 6–10 drones. The tactical calculus accepted that the first wave might be lost to barriers or sentries but designed later waves to ride the breach.

In early 2024, MAGURA units struck at Russian patrol ships and corvettes near Crimea. The sinking of the Ivanovets corvette in February 2024 and the destruction of the landing ship Tsezar Kunikov days later marked a turning point. Suddenly, ships that had operated confidently within range of Crimea's coastal defenses found themselves vulnerable to small craft that were almost invisible on radar and could not be intercepted before impact. Instead of merely inflicting damage, the objective of these missions was the destruction of the target vessel. Achieving this required a deliberate and coordinated tactic, clearly illustrated in the fate of the missile boat Ivanovets. Detected by the vessel only at the last moment, the incoming drones left the crew little time to respond. Although capable of over 30 knots, the ship failed to accelerate, and its main guns remained inactive. Russian sailors opened small-arms fire, but it was ineffective against the fast and maneuverable craft. Group 13 executed the strike methodically: the first and second drones hit the stern on opposite sides, disabling both propellers and leaving the vessel adrift. A third drone struck beneath the *Moskit* launchers, ripping a hole in the hull, and a fourth was then directed into the same breach. The final blast triggered the detonation of four *Moskit* missiles, each weighing around four tons, which blew the *Ivanovets* apart and left the crew with almost no chance of survival. [23]

Ukraine's military captured the moment of the blast on video, photo: GUR [24]

Approximate strike locations on the Ivanovets by Magura sea drones [25]

The strike on the Tsezar Kunikov demonstrated the futility of static defense against saturation. Ten sea drones attacked the landing ship, the first four of which were destroyed by small arms fire. The fifth drone hit the stern and immobilized the ship. The next drones struck the port side, closer to the stern, intending to capsize the landing craft. The ninth drone entered the breach and exploded virtually inside the ship. After this, the landing craft could no longer be saved, as it was lying on its port side.

23. Sutton, H. I. (2025). World First: Ukrainian Maritime Drone Shoots Down Russian Flanker Jet. navalnews.com
24. Robert Greenall, Ukraine 'hits Russian missile boat Ivanovets in Black Sea', 1 February 2024, www.bbc.com
25. Vadim Kushnikov, Ukrainian drones sink Russian guided missile corvette Ivanovets, 1 February 2024, militarnyi.com

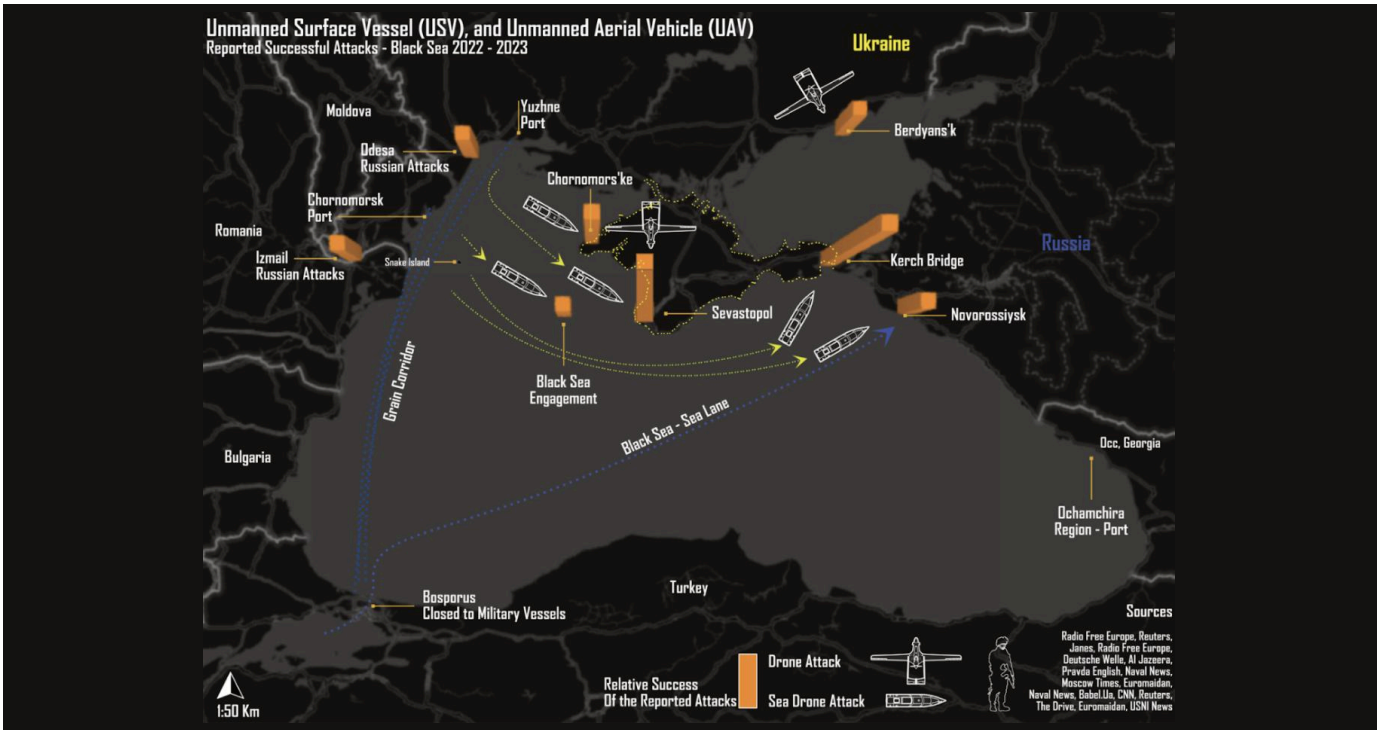
In March 2024, on the third attempt after two attacks that had dealt some damage, the Sergei Kotov (which had been operating in the interests of the Syrian Express) was hit by 5 drones, suffered damage to the stern, starboard, and port sides, and successfully sank. This patrol ship was designed for precisely these kinds of threats, which confirmed the change: Russia could no longer consider its ships safe near Ukrainian waters.

By mid-2024, MAGURA drones were no longer one-off weapons; they were being produced in serial batches, with common standards that allowed operators to train consistently and developers to refine designs systematically.

A unique glimpse into this process comes from the commander of Group 13, call sign "Thirteenth," the GUR special unit tasked with MAGURA operations. He described the tactical logic behind the early missions: *"The first drone is... a 'bully.' It doesn't matter where it hits — it just has to start a fight."* **26**

The aim, in other words, was not simply destruction but disruption — forcing Russian crews into defensive posture, shaking confidence, and opening opportunities for subsequent waves.

Over time, the Russians began to destroy drones using aircraft. Their helicopters constantly hunted for sea drones in the daytime when they were more visible. In response, MAGURAs, which had previously been used as kamikaze drones, began to be equipped with air-to-air missiles. Soviet R-73 missiles were adapted for launch from naval drones. The guidance system was also modified by increasing the target search angle. This modification was named SeeDragon, and it was a real breakthrough. On December 31, 2024, a MAGURA V5 destroyed a Russian Mi-8 helicopter using an R-73 Sea Dragon missile, and a second went missing. According to Thirteenth, this was no accident: *"We were specifically hunting for air targets. It was a planned operation, and we were ready to face the enemy head-on... The first launch was a direct hit. They didn't even realize what was happening."*

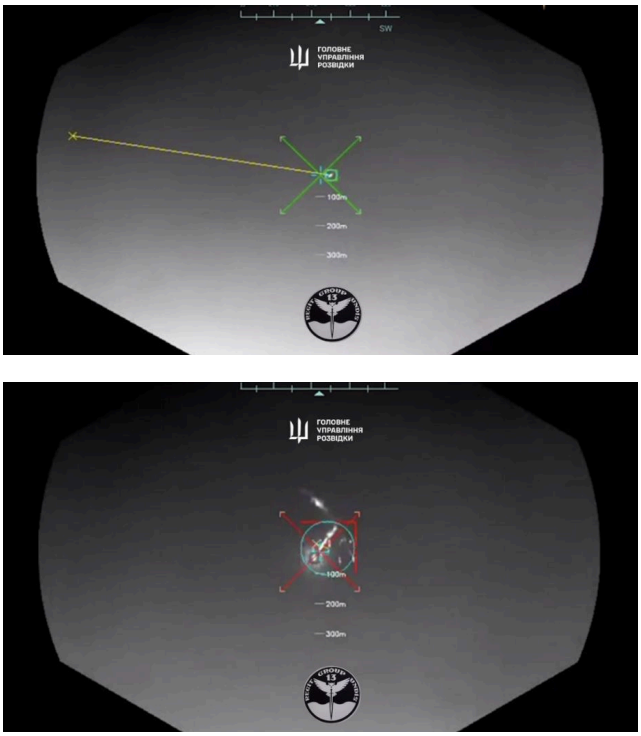


Giangiuseppe Pili. Reported successful attacks - Black Sea 2022-2023

26. Callsign-13. (2024). The first drone is a "bully": it should start a fight. Defence Intelligence of Ukraine. gur.gov.ua/en

This was the first time in history that a naval drone had shot down an aircraft. Tactically, it showed that MAGURA could be adapted into a multi-domain platform, striking targets in the air as well as at sea. Strategically, it redefined Russia's risk calculus: not only were their ships unsafe, but helicopters and fighter patrols were also within reach of cheap, uncrewed craft.

According to Andriy Yusov, spokesperson for GUR, lessons learned are analysed after each combat mission. The platform is constantly being upgraded to improve protection and reduce detection. Within months, the upgraded MAGURA V7 was integrated with AIM-9 Sidewinder missiles. AIM-9 Sidewinders were mounted on a retractable pylon system, with target lock achieved through the missile's wide-angle infrared seeker and horizontal rotation of the drone, allowing for a simplified launcher design. By May 2025, Ukrainian forces claimed the downing of two Russian Su-30 fighter jets.



GUR. MAGURA shoots down a Russian Su-30 fighter jet (screenshots before and after the hit). [27]

GUR has announced plans to establish a fleet of naval drones, including strike systems and platforms designed to provide fire support during maritime operations. According to Militarnyi, they have already developed two new models. The first uses a conventional boat engine with propellers and can carry up to four containers loaded with FPV drones. A special forces operator working with these drones noted: *"Our naval platform carries between 500 and 3,000 kilograms of various types of weapons — aerial, surface, and underwater. The system integrates cutting-edge technologies combined with NATO-standard artificial intelligence."*

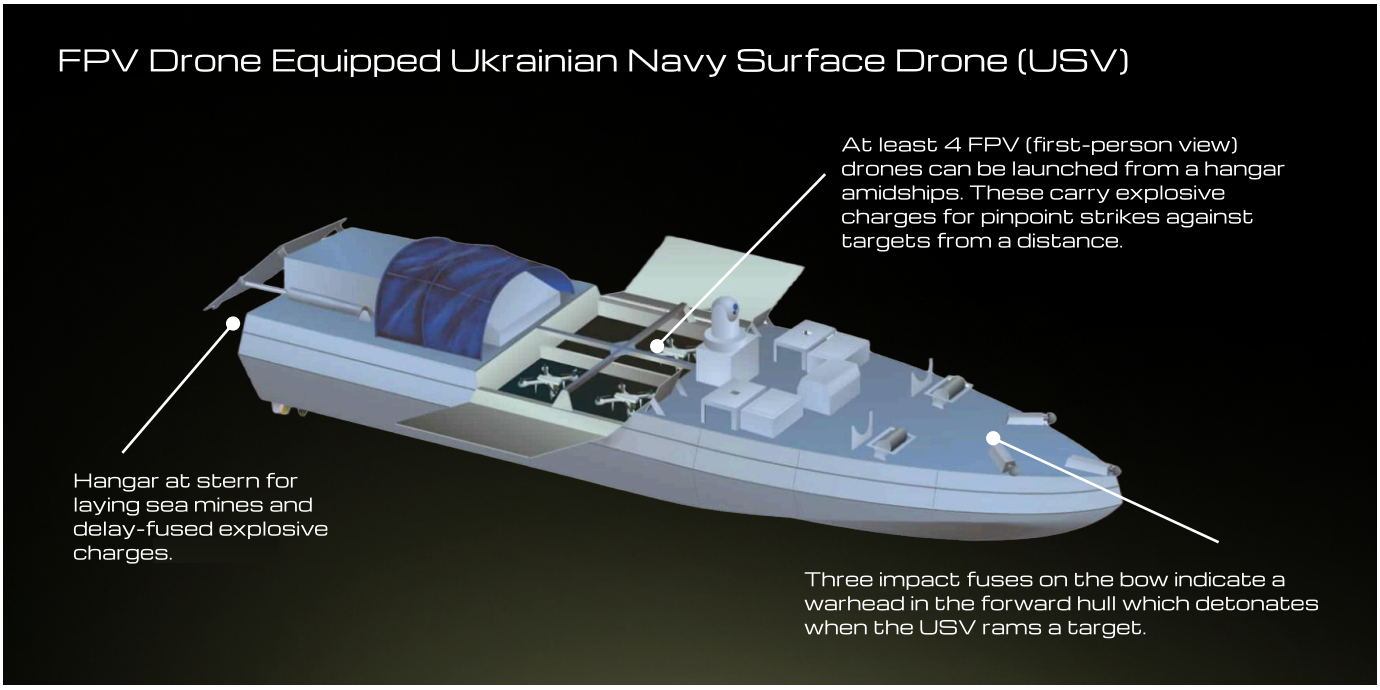
The second model features a different hull design and is equipped with a launcher for four fixed-wing strike drones. GUR likely employed this latter model to deliver the weapons that attacked Russian boats and a Tor-M2 air defense system near Crimea in April, 2025. The first mention of such an operation came in January 2025, when reports from the Kherson region noted the destruction of two Russian Pantsir systems and one Osa air defense unit. The strike was carried out with FPV drones launched from naval boats and, although the drones were not specified, they were likely also modified versions of the MAGURA platform.

Both platforms are fitted with Starlink antennas, extending their operational range to the maximum distance the vessels can travel.

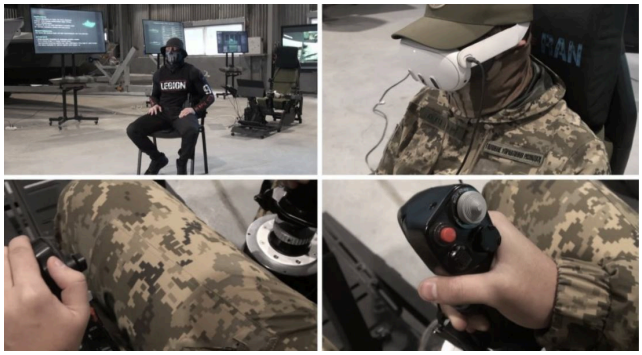
For the first time, a control station for these naval drones was also shown, featuring an operator's chair, an aircraft-style control yoke, and a throttle lever. Video feeds from onboard cameras are transmitted to augmented-reality goggles, giving the operator a wide field of view, and are mirrored on a monitor for other officers in the control center.

Screenshot from the documentary Sea Battle. The Age of Drones.

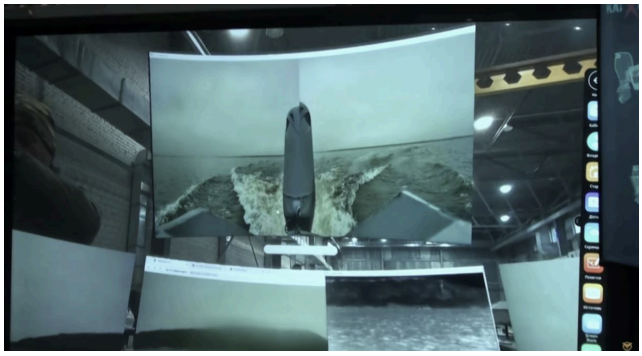
27. Pryhodko, R. (2025). Ukraine Presents Magura Naval Drone with AIM-9 Missiles. militarnyi.com



H. I. Sutton. A Ukrainian naval drone carrier with aircraft-type drones. **28**



GUR. The control station of the MAGURA in the control point of the GUR. **29**



GUR. The interface for controlling the MAGURA in the AR glasses. **30**

In strategic terms, MAGURA's importance lies not only in the ships it has sunk but in the uncertainty it has created. Russian commanders now plan around the constant risk of small, fast, low-cost boats emerging from the clutter of the Black Sea. Convoys must sail with escorts; ships must remain further from contested shores; ports require additional defenses. In this way, MAGURA has multiplied its effect beyond its physical strikes, shaping adversary behavior and rewriting the risk calculus of the Black Sea war.

28. Yan, O. (2025). Ukrainian Intelligence Unveils Naval Drone Carriers Used in Crimea Strikes. militarnyi.com
29. Yan, O. (2025). Ukrainian Intelligence Unveils Naval Drone Carriers Used in Crimea Strikes. militarnyi.com
30. Yan, O. (2025). Ukrainian Intelligence Unveils Naval Drone Carriers Used in Crimea Strikes. militarnyi.com

Sea Baby – The Heavy-Hitter of the USV Fleet

Where MAGURA V5 embodied the stealth hunter, the Sea Baby emerged as Ukraine's heavy-duty enforcer of maritime denial. Conceived by the Security Service of Ukraine (SBU) in mid-2022, Sea Baby was designed for a different mission: to impose powerful local effects against hardened, static targets. It is bigger, tougher, and carries a larger warhead - up to 1,000 kg compared to approximately 200 kg on the MAGURA. According to military expert Volodymyr Zablotskyi of Defence Express, the guidance and control systems in these unmanned boats are identical. 31

The Sea Baby project began in July 2022, when Brigadier-General Ivan Lukashevych formulated a need for an SBU-controlled maritime drone capable of striking ships moored in ports and infrastructure along the littoral.

The first mission involving five naval drone prototypes, each carrying 108 kg of TNT, failed after Elon Musk disabled Starlink in the region, cutting off their control link. The intended target was only about an hour away, but the drones never reached it, and only two managed to return to operators. Following this incident, a decision was made to equip the upgraded Sea Baby with redundant communications systems — detached from reliance on a single network — capable of transitioning between cellular, satellite, and military-grade comms links to counter battlefield signal denial.

Later, on October 29, 2022, upgraded drones launched a large-scale attack: one struck the frigate Admiral Makarov, another destroyed the minesweeper Ivan Golubets, while others hit a fuel depot and damaged additional ships inside Sevastopol's bays. The ships in the harbor were moored almost side by side, resembling their routine peacetime arrangement. The additional barrier in the form of boom defenses was overcome by detonating one of the naval drones (out of nine).

The seven UAVs likely served as distraction, target adjustment, and possibly communication relay, which significantly increased the chances of the USVs to break through. This marked the world's first remote-controlled naval operation and showed the need for larger drones with more powerful warheads.

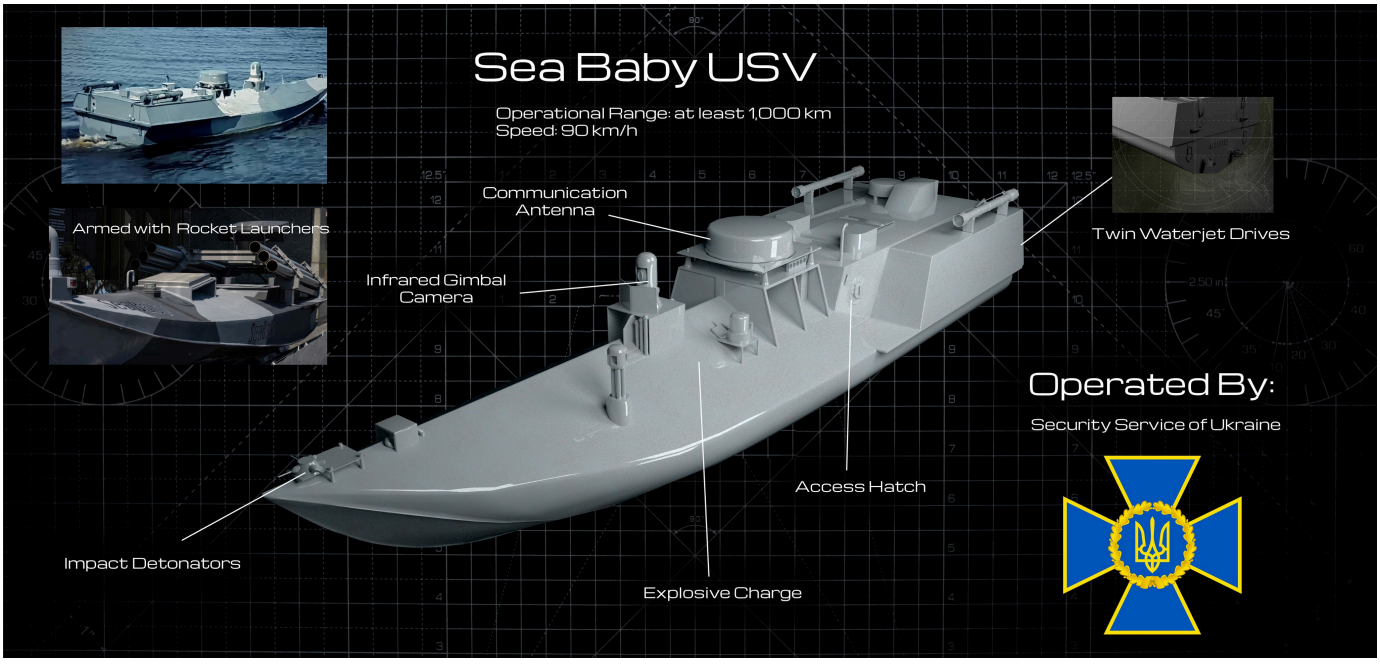
Collaborating with engineers from the Ukrainian Navy and private firms, the Security Service of Ukraine (SBU) crafted a vessel significantly larger than prototype and MAGURA drone: approximately 6 meters, capable of carrying up to 850 kg of explosive payload, with a range of at least 1,000 km and speeds reaching near 90 km/h. 32

31. Kramarenko, D. (2024). Magura vs. Sea Baby: Closer look at Ukrainian drone warfare against Russian ships. RBC-Ukraine. newsukraine.rbc.ua
32. Romaniuk, R. (2024). Sea drones, Elon Musk, and high-precision missiles: How Ukraine dominates in the Black Sea. Ukrainska Pravda. pravda.com.ua/eng

Sea Baby – Technical Specification Table

Specification	Sea Baby (2023)	Sea Baby (2024/2025 Upgraded)
Developer / Sponsor	Security Service of Ukraine (SBU)	Security Service of Ukraine (SBU)
Length	~6 m	~6 m
Width	~2 m	~2 m
Height (above water)	~0.6 m	~0.6 m
Hull Material	Composite (radar-reducing material)	Composite (stealth-optimized)
Speed	~90 km/h	~90 km/h
Range	≥ 1,000 km	≥ 1,000 km (black sea-wide coverage)
Standard Payload	Up to 850 kg of explosives	Up to 1,000 kg of explosives
Advanced Payloads	—	6× RPV-16 thermobaric launchers; BM-21 Grad rockets; MG turrets; UAV mothership capability
Unit Cost	~8.5 million UAH (~USD 220–250 k)	Similar range, potentially slightly higher
Communications	Satellite (e.g. Starlink); backup systems	Redundant communications (Starlink and Kymeta); EW-hardened
Operational Role	Kamikaze strike craft for static targets	Multi-role assault platform — sea, land, air engagements, ISR

The new (top) and old (bottom) versions of Sea Baby / Photo: SBU **33**



H. I. Sutton. Sea Baby Drone. **34**

33. All Upgrades to Ukraine's Sea Baby Naval Drone Analyzed: From Boat-Bomb to UAV Mothership With a Smart Turret and Mines, June 15, 2025, en.defence-ua.com
34. Sutton, H.I. (2025). Overview Of Ukrainian Maritime Drones (USVs) Of The Russo-Ukrainian War. www.hisutton.com

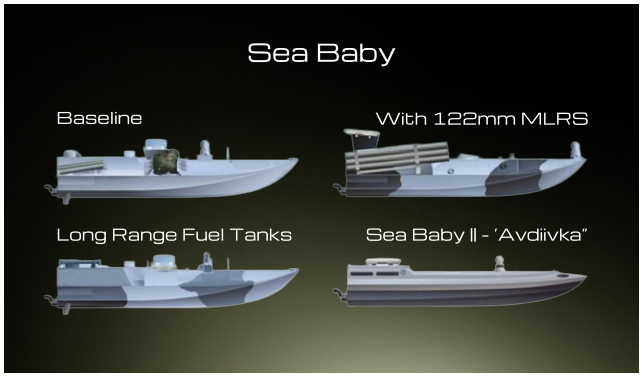
Sea Baby first made its mark in July 2023, when two units exploded against the Crimean Bridge, damaging both its abutment and a section of the span — a bold sign that Ukraine could physically threaten the main land link to occupied Crimea using unmanned sea drones. In August 2023, a modification of the drone called Kozak Mamai hit the large landing ship Olenegorsky Gornyak and the tanker SIG. Kozak Mamai carries 450 kg of explosives, is high-speed and armored.

In March 2024, an improved version of Sea Baby was introduced, the first product was named "Avdiyivka". According to the Security Service of Ukraine, this reusable drone is armed, allowing it to strike targets directly and support cheaper unmanned systems. The SBU transformed Sea Baby from a one-way kamikaze bomb into a multi-role platform. Upgrades included warp-loadout capacity for guided missile launchers, laser-designation modules, thermobaric launchers based on RPV-16 grenades, and even the capacity to carry smaller drones. Footage released by Russian sources shows a large container on the Sea Baby, likely intended for FPV drones. There were recorded cases of FPV drones launched from USVs being used for site monitoring and for targeting enemy personnel, in particular during the December 2024 strike on gas platforms in the Black Sea that had been seized by the Russian fleet. Experts note that such drones can carry out reconnaissance and strike targets simultaneously, though no confirmed missions of this kind have been reported so far. [35] Sea Baby variants with six barrel-mounted thermobaric launchers demonstrated that the vehicle was no longer just a strike drone but a lethal, adaptable mobile weapons system, capable of adapting to multiple mission profiles within a single hull.

In particular, Sea Baby was used for sea mining. A specialised SBU team tracked the routes of ships and civilian transport near the Crimean peninsula for a month and a half before sending Sea Baby to lay two mines. In September 2023, the Russian missile ship Samum was blown up by one of these mines. In the following weeks, another 15 mines were deployed. During one mission, the drone was detected by three Raptor-class patrol boats and responded with a grenade launcher, striking one of them.

The following month, the patrol ship Pavel Derzhavin struck two mines. The last time, a large tugboat was sent to rescue it, but it also struck a mine and had to be towed back to port. The anti-mine ship Vladimir Kozitsky was also damaged. [36]

Tactically, Sea Baby operations matured swiftly. Early attacks were one-way; later versions were fitted with defensive weaponry. In December 2024, footage surfaced showing Sea Baby drones armed with machine-gun turrets engaging Mi-8 helicopters and small Russian patrol vessels — bridging the gap between kamikaze weapon and a sustainable combat system. According to General Hunter of the Security Service of Ukraine, the driving force behind the program, the idea was to break a combat vessel into separate elements — air defense systems, weapons, protective gear, and so on — each installed on individual unmanned boats.



H. I. Sutton. Weapon options of the Sea Baby. [37]

Meanwhile, rocket-equipped Sea Baby units were reportedly deployed against Russian positions along Ukraine's southern coast, using Salvo-launched Grad artillery rockets from atop drone boats — a tactical novelty expanding Sea Baby's influence beyond pure maritime use. The platform designed for kamikaze strikes was evolving into a floating missile platform. According to Defense Express, the Grad launchers mounted on Sea Baby are shorter and fixed at a set angle. This means that the drone must reach a pre-calculated coordinate point. Experts emphasize that because the launch rails' elevation is far from optimal, unguided rockets fired from it are unlikely to reach the

35. Defense Express (2025). What upgrades have the SBU Sea Baby marine drones received, and how powerful are they now? defence-ua.com
36. Kushnikov, V. (2024). Four Russian ships were damaged by remote mining from Ukrainian drones. Militarnyi. militarnyi.com/en

BM-21 Grad's quoted maximum range of 20.4 km. According to former Ukrainian Navy deputy chief of staff Andriy Ryzhenko, their effective range is only about 6–8 km. [38]

Sea Baby's evolution was not accidental but structurally motivated. Ukraine's SBU garnered public support through fundraising platforms such as United24, raising millions in days for Sea Baby production — highlighting political and societal ownership of the project.

And as SBU General Hunter noted that out of roughly 27 Russian vessels targeted, 11 were attributed to Sea Baby strikes — amplifying its psychological and material impact on maritime warfare.

Sea Baby Purpose Evolution

Stage / Period	Core Role	What Was New	Representative Operations	Strategic Effect
Stage 1: 2022–2023	Kamikaze strike craft	• Long range (~1,000 km) • 850 kg explosive payload • First use against infrastructure	• Jul 2023 — Crimean Bridge strike • Sep 2023 — Strike on Samum corvette	Proved no port or bridge was safe; psychological shock in Crimea
Stage 2: Late 2023	Port and ship interdiction	• Targeting support and patrol vessels	• Attacks on Pavel Derzhavin (patrol ship) and Vladimir Kozitsky (hydrographic vessel)	Expanded focus from symbols to everyday Russian fleet assets
Stage 3: 2024	Multi-role strike platform	• Added thermobaric RPV-16 launchers • Mounted Grad MLRS pods (floating artillery)	• May 2024 — Testing Sea Baby as floating MLRS	Shifted from one-way bomb to fire-support platform for coastal strikes
Stage 4: Late 2024	Armed drone boat	• Fitted with machine-gun turrets • Defensive capability vs helicopters & boats	• Dec 2024 — Combat footage of Sea Baby firing at Russian Mi-8 helicopters	Became survivable, able to contest air/sea threats, not just suicide
Stage 5: 2025	Naval mothership prototype	• Integration with smaller UAVs • Experimental role as drone carrier	• 2025 — Reported UAV launches from Sea Baby decks	Transition to system-of-systems role, enabling swarms and ISR-strike fusion

37. Sutton, H.I. (2025). Ukraine's Sea Baby Maritime Drone (USV). http://www.hisutton.com/
38. Chernysh, O. (2024). How Ukraine Mounted Missiles on Naval Drones. BBC News Ukrainian. bbc.com/ukrainian

Sea Baby Purpose Evolution

Strategically, the Sea Baby forced Moscow to reassess its assumption of port safety. Where warships once found sanctuary at dock, Sea Baby's range and payload made no coastal position invulnerable. Together, these two drones — and other experimental models — formed a growing unmanned flotilla for Ukraine.

Doctrinally, Ukraine treated USVs as expendable assets that could be risked on high-payoff missions without fear of casualties. At an estimated cost of only $250,000–$300,000 per unit (comparable to a single anti-ship missile), a USV is a bargain compared to a crewed warship — and yet capable of taking a warship out of action with one hit. Their small fiberglass or composite hulls and low profile on the water make them extremely hard to detect by traditional naval sensors; they produce a minimal radar cross-section and infrared signature, especially amid wave clutter. Russian commanders likened them to "explosive jet-skis" — a description not far from reality, as many are literally built on commercial jet-ski chassis. Ukrainian engineers capitalized on this by running the USVs just above the waves, often at night or along cluttered coastlines, to approach undetected until the final few hundred meters.

By that point, a defending ship has mere seconds to react. In several instances, Russian warships failed to spot incoming drones until they were almost alongside — and by then even a 50-foot patrol boat laden with explosives could deliver a devastating blow.

The psychological effect should not be overlooked: knowing that any dark shape skimming across the water might be a bomb-laden drone has kept Russian crews on constant high alert. This was vividly demonstrated on 10 November 2023, when four Magura sea drones slipped undetected into Vuzka Bay near Chornomorske in western Crimea and destroyed two Russian landing craft of the Serna and Akula classes, sinking them right at the pier despite the presence of crews. The cover of night amplified the element of surprise, leaving the enemy unable to predict or count how many drones were approaching. These were Soviet-designed vessels, built for coastal strikes and anti-ship missions, but never intended to counter such small and elusive threats.

USV Campaign and Russian Fleet Withdrawal

Sevastopol Port Raid

Date: October 29, 2022

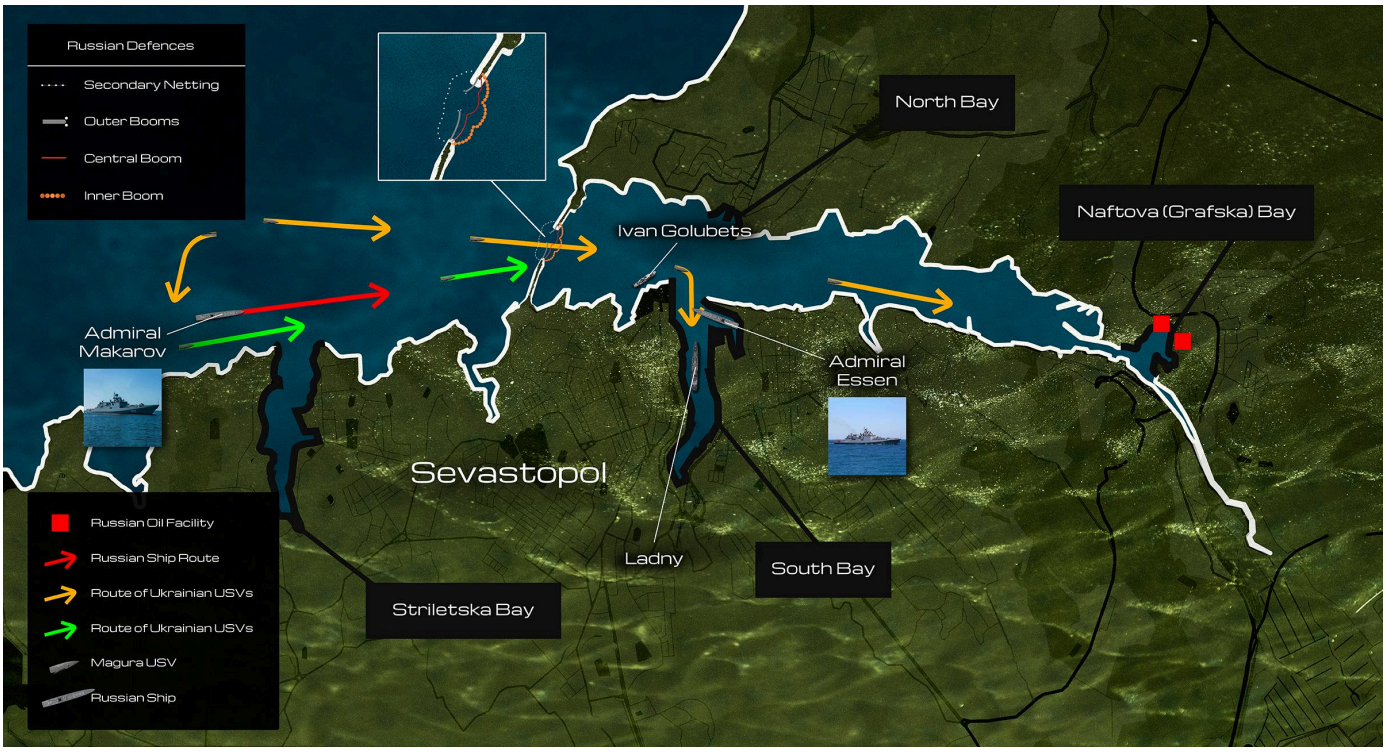
Target: Black Sea Fleet's Sevastopol Base

Weapon System: Seven MAGURA V5 drone boats, nine UAVs (unspecified)

Cost-Effectiveness Ratio: $49.9 in Russian target value for every $1 spent on Ukrainian weapon systems.

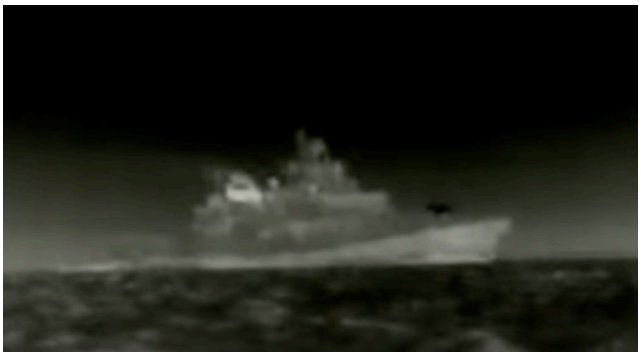
The pre-dawn hours of October 29, 2022, marked Ukraine's first large-scale USV attack in history. Seven MAGURA V5 drone boats [39], each with ~300lb payload, along with nine aerial drones (unspecified) overhead, were launched from Ochakiv and went into Sevastopol Bay.

The USVs split into two groups: seven heading straight for Sevastopol Bay, and nine going south of the harbor. The latter detected an **Admiral Makarov** warship, which was underway. Freshly replacing the sunken Moskva cruiser as the Black Sea Fleet's flagship, this ~125m long vessel was armed with eight cells for *Kalibr/Oniks/Zircon* cruise missiles and actively used in strikes across Ukraine. As one of the USVs was approaching the frigate, it was targeted by the Mi-8 helicopter and heavy machine guns [40]. Nevertheless, the USV directly hit the vessel on its right, reportedly damaging half of its engines [41]. Surprised by the attack, the crew headed back to Sevastopol Bay, while the remaining two drones — unable to strike due to high tides — accompanied the warship towards the shore.



Sea drones' attack on Sevastopol

39. Sutton, H. I. (2025). Overview Of Ukrainian Maritime Drones (USVs) Of The Russo-Ukrainian War. hisutton.com
40. Navy Lookout (2022). Considering the implications of the attack on the Russian fleet in Sevastopol. navylookout.com
41. Ukrainska Pravda (2024). Vice Admiral personally operated uncrewed vessels in first remote maritime operation. pravda.com.ua



Ukrainska Pravda. Footage of a Ukrainian USV approaching Admiral Makarov frigate. **42**

Reuters. Ukrainian USVs entering and advancing into Sevastopol Harbor. **45**

As the second group consisting of the Maguras neared the Striletska Bay, they were detected and attacked with ship-based CIWS and coastal artillery (unspecified) from the shore. Russian shore batteries also misidentified the *Admiral Makarov* frigate, opening fire on their own vessel. Amid the confusion, Ukrainian UAVs were striking military facilities around the fleet, acting as decoys for Russian air defenses and spotters for cueing the boats. Despite losing GPS signal to Russian EW, the remaining MAGURAs seized this moment to sail deep into Sevastopol Bay, using their live footage from the cameras. **43**

Inside the harbor, they split into three directions — to *Pivnichna (North)*, *Pivdenna (South)*, and *Naftova (also known as Grafskaya) Bays*. The drone boats managed to strike several targets. In the South Bay, one of the USVs hit the **Ivan Golubets** minesweeper, while another managed to strike **Admiral Essen** *(Admiral Makarov's sister ship)* and the **Ladny** guided missile frigates, reportedly slightly damaging them both. The remaining ones passing through the Naftova Bay struck several oil tanker stations. Nevertheless, local officials and Russian media claimed that the attack was successfully repelled, yet acknowledged that only the *Ivan Golubets* minesweeper suffered minor damage. **44**

Albeit the Sevastopol attack was not as spectacular as the sinking of the Moskva cruiser or the Saratov landing ship, the surprise and reach of Ukraine's drones shook Russian confidence. Even if Moscow downplayed the damage to its own fleet, asymmetry of repair-to-raid spending remains pronounced — and not in Russia's favor. Seven MAGURA V5 USVs cost about $1.9 million, while repairs to the Admiral Grigorovich frigate alone could have reached $450–500 million — more than 235 times the drones' total price tag. **46**

Weapon System Cost (USD)	Object Damaged	Replacement Value (USD)	Cost-Effectiveness Ratio
MAGURA V5 USV ~273,000/ unit **x7 = ~ 1,911,000**	**2x Admiral Grigorovich-class (Admiral Makarov, Admiral Essen)**	~450,000,000–500,000,000/ unit **x2 = ~900,000,000–1,000,000,000 + infrastructure damages**	~235.5–261.6/ unit **x2 = ~471–523.2**
	Natya-class (Ivan Golubets)	N/A	N/A
	Krivak-class (Ladny)	N/A	N/A

Cost-effectiveness ratio: value damaged per dollar spent (object value ÷ USV costs). **47**

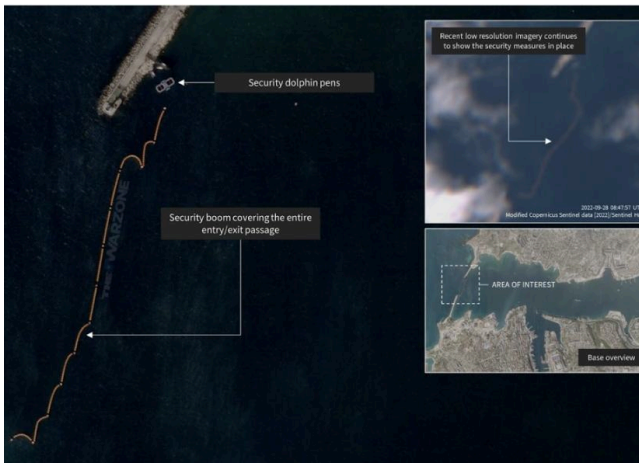
42. Ibid.
43. Romaniuk, R. (2024). Sea drones, Elon Musk, and high-precision missiles: How Ukraine dominates in the Black Sea. Ukrainska Pravda. pravda.com.ua/eng
44. Gromova, V. (2022). Ivan Golubets minesweeper was damaged during the Sevastopol attack. RBC. rbc.ru
45. Zafra, M., McClure, J. (2023). Sea drones and the counteroffensive in Crimea. Reuters. reuters.com
46. Cost-effectiveness ratio for Ivan Golubets minesweeper and Ladny frigate are not listed since public data on their production cost is not available.
47. Army Recognition (2022). Ukraine attempts a new operation against Russian frigate Admiral Makarov. armyrecognition.com

Equally important was the psychological dimension. For Russia, the attack delivered a symbolic blow, undermining domestic narratives of naval dominance. The strike demonstrated that even in Sevastopol — portrayed as the Black Sea Fleet's most secure bastion — Russian warships were vulnerable to drones. Never before had the fleet been forced into a defensive posture within its own sanctuary, an unprecedented reversal of roles. This is reflected in the fact that Russian vessels subsequently withdrew deeper into bays and anchorages and that the navy rushed to construct physical barriers, booms, and nets across harbor entrances to prevent further drone incursions. These measures highlighted both the effectiveness of Ukraine's innovative tactics and the psychological impact on a fleet that had once projected unchecked control in the Black Sea. Never before had the Black Sea Fleet been forced into a defensive position in its own most-protected sanctuary by a coordinated strike of remotely operated drones.

For Ukraine, the raid was successful both operationally and tactically. MAGURA's low-profile, V-hulled design rode only ~0,5m (1,6ft) above the water [48], making them difficult to detect on radar — especially at night when sea clutter masks small targets. Since the attack combined air and sea operations, USVs and UAVs coordinated in real-time, potentially relying on satellite links like Starlink. The UAVs acted as decoys and provided overwatch, saturating local defense systems and directing the attack routes from above. Meanwhile, operators controlled USVs from multiple directions, using onboard video to steer them toward the targets. Overall, the operation was a powerful morale boost, showcasing innovation that offset conventional disadvantages and proving that even the most fortified Russian positions could be contested using low-cost unmanned systems.

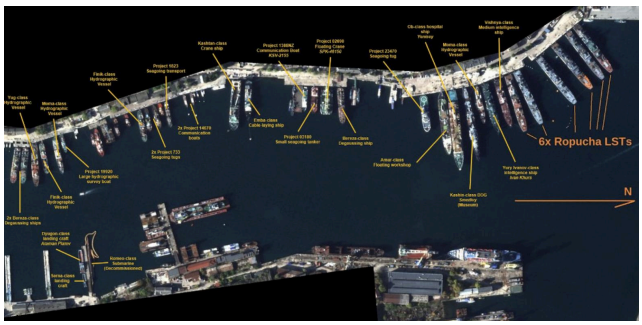
For Moscow, the raid exposed the vulnerability of its most protected naval base, becoming another wake-up call to strengthen its defenses in Sevastopol harbor. Before October 29, the Black Sea Fleet's main base largely ran on peacetime settings: ships moored at their usual berths, patrols were predictable, and the harbor-entrance boom was often left open.

Even after a Ukrainian unmanned boat washed ashore near Sevastopol in September, the immediate fixes were rather incremental: closing the entrance boom more routinely, laying an additional barrier inside the bay, adding another pen for trained anti-diver dolphins, and tightening local air-defense posture.



The War Zone. Russia is implementing security measures at the Sevastopol naval base, September 26, 2022. [49]

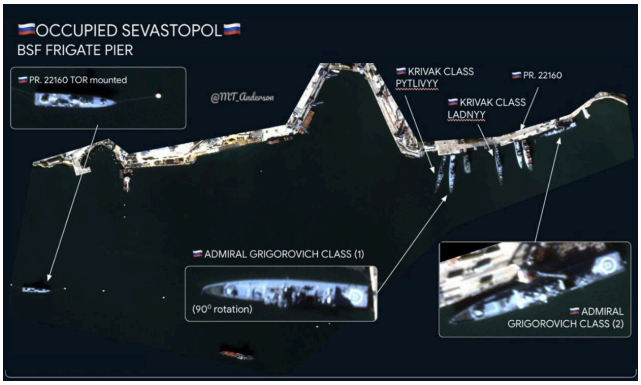
Still, one day before the strike, its elite vessels were densely concentrated within the berths. Notably, six *Ropucha*-class landing ships are berthed side by side, alongside various auxiliary vessels, intelligence ships, and hydrographic platforms. The arrangement reveals minimal dispersion, with many high-value units clustered in close proximity, creating a highly vulnerable posture in case of precision strikes or drone incursions.



Planet Labs Inc. View of the Sevastopol port (October 28, 2022). [50]

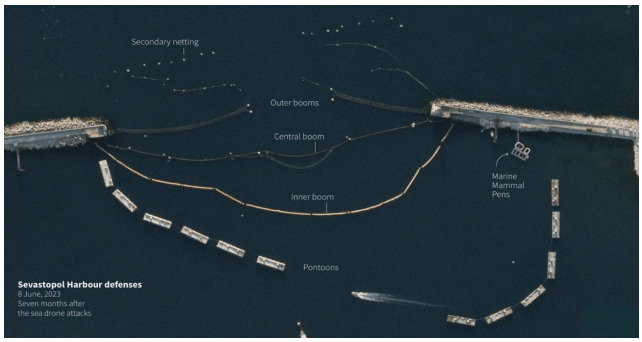
49. Payne, S., Altman, H., Rogoway, T. (2022). Ukraine Unleashes Mass Kamikaze Drone Boat Attack On Russia's Black Sea Fleet Headquarters. The War Zone. twz.com
50. Evergreen Intel. (2022). Russian Navy Black Sea Fleet ships at anchor. x.com/vcdgf555

Shortly after the strike (November 1, 2022), the fleet was disrupted and started repositioning. The Admiral Grigorovich-class frigates are depicted as relocated and rotated, with one even turned at a 90-degree angle (image below), suggesting urgent maneuvering for either damage control or to reduce vulnerability. Other surface combatants, such as the Krivak-class frigates (Pytlivy and Ladny), remain in port, but their berthing arrangements appear altered. Defensive adaptations are also visible, with new protective barriers (booms and nets) positioned at the harbor entrance to counter further USV attacks. These adaptations reduced operational flexibility and imposed additional logistical and manpower burdens.



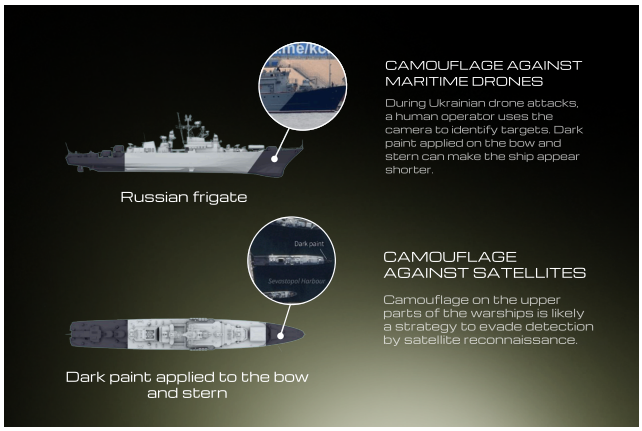
MT Anderson. Occupied Sevastopol frigate pier (November 1, 2022). **51**

Over time, the Black Sea Fleet strengthened Sevastopol's defenses. By June 2023 — seven months after the raid — the harbor mouth and inner berths were fortified with additional booms, nets, and pontoons, along with extra dolphins patrolling the entrance.



Planet Labs Inc.; Reuters. Sevastopol Harbour defenses (June 8, 2023). **52**

Beyond strengthening the harbor entrance, the Russian Navy also aimed to make its ships harder to target. As OSINT analyst H. I. Sutton has documented, crews started repainting hulls with a "dazzle-lite" scheme — darkening the bow and stern. The goal is to confuse the enemy. By blurring a ship's outline, direction, and apparent speed — especially in night footage — this approach makes it more difficult for satellite identification and drone targeting.



H. I. Sutton; Reuters. Camouflages for Russian vessels. **53**

51. Anderson, M. T. (2022). Occupied Sevastopol BSF frigate pier. x.com/MT_Anderson
52. Zafra, M., McClure, J. (2023). Sea drones and the counteroffensive in Crimea. Reuters. reuters.com
53. Ibid.

Strikes on the Crimean Bridge and Novorossiysk port

Date: July–August 2023

Target: Kerch Strait Bridge, Novorossiysk Naval Port

Weapon System: 2 Sea Baby and 2 Mamai USVs.

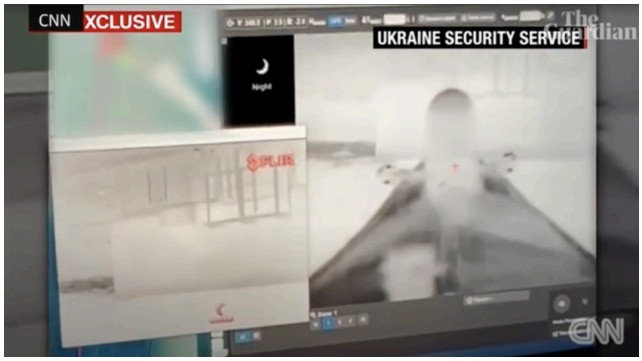
Cost-Effectiveness Ratio: $9.9–625 in the Russian target value for every $1 spent on Ukrainian weapon systems.

Crimean Bridge attack (July 17, 2023)

Just before dawn on July 17, 2023, two low-profile drone boats entered the Kerch Strait and headed directly for the Crimean Bridge. Around 3 a.m., two explosions tore up the road deck near the 145th pier on the Taman (Russian mainland) side, bringing traffic to a standstill in both directions. Russian authorities later estimated the repair costs at approximately $12–15 million. 54

Within weeks, Ukraine's security service released footage from the drone's camera taken just before the bridge strike, confirming that the attackers were home-built Sea Baby drones. These high-speed boats, each capable of carrying an 850 kg payload and striking targets at least 1,000 km away, set out from the Ukrainian-held coast and traveled overnight to the strait. During the cruise phase, operators used waypoint navigation via SATCOM/GNSS, then switched to manual, human-in-the-loop control as the drones neared their target.

BBC. Satellite footage of the damage to the Crimean Bridge. **55**



SBU. Footage of Sea Baby drone approaching the Kerch Bridge. **56**

54. TASS (2023). The restoration funds for the Crimean Bridge are expected to range from 1 to 1.3 billion rubles. tass.ru
55. Ratford, A., Armstrong, K. (2023). Ukraine war: Vladimir Putin vows response after 'terrorist' attack on Crimea bridge. BBC News. bbc.com
56. Walsh, N. P., Butenko, V., & Davey-Attlee, F. (2023). The moment Ukraine used an experimental drone to attack a Russian bridge. CNN. edition.cnn.com

What let the Sea Babies through on 17 July was the absence of a continuous, physical barrier at waterline height. In pre-dawn, light-sea conditions, a low-freeboard hull close to the radar horizon blends into sea clutter. Therefore, visually, warning time is brief until a searchlight acquires it. Smoke must be laid early and with favourable wind, unable to arrest a vessel at short range. In combination — open waterlines, short detection windows, and manual terminal control — these factors enabled both USVs to reach their intended deck joints.

As the SBU representative said in an interview with SII: *"The equipment is no longer being transported. After that, the Crimean bridge lost interest for us, but when our drones were ready again, we understood what was needed. It is necessary not only for military purposes, but also to raise our military morale, because such strikes affect it."*

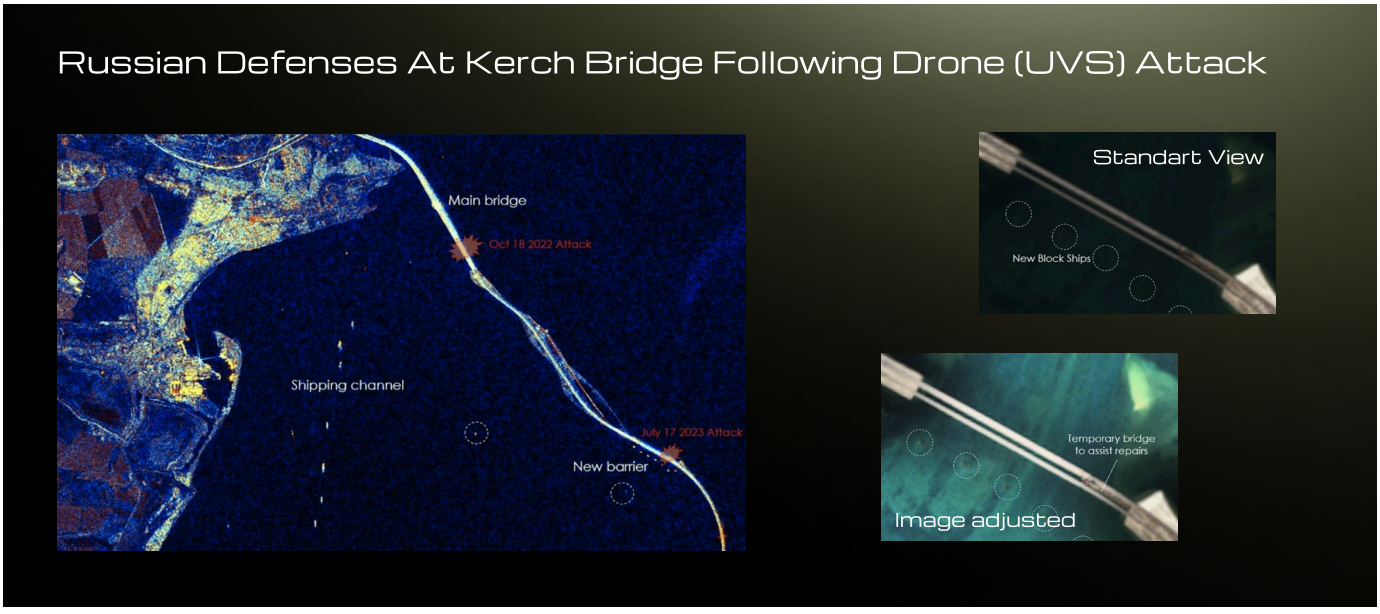
Even though Russian officials claimed to have repaired the bridge in October 2023, three months after the attack, it was still only partially in use, disrupting the supply chain between the only fixed road between Russia and Crimea in the long run. Operationally, the episode showed that a bridge need not be destroyed to impose costs on the enemy.

According to Russian officials, the repair cost was estimated to be between $11,834,521 and $15,400,000 [57]. Ukraine spent up to $1,200,000 on drones for this attack, gaining about $10–$13 in bridge damage for every $1 spent on drones.

Shortly after the attacks, Russia rushed to increase its defenses of the Kerch Bridge. In August 2023, Russia sank ferries and barges to create fixed obstacles and laid boom and net lines to direct approaches into narrow, predictable lanes. The Russians positioned the barges closer together, with some arranged so they could be towed forward, effectively blocking any passage.

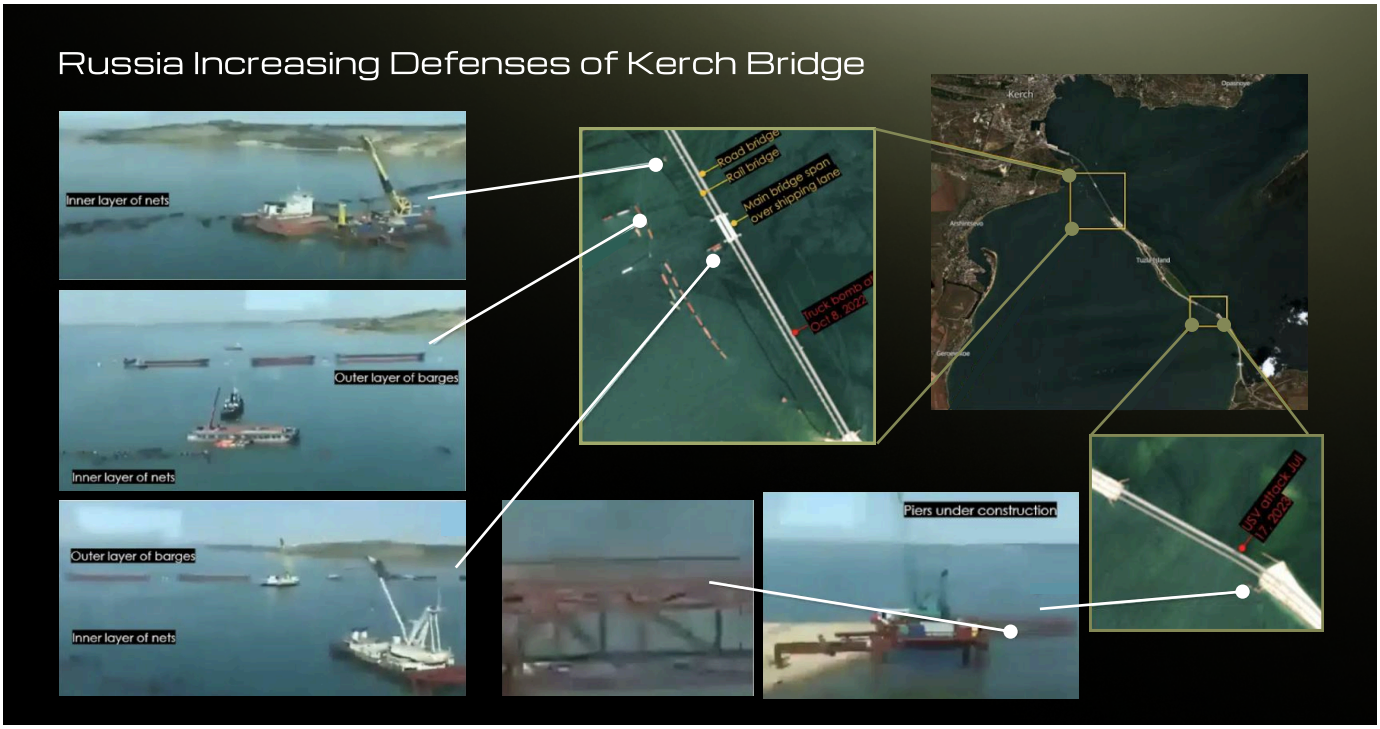
Weapon System Cost (USD)	Object Damaged	Repair Value (USD)	Cost-Effectiveness Ratio
Sea Baby USV ~240,000/unit **x5 = ~1,200,000**	**Kerch Strait Bridge**	~11,834,521–15,400,000	~9.9–12.8

Cost-effectiveness ratio: value of damaged object per dollar spent (object value ÷ USV costs).



H. I. Sutton. Russia builds sea fence with sunken ferries after Ukrainian drone attack (August 26, 2023) **58**

57. TASS (2023). The restoration funds for the Crimean Bridge are expected to range from 1 to 1.3 billion rubles. tass.ru
58. Sutton, H. I. (2023). Russia has been placing block ships across the western approaches to Kerch Bridge, following Ukrainian USV attack. Reports suggest these are sunken ferries. x.com/CovertShores



H. I. Sutton. Russia increasing the defenses of the Kerch bridge (June 2024). ***59***

By 2024, this layered scheme thickened with additional barge walls, parallel booms, more sensors, expanded patrols, and air defence. Risk was reduced, but the arrangement demanded steady upkeep: storms displaced booms, moorings required maintenance, and personnel and equipment were tied to a rear-area chokepoint.

59. Sutton, H. I. (2024). Russia Rushes To Complete Huge New Defenses Of Kerch Bridge. Naval News. navalnews.com

Novorossiysk Port attack (August 4, 2023)

Not long after the Kerch Bridge strike, Ukraine launched another attack on the Russian Navy. A team of USVs was sent to Novorossiysk on the night of August 4, 2023. This Black Sea Fleet port, about 600 km from Sevastopol, became a safe haven for its vessels after Ukraine's attack on Sevastopol Harbor in October 2022. The **Olenegorsky Gornyak**, a landing ship previously stationed with the Northern Fleet, arrived at Novorossiysk in early February 2022 for training exercises. Designed to launch amphibious forces for beach landings and to quickly unload cargo at ports, it was widely used in the early stages of the full-scale Russo-Ukrainian war for the Russian advance from Crimea into mainland Ukraine.

BBC. The Map of the naval attack on Novorossiysk. **60**

As the vessel was towed inside Novorossiysk Bay, at least one drone boat emerged. It was reportedly SBU-produced Mamai, loaded with 450kg of explosives, that directly struck the Gornyak on its left.

The Ropucha-class warship suffered a serious hole and became unable to carry out its combat missions.

SBU. Footage of a USV approaching the Olenegorsky Gornyak ship. **61**

Later imagery confirms that the ship was severely damaged and had begun to take on water while listing to port. In at least one video, Olenegorsky Gornyak is seen under tow, already listing badly and sitting very low in the water. However, the Russian Ministry of Defense claimed they repelled the attack of two drones with their warships, while not mentioning the damage to the vessel. **62**

OSINTtechnical. Olenegorsky Gornyak listing after the attack, August 2023. **63**

60. Waterhouse, J., Armstrong, K. (2023). Russian ship hit in Novorossiysk, Black Sea drone attack, Ukraine sources say. BBC News. bbc.com
61. Waterhouse, J., Armstrong, K. (2023). Russian ship hit in Novorossiysk, Black Sea drone attack, Ukraine sources say. BBC News. bbc.com
62. Boffey, D. (2023). Ukraine says it has put Russian warship out of action in sea drone attack. The Guardian. theguardian.com

The blow was significant. Olenegorsky Gornyak was one of four Ropucha-class landing ships in the Black Sea Fleet. With Ukrainian naval drones now highly destructive, each loss becomes more costly. Severe damage to the warship drives replacement costs up to $50 million. Since Ukraine spent up to $480,000 on drones to inflict this damage, the cost ratio is nearly $625 in damage to Gornyak for every $1 spent on drones. 64

Weapon System Cost (USD)	Object Damaged	Repair Value (USD)	Cost-Effectiveness Ratio
Mamai USV ~240,000/unit **x2 = ~480,000**	**Ropucha-class (Olenegorsky Gornyak) ship**	300,000,000 65 + infrastructure damages	625

Cost-effectiveness ratio: value damaged/destroyed per dollar spent (object value ÷ USV costs).

After the October 2022 attack on Sevastopol, the Navy sought safety by moving its elite vessels to Novorossiysk port, 675 km from the Ukrainian-held shores, which was believed to be too distant for USVs to reach. Yet, Ukraine's strike showed the Russian Navy cannot trust any sanctuary — even in its internationally recognized maritime zone. Consequently, the Black Sea became a theater where no asset is truly safe. The balance of power continues to evolve with every strike.

63. Newdick, T. (2023). Image of Russian warship's hull torn open by Ukrainian drone boat emerges. The War Zone. twz.com
64. Public data on the production cost of the Mamai drone is not available. For purposes of cost-effectiveness analysis, estimates for the Sea Baby model have been used as the closest proxy.
65. Taylor, W. (2023). Russia's $300 million Kilo-class submarine hit in attack on Black Sea Fleet naval base as fireballs light up shipyard. lbc.co.uk

Sinking of Ivanovets missile corvette

Date: January 31, 2024

Target: Ivanovets missile corvette

Weapon System: 6 MAGURA V5 naval drones.

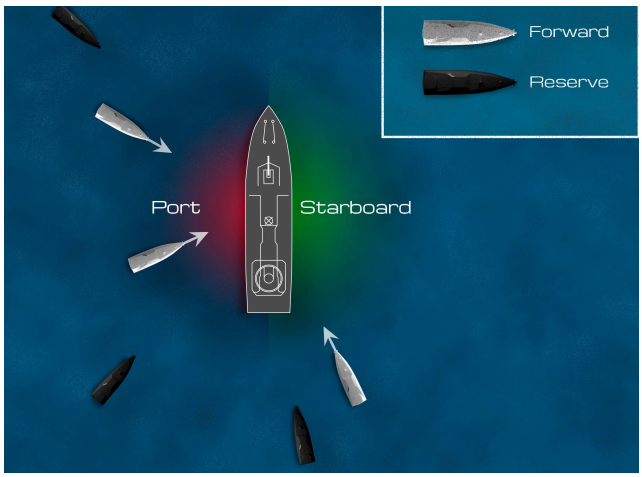
Cost-Effectiveness Ratio: $39.7 in Russian target value for every $1 spent on Ukrainian weapon systems.

In the early hours of January 31, 2024, six MAGURA V5 boats took up positions near the mouth of Lake Donuzlav in the north-west Crimea — a nighttime patrol area regularly used by the Black Sea Fleet. Their mission was to intercept the Tarantul-III missile corvette **Ivanovets** as it patrolled beyond the usual channel.

H. I. Sutton, Naval News. Map of the USV attack on the Ivanovets corvette (January 31, 2024). **66**

Instead of pursuing the corvette across the open sea, the drones relied on external intelligence to predict its patrol route. Then, the boats were pre-positioned along this path, waiting for nightfall to launch their attack. The operation was carefully coordinated. MAGURAs split into two groups: a forward element and a small reserve that stayed a couple of thousand yards behind. Drones then approached from different directions in a staggered sequence, ensuring that every defensive maneuver opened a path for the next attacker.

This tactic aims to overwhelm the adversary, forcing defenders to commit to one threat, only to be caught off guard by another while still recovering from the first.



Staggered swarm attack tactic used for the USV strike on the Ivanovets corvette

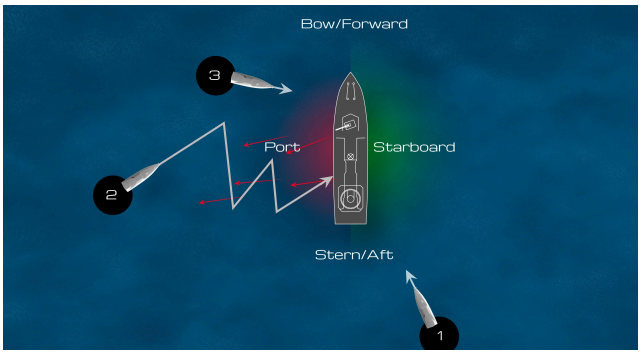
Detection, defensive fire, and the first strikes occurred almost simultaneously, leaving little room for reaction. Ivanovets detected the incoming drones at close range, quickly accelerated, and turned its bow to keep the threats within the forward firing arc. The crew immediately brought the AK-630 close-in weapon systems into action. GUR's footage shows the barrels glowing from sustained bursts and searchlights sweeping the approach lanes. This suggests that the guns were being manually aimed using the optical sight at very short ranges, rather than being guided by automatic radar or EO locks.

On paper, the AK-630 is a formidable 30 mm six-barrel CIWS, firing about 4,000 rounds per minute with an effective range of up to 5 km, controllable by either radar or optical director. In this engagement, however, the late detection and the MAGURAs' high terminal speed gave the crew only seconds to line up a shot against small, maneuvering targets. While this might be effective against a single, steady boat, it was much less so when several drones attacked from different directions just seconds apart.

66. Ozberk, T. (2024). Ukraine sinks Russian Tarantul-II class corvette with Kamikaze USV swarm attack. Naval News. navalnews.com
67. Ministry of Defense of Ukraine (2024). Ship wreck of the day! Warriors of the special unit "Group 13" of the @DI_Ukraine destroyed the missile corvette "Ivanovets" of the russian Black Sea Fleet. x.com/DefenceU

GUR. Footage of Ivanovets corvette's AK-630 CIWS attacking Ukrainian USVs. **67**

The lead trio of drones carried out the attack exactly as planned. The first drone approached from starboard-astern and detonated near the stern. About twenty seconds later, the second zigzagged through defensive fire and struck the port quarter. Roughly ten seconds after that, a third drone drove into the fresh breach amidships. **68**



MAGURA V5 attacking the Ivanovets corvette

Each hit further reduced Ivanovets's speed and ability to maneuver, making it increasingly vulnerable and opening clear run-in lanes for the trailing drones. In the end, the corvette lost control, rolled over, and sank stern-first. In short, the ship's impressive firepower proved ineffective because the crew was forced to aim manually at very close range. The first explosion shattered their defensive rhythm, and the staggered attack kept presenting new threats faster than the crew could respond. **69**

Western observers note that this was the first confirmed sinking of a warship at sea by unmanned surface vehicles. Ivanovets, one of only three guided-missile corvettes in the Black Sea Fleet, was equipped with supersonic Moskit anti-ship missiles capable of striking targets up to 130 kilometers away. In 2023, Ivanovets launched one of these missiles to sink the Ukrainian corvette Ternopil, a vessel Russia had captured in 2014 **71**. The fact that just half a dozen drones — facing cannons and CIWS defenses — could overwhelm and defeat a 56-meter corvette demonstrates the tactical power of USVs when deployed in numbers. With only six MAGURA-5 boats, Ukraine managed to inflict nearly $40 in damage to Ivanovets for every $1 spent on its drones.

GUR. Footage of the strike on the Ivanovets missile corvette. **70**

Weapon System Cost (USD)	Object Damaged	Repair Value (USD)	Cost-Effectiveness Ratio
MAGURA V5 USV ~273,000/unit **x6 = 1,638,000**	**Tarantul-class (Ivanovets) corvette**	~65,000,000 **72**	39.7

Cost-effectiveness ratio: value damaged/destroyed per dollar spent (object value ÷ USV costs).

As Ukraine's military intelligence chief Kyrylo Budanov quipped after the Ivanovets operation, *"one shouldn't underestimate a pod of dolphins [drones] hunting together."* **73** Smaller-scale skirmishes occurred throughout this period as well: Russian supply barges, patrol boats, and even a Raptor-class assault boat were reportedly sunk or damaged by Ukrainian USVs in separate incidents. Bit by bit, Ukraine was chipping away at Russia's naval presence, making the Black Sea a more level playing field.

68. Altman, H. (2024). Ukraine sinks Russian navy missile Corvette in drone boat attack. The War Zone. twz.com
69. Naval News. Analysis: An Operational View on the USV Attacks in the Black Sea from an Admiral's Eyes, February 2024. navalnews.com
70. Defense Express (2024). What's the Secret of Success Behind Ivanovets Missile Corvette Destruction. en.defense-ua.com

Sinking of Tsezar Kunikov Landing Ship

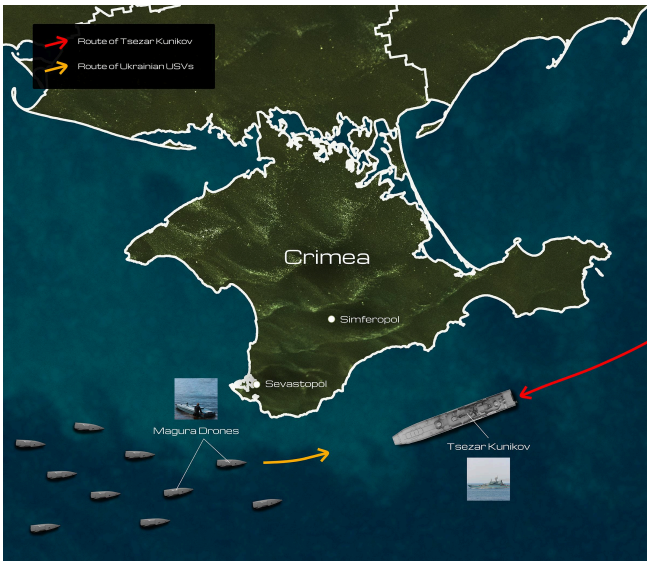
Date: February 14, 2024

Target: Tsezar Kunikov ship

Weapon System: ~10 MAGURA V5 naval drones.

Cost-Effectiveness Ratio: $46 in Russian target value for every $1 spent on Ukrainian weapon systems.

Two weeks after sinking the Ivanovets, Ukraine launched another mass naval drone attack. On the night of February 14, 2024, up to ten MAGURA V5 boats with ~705 lb payload each, were sent southeast of Sevastopol. Near Alupka, they detected a Ropucha-class **Tsezar Kunikov** ship, on its way from Novorossiysk to Sevastopol. The warship serves as a logistical support for the Russian Navy, transporting troops, equipment, and ammunition, and used during Russian wars in Georgia, Syria.



Approximate route of Ukrainian USVs and Russian Tsezar Kunikov warship.

As the swarm of USVs approached the Kunikov, the vessel's crew attacked it using small-arms fire. The Russian Ministry of Defense claimed that several of the drone boats were destroyed [74]. Nevertheless, five of them managed to break through and hit the warship, damaging the port side that eventually sank it. The MAGURAs came before dawn, riding low and fast in sea clutter that defeats lookouts and legacy radars. A Ropucha relies on 1970s-era point defense (AK-176 main gun, AK-630 close-in guns on the MR-123 director), which works against a single fast craft in daylight but falters against several tiny targets at night. By the time small arms and manually-aimed mounts could bite, a few leakers were already at the hull.

GUR. Footage of a Ukrainian USV approaching the Tsezar Kunikov ship. [75]

This marked the first sinking of a large amphibious ship by drones. Ten MAGURA V5 drones, worth a total of $2.86 million, were used — half of them ($1.43 million) managed to wreck a $100 million Russian vessel. This means that every $1 of drones destroyed roughly $46 of Russian ship value.

71. Kushnikov, V. (2023). Russia sinks a captured Ukrainian corvette. Militarnyi. militarnyi.com
72. Ostiller, N. (2024). Military intelligence: Russian missile ship sunk off occupied Crimea. The Kyiv Independent. kyivindependent.com
73. GUR documentary. (2025). Naval battle. The era of drones. GUR MO. https://www.youtube.com/watch?v=qUxjEb_WdfU
74. Newdick, T. (2024). Russian Ship Under Drone Boat Attack Seen In Dramatic Onboard Video. The War Zone. twz.com

Weapon System Cost (USD)	Object Damaged	Repair Value (USD)	Cost-Effectiveness Ratio
Magura V5 = ~273,000/unit **10x = 2,730,000**	**Ropucha-class (Tsezar Kunikov) landing ship**	110,000,000 [76]	46.1

Cost-effectiveness ratio: value destroyed per dollar spent (object value ÷ USV costs).

Not only did the loss of Tsezar Kunikov disrupt Russian logistical supply chains to Crimea, but it also made a blow that cannot be easily replaced inside the theater. After the February 14th attack, just 5 out original 13 Ropucha-class ships remained in service with the Black Sea Fleet, with them facing continued attacks [77]. Other vessels are stationed in the Baltic, Northern, and Pacific Fleets, but they are barred from entering the Black Sea via the Mediterranean under the terms of the Montreux Treaty. [78]

75. Ministry of Defense of Ukraine (2024). Veni, vidi, vici. @DI_Ukraine released video of the successful strike on the russian landing ship Caesar Kunikov. x.com/DefenceU
76. UNITED24. (2024). Russia's Most Valuable Tech Losses in Its War Against Ukraine. United24media.com
77. Ostiller, N. (2024). Navy says only 5 Ropucha-class ships left in Russia's Black Sea Fleet after sinking of Caesar Kunikov. The Kyiv Independent. kyivindependent.com
78. Newdick, T. (2024). Ukrainian drone boats sink another Russian navy landing ship. The War Zone. twz.com

Downing of Russian Su-30 Fighters

Date: May 2, 2025

Target: two Flanker Su-30 fighter jets

Weapon System: 3 MAGURA V7 naval drones, four AIM-9X Sidewinder missiles.

Cost-Effectiveness Ratio: ~$35.4 in the Russian target value for every $1 spent on Ukrainian weapon systems

In the early hours of May 2, 2025, three GUR-operated MAGURA V7 sea drones slipped along the approaches to Novorossiysk, the Russian port that had become a refuge for Black Sea Fleet units. Overhead, a pair of Russian **Su-30** Flankers patrolled the Black Sea waters at a low altitude, likely on counter-drone duty. Suddenly, two of the Maguras fired air-to-air missiles, bringing both fighter jets down.

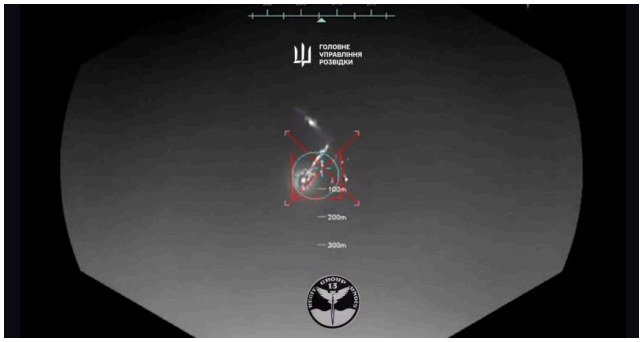
This marked the world's first shoot-down of manned combat aircraft by naval drones. Early reports credited a modified R-73 (nicknamed Sea Dragon) and later the AIM-9M [79]. GUR chief Kyrylo Budanov has since stated the boats carried the AIM-9X Sidewinder [80] — a short-range, imaging-infrared missile with high off-boresight lock, strong IR counter-countermeasures, and thrust-vectoring for hard post-launch turns. Unlike the AIM-9M, the 9X can lock far off the launcher's nose (similar in concept to Russia's R-73) and is harder to spoof with flares. Block II adds a datalink for lock-on-after-launch (LOAL), though it's not publicly known whether MAGURA-7 uses this feature.

This choice of weapon shaped the course of the attack. The MAGURA V7's aircraft-type rails raise and lower but don't rotate sideways, so the crew still had to point the hull toward the target. With the EO/IR turret cueing the AIM-9X (which can lock well off the nose), the heading only needed to be approximate.

After launch, the missile's thrust-vectoring pulled it onto the jet even with small course errors and flare bursts.

Naval News. MAGURA V7 drone boat carrying the AIM-9X Sidewinder missiles. **81**

One MAGURA V7 served as bait, showing just enough wake and engine heat for patrol sensors to draw the jets. The other two boats held offset positions already aligned with the likely route in, so only small heading changes would be needed when a target appeared. The first Su-30SM descended to low altitude. The nearest drone turned towards the jet, used its stabilized infrared camera to cue the AIM-9X, and fired. The missile maintained track despite flares and struck the aircraft. Minutes later, the partner boat executed the same sequence: slight heading adjustment, missile away, and a second hit.



GUR. Footage of USV striking a Su-30 jet. **82**

79. Defense Express. (2025). The Missile Used By Ukrainian Magura Drone For Historic Su-30 Downing Was the AIM-9 Sidewinder. en.defence-ua.com
80. Altman, H. (2025). AIM-9X Being Used By Ukraine's Drone Boats To Engage Russian Jets, Not AIM-9M. The War Zone. twz.com
81. Sutton, H. I. (2025). First Image Of Ukraine's Sidewinder-Armed Magura V7 Surface Drone. Naval News. navalnews.com

For the Russians, this meant their low-flying maritime patrols now faced a lethal threat from below, signaling that dangers now reach well beyond coastal infrastructure. With three MAGURA-7 boats and four AIM-9X missiles, Ukraine was able to destroy roughly $35.4 worth of two Su-30 jets for every $1 spent on its weapon systems. [83]

Weapon System Cost (USD)	Object Damaged	Repair Value (USD)	Cost-Effectiveness Ratio
MAGURA V7 USV ~273,000/unit **x3 =825,000**	**x2 Flanker (Su-30) fighter jets**	~50,000,000/ unit [84]	~35.4
AIM-9X missile ~500,000/unit **x4 = ~2,000,000**			
Total: ~2,825,000			

Cost-effectiveness ratio: value destroyed per dollar spent (object value ÷ USV costs).

As naval analyst H.I. Sutton noted, *"fast jets are not safe from the USVs... In future, Russian aircraft may have to stay higher and use expensive stand-off weapons to tackle Ukrainian drones"* [85]. In other words, Ukraine's USVs not only threaten ships; they now force Russia to adapt its air tactics at sea, raising the cost and complexity of counter-drone operations.

82. GUR. (2025). World First: Defence Intelligence of Ukraine Destroys russian Su-30 Fighter Jet with a Sea Drone Strike,. gur.gov.ua
83. Public data on the production cost of the MAGURA V7 is not available. For purposes of cost-effectiveness analysis, estimates for the earlier MAGURA V5 model have been used as the closest proxy.
84. GUR. (2025). World First: Defence Intelligence of Ukraine Destroys russian Su-30 Fighter Jet with a Sea Drone Strike,. gur.gov.ua
85. Sutton, H. I. (2025) World First: Ukrainian Maritime Drone Shoots Down Russian Flanker Jet. Naval News. navalnews.com

Tactical Disruption and the Psychology of Risk

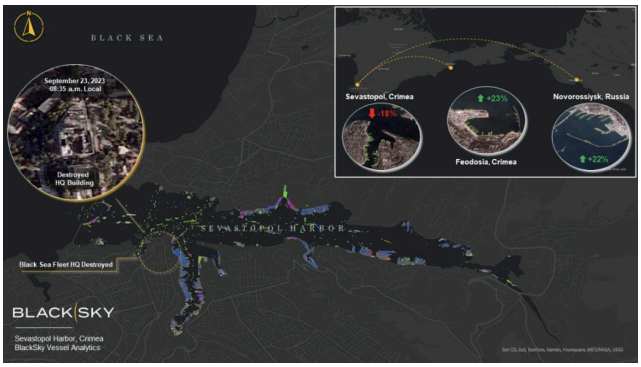
The decisive shift in the Black Sea came not with the first Russian ship destroyed, but with the moment Russia could no longer trust its own sanctuaries. The October 2022 attack on Sevastopol, when uncrewed surface vessels penetrated one of the most heavily defended anchorages in the world, demonstrated the fundamental vulnerability of large navies to small, cheap platforms. RUSI's analysis emphasized its historical character: never before had drones been used to breach layered defenses around a fleet base, and the effect was immediate — Russia was forced to treat every harbor, inlet, and patrol zone as potentially compromised. 86

From that point, Ukraine's USVs became a permanent disruptive presence. Naval News later described them as Kyiv's "winning cards": a capability that did not require constant victory to matter, but simply had to persist in the battlespace to impose a continuous psychological tax on Russian decision-making 87. Every small radar contact became a threat, every transit near Crimea a gamble. Russian crews began sailing in tight formations, assigning escorts even for routine movements. High-value ships, such as Ropucha-class landing vessels and government transports (such as Sparta-IV and Yaz), were now always accompanied by two or more close escorts — typically Project 22160 patrol ships and, when available, a frigate — often with helicopters overhead. Ships switched off their automatic identification systems (AIS) to avoid open-source detection 88. What had once been routine patrols now became defensive maneuvers carried out under constant threat.

H. I. Sutton. Elite Russian vessels (Ursa Major and Yaz) escorted across the Black Sea (September 14, 2023). **89**

86. Sutton, H. I. (2024). Uncrewed Platforms Have Been Critical to Ukraine's Success in the Black Sea. RUSI. rusi.org
87. Sutton, H. I. (2025). Ukraine's Winning Cards Against Russia In The Black Sea. Naval News. navalnews.com
88. Sutton, H. I. (2023). Russia Forced to Adapt to Ukraine's Maritime Drone Warfare in Black Sea. Naval News. navalnews.com
89. Sutton, H. I. (2023). Ukraine's Attack On Sevastopol Also Targeted Important Ships Crossing Black Sea. Naval News. navalnews.com

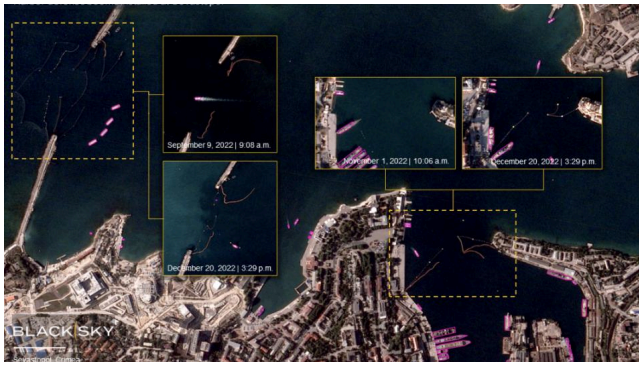
The Black Sea Fleet had been driven "into a largely defensive crouch." Ships withdrew eastward toward Novorossiysk, far from contested waters. Following Ukrainian missile strikes on warships and the Sevastopol naval base in September 2023, ship traffic at the Crimean port dropped by 18%. Meanwhile, ship movements increased by over 20% in Feodosia — located 100 miles away on the opposite side of Crimea — and in Novorossiysk, more than 200 miles away on Russia's Black Sea coast. By December 2023, many vessels stationed in Feodosia had relocated to Novorossiysk.



BlackSky. Russian fleet migration away from Sevastopol to other harbors. **90**

Patrol craft once tasked with enforcing a blockade were reassigned as pickets and screeners, burning fuel and exhausting crews in the attempt to spot and neutralize USVs. This is the essence of tactical disruption: Ukraine's drones didn't have to be everywhere to be effective — the perception of their possible presence alone forced Russia to adjust its deployment of resources.

That disruption drove Russia's material and organizational adaptation. Ports such as Sevastopol and Novorossiysk were quickly encircled with booms, floating barriers, and defensive nets. By April 2023, Sevastopol harbor alone had six separate boom lines, with additional nets added over time. **91**



BlackSky. A comparison of defenses around Sevastopol harbor (autumn 2022–summer 2024). **92**

As a result, watch rotations intensified. Be-12 flying boats were deployed to detect USVs, while Mi-8 and Ka-27 helicopters stood ready to attack drones with missiles and machine guns. Scheduled and unscheduled drills became routine. For example, on 23 December 2023, the Black Sea Fleet held a base-defense exercise in Sevastopol that focused on detecting and destroying enemy drones using shipboard weapons and small arms. **93**

H. I. Sutton. Russia's multi-layered defense against Ukraine's maritime drones around Sevastopol.

Between these drills, Russian nightly communiqués frequently reported alert nights and engagements, even when no independent wreckage was found. For example, on 10 September 2023, officials reported that air defenses had downed eight drones and destroyed three "speedboats" near Crimea.

90. Defense One. (2024). New sat images show Russian vessels fleeing Black Sea ports. defenseone.com
91. Sutton, H. I. (2023). New Defenses Show Russia On Defensive In Sevastopol As Ukraine Attacks. Naval News. navalnews.com
92. Defense One (2024). New sat images show Russian vessels fleeing Black Sea ports. defenseone.com
93. Lenta.ru. (2023). The Black Sea Fleet recently held exercises in Sevastopol focused on neutralizing enemy drones. lenta.ru

Just ten days later, on the night of 20–21 September, they claimed to have destroyed 19 drones over Crimea and the Black Sea. These incidents show that crews were repeatedly called to nighttime action stations, regardless of whether later evidence confirmed Ukrainian losses. Compared with Sevastopol's layered barriers and patrols, Novorossiysk has remained lighter on defenses. Around 11–15 November, a boom was laid across the naval base entrance — just after Kyiv publicly stated its maritime drones could range about 430 nautical miles (800 km), putting Novorossiysk within reach.

H. I. Sutton. Russian defences in Novorossiysk port (November 2022). **94**

UK Ministry of Defence. Russia increased its defenses at the entrance to Novorossiysk port (March 18, 2024). **95**

By March 2024, British defense intelligence reported four barges positioned at the harbor mouth to "enhance the defenses" against Ukrainian uncrewed surface vessels; even so, the barrier-and-patrol density still falls well short of Sevastopol's.

NATO and CSIS reporting both note that the diversion of manpower and investment into static defenses represents a structural cost: vessels and crews tasked with defending harbors or escorting convoys were no longer available for offensive operations **96**. In practice, Russia lost not only ships to Ukrainian drones but also the initiative in the theater.

94. Sutton, H. I. (2022). Summary Of Increased Russian Defenses At Sevastopol And Novorossiysk. hisutton.com
95. Tril, M. (2024). British Defense Ministry: Russia enhances defense of Novorossiysk Sea Port in Black Sea Fleet from Ukrainian strikes. Euromaidan Press. euromaidanpress.com

Denial Through Cost Imposition

If tactical disruption undermines confidence, the second major effect of Ukraine's USV campaign is the economic asymmetry it imposes. At the core of this effect lies the unit cost differential. A MAGURA V5 drone can be produced for approximately $273,000, while the heavier Sea Baby remains in a similar range — about 8.5 million hryvnias, or $230,000–$250,000 depending on configuration and exchange rates. For Ukraine, this means losses are tolerable, because every craft is designed to be attritable and replaced in serial production runs. For Russia, the targets at risk are orders of magnitude more expensive.

The most telling example is the sinking of the Ivanovets corvette on 1 February 2024. Built as a Project 1241 Molniya-class missile ship, its estimated value was $60–70 million. Ukrainian forces achieved its destruction with a handful of MAGURA drones whose combined cost was well under $1 million. The exchange rate is stark: one drone costing less than 0.5% of the value of the ship destroyed. This is the true currency of denial — a small strike asset forcing the loss of an irreplaceable capital unit.

The asymmetry extends beyond battle damage. Each Ukrainian sortie, even if intercepted, compels Russia to maintain expensive defenses. RUSI notes that nets, barriers, layered patrols, and constant counter-drone drills all represent a permanent drain of fuel, munitions, and manpower [97]. RAND's analysis of attritable systems stresses this point: denial is achieved not only by destruction but by forcing the opponent into a cycle where sustaining defenses is economically unsustainable [98]. Every dollar Kyiv invests in producing another drone forces Moscow to spend ten, or a hundred, in fuel, training, ammunition, and the maintenance of defensive infrastructure.

This dynamic has a direct effect on blockade economics. Russia can no longer sustain a cost-effective interdiction posture in the northwestern Black Sea. Where once a few ships could enforce control, today each movement requires escorts, radar sweeps, and port reinforcements — all costs that accumulate daily. Meanwhile, Ukraine can replace a lost drone with another crowdfunding round or production batch in weeks. This inversion of cost is what makes USVs strategically decisive: they force a navy built on expensive legacy platforms to fight a war on economically ruinous terms.

Ships no longer need to be matched with ships; instead, drones invert the logic of sea control by ensuring that high-value vessels cannot operate freely without incurring risk disproportionate to their purpose. In effect, Ukraine's USVs are economic weapons as much as tactical ones. Their impact is not only in the ships they sink but in the structural imbalance they enforce. Each drone sortie is a financial transaction that Russia cannot afford to replicate indefinitely — a war of attrition fought not just in steel and explosives, but in the economics of naval power itself.

96. NATO Parliamentary Assembly. (2025). 2025 Black Sea Report. nato-pa.int Center for Strategic and International Studies. (2025). Maritime Domain Lessons from the Russia-Ukraine Conflict. csis.org
97. Ibid.
98. Hvizda, M., Frederick, B., Laufer, A., Evans, A. T., Gunness, K., & Ochmanek, D. A. (2025). Dispersed, Disguised, and Degradable. RAND. rand.org

Integration with ISR and Joint Networks

A critical enabler of Ukraine's naval drone campaign has been the integration of USVs into a wider intelligence-surveillance-reconnaissance (ISR) and strike network. Rather than operating in isolation, the unmanned boats are used in concert with aerial drones, electronic warfare, and traditional forces to maximize their effectiveness as part of joint, multi-domain operations.

From the reconnaissance phase to the strike, UAVs have often worked hand-in-hand with USVs. High-flying Bayraktar TB2 drones, for instance, can scout Russian naval movements far beyond the horizon of Ukraine's coast, cueing USV launch teams when a target opportunity appears. In several documented attacks, Ukrainian officials have indicated that drones provided real-time overwatch: during the Ivanovets corvette attack, ISR drones likely confirmed the target's position and helped coordinate the timing of the six USVs approaching from multiple vectors. In the Sevastopol operations, Ukraine is believed to have flown UAVs not only to distract Russian defenses but also to observe and record the strikes, relaying damage assessments back to command in real time. This live feedback loop would have allowed Ukraine to adjust its tactics (for example, sending remaining drones to a ship that appeared unscathed or aborting if a target was clearly neutralized). The sensor-sharing between unmanned systems — an aerial drone spotting a target for a surface drone, or vice versa — exemplifies modern networked warfare. It effectively gives a commander "eyes on" a target from multiple perspectives, all without risking pilots or warship crews.

Electronic warfare (EW) and secure communications have been another piece of the integration puzzle. Ukrainian drones rely on robust links — often via Starlink satellite communications — for control and live video. Russia made several attempts to jam or spoof these links; at times, outages or geofenced denial of Starlink service disrupted Ukrainian operations.

In response, Ukraine equipped newer USVs with multi-channel comms (satellite, radio, cellular) and pre-programmed waypoint navigation so that even if they lost contact, they could continue toward the target. Meanwhile, Ukraine's own EW units worked to jam Russian radars and datalinks during major attacks on the fleet, seeking to degrade Russian situational awareness. While details are scarce, there are indications that prior to some drone strikes, the Ukrainians unleashed cyber/EW effects — for example, hacking into CCTV feeds or sensor networks in Sevastopol — to blind the enemy at the critical moment. This sophisticated integration of cyber-electromagnetic effects with physical attacks reflects a high level of coordination. Rear Admiral Mike Mattis observed that Ukraine's ability to generate "all-domain effects" in the Black Sea — combining unmanned systems with ISR, EW, and precision fires — has been eye-opening for NATO observers and is now a case study in innovative war. [99]

For Ukraine, a nation fighting under resource constraints, this networked approach maximized the impact of each drone. A single USV on its own might struggle to locate or reach a target; linked into a broader ISR-strike network, that same USV becomes a lethal node in a kill-chain. The lesson is clear: unmanned systems are most effective when meshed into an integrated force, not used as standalone silver bullets. Ukrainian commanders treated USVs as assets to be combined with traditional forces (special ops, artillery strikes on port facilities, etc.) and other drones to achieve an effect greater than the sum of its parts.

99. Center for Strategic and International Studies. (2025). Maritime Domain Lessons from Russia-Ukraine. csis.org

Russia's Black Sea posture is built around layered sea denial: blockades, coastal missile and naval-aviation strikes, submarines and mines, plus long-range cruise-missile fire. In early 2022, that mix isolated Ukraine's ports, degraded its fleet, and damaged coastal infrastructure. Now, Russia, caught off-guard by Ukraine countering the Black Sea Fleet with domestically-produced USVs, is trying to scramble the threat — with mixed results. Yet, as Ukraine takes a more assertive stance at sea, Moscow is likely to employ its full arsenal of tactics once again.

Naval Blockades

From the onset of the full-scale Russo-Ukrainian war, Russia ran two complementary campaigns at sea: seize where it could, deny where it must. In the Sea of Azov, it closed the strait and put naval infantry ashore to take the coast around Berdyansk and encircle Mariupol.

In the Black Sea, it imposed a distant blockade of the approaches to Odesa, Chornomorsk, and Pivdennyi, later extending pressure to the Danube corridor (Reni, Izmail), relying less on a picket line of hulls than on manufactured risk. Moscow posted sweeping danger notices, sowed mines, and used long-range missile and drone strikes to choke off shipping and tie Ukrainian units to the shoreline, while major surface combatants stayed well beyond Ukraine's anti-ship reach.

On 24–25 February 2022, Russia's maritime authorities suspended navigation in the Sea of Azov and warned that the entire northwest Black Sea north of 45°21′ was off-limits — vessels in that area would be treated as 'terrorist threats.'[100] The effect was a de facto blockade that weaponized risk and insurance as much as steel and propellant.

(Feb–Mar 2022). Russia closed the Sea of Azov, gathered forces around Berdyansk and Mariupol, and imposed a distant blockade of Ukraine's Black Sea ports. The blockade relied not only on mines and missile strikes, but also on the manufactured risk of sailing through declared danger zones

100. Vance, C., & Pedrozo, R. (2022). Ukraine Symposium – Maritime Exclusion Zones in Armed Conflicts. Lieber Institute West Point. lieber.westpoint.edu

The early pattern had three layers. First, close the Azov and seize the coast: Russian amphibious units landed west of Mariupol on 25 February and, supported by naval gunfire, helped encircle the city while Berdyansk became a logistics hub for the siege. U.S. officials counted roughly ten Ropucha-class landing ships assembled for these moves — enough to put "potentially thousands" of naval infantry ashore. 101

Second, build a long-range A2/AD cocoon: ships and Kilo submarines launched Kalibr missiles, coastal Bastion batteries in Crimea pushed the anti-ship threat envelope, and aircraft extended their reach. Third, mine the approaches and let fear do the rest. When the Estonian-owned M/V Helt sank after striking a drifting mine on 3 March, NATO's Shipping Centre and multiple hydrographic offices warned of unmoored mines across the western Black Sea — effectively closing the lanes to neutral shipping 102. Turkey's decision on 28 February–1 March to apply Montreux Convention wartime provisions 103 then froze the naval balance in the theater: no fresh NATO task groups into the Black Sea, and no new Russian reinforcements through the Straits.

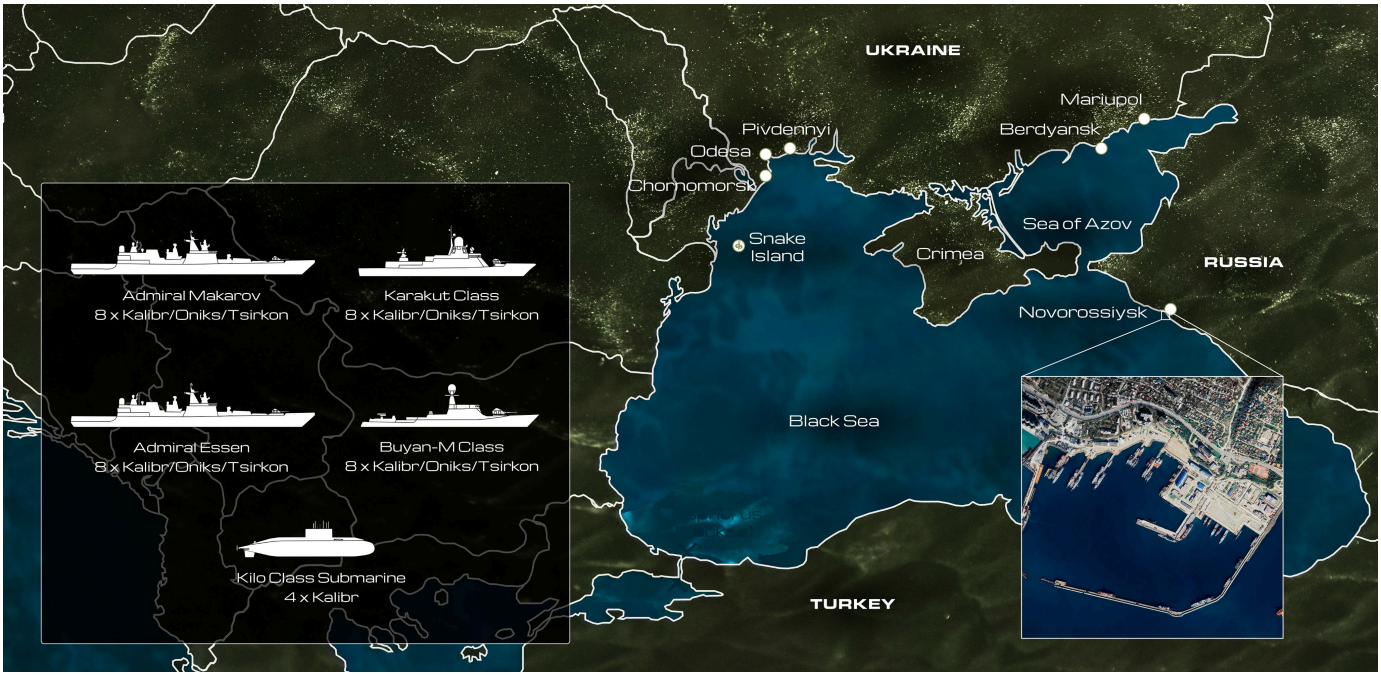
Daily Mail. Site of M/V Helt sinking near Odesa after a mine explosion (3 Mar 2022). **104**

Snake Island tightened the noose. Its occupation on day one gave Russia a forward surveillance and missile outpost astride the Danube approaches; its abandonment on 30 June under sustained Ukrainian strikes loosened Russia's grip but did not end sea denial.Even as the big ships edged back beyond the horizon after Moskva's loss, the blockade persisted because the instrument was never just hulls. Moscow repeatedly declared danger areas, seeded mines (or benefited from their drift), and used stand-off weaponry to signal that any attempt to approach Ukrainian ports might be lethal or uninsurable. This was blockade by cumulative risk.

The amphibious arm took heavy attrition: the Saratov (Alligator class) was destroyed at Berdiansk in March 2022; Novocherkassk and Minsk were wrecked in 2023; Tsesar Kunikov was sunk in February 2024; Olenegorsky Gornyak was badly damaged off Novorossiysk; other Ropuchas were hit in Sevastopol. By mid-February 2024, Ukraine's navy assessed that only five Ropucha-class ships remained serviceable in the Black Sea. 105

What matters for a decision-maker is not the romance of big-deck fleets but the residual toolkit Russia still has for sea denial. Today, two Admiral Grigorovich-class frigates — Admiral Makarov and Admiral Essen — often operate from Novorossiysk. Both are Kalibr platforms when stocks allow, and both can cue strikes while staying inside Russia's layered air defense arc. Several Kilo (Project 636.3) submarines remain operational from the same bastion, even after the loss of B-237 Rostov-na-Donu in dry dock. These boats are quiet, missile-capable, and well-suited to a fleet that prefers to threaten from sanctuary. Missile corvettes — Buyan-M and Karakurt classes — add intermittent Kalibr capacity, and Russia's patrol ships and Coast Guard craft continue presence missions in the eastern Black Sea and Azov.

101. Mongilio, H. (2022). Russian navy launches amphibious assault on Ukraine; Naval infantry 30 miles west of Mariupol. USNI News. news.usni.org
102. NATO Shipping Centre. (2022). Risk of collateral damage in the northwestern Black Sea. shipping.nato.int
103. Mongilio, H. (2022). Turkey closes Bosphorus, Dardanelles straits to warships. USNI News. news.usni.org
104. Newman, J. (2022). Estonian cargo ship sink after "hitting a mine" off Ukraine coast near Odesa. Mail Online. dailymail.co.uk
105. Ostiller, N. (2024). Navy says only 5 Ropucha-class ships left in Russia's Black Sea Fleet after sinking of Caesar Kunikov. The Kyiv Independent. kyivindependent.com



The Russian Navy base in Novorossiysk. Photo credits: Google Earth ***106***

Most tellingly, Russia retains the ability to reseed mines, to issue expansive danger notices on short timelines, and to blend drones, ballistic, and cruise missiles into night-by-night harassment of ports and Danube river hubs. Even after the retreat from Sevastopol, that mix has kept Odesa under pressure and forced Ukraine into a costly, constant air-defense alert.

Russia runs its blockades with two steps: declaring vast zones 'unsafe,' then deterring neutral shipping with mines, insurance spikes, and a drumbeat of strikes. If Ukraine adapts — by shifting cargo to Danube ports or hugging NATO waters — punish those nodes and routes. The reaction to Ukraine's adaptation was a shift from surface operations to deploying a 'fleet in being' behind hardened harbors, increasing reliance on land-based missiles, aviation, and submarines to maintain pressure.

Ukraine's progress has come from practical steps rather than dramatic breakthroughs. Mobile and deceptive coastal anti-ship units restricted Russian vessel operations near shore, limiting their maritime advances. Removing Russian forces from Snake Island disrupted Russian control and eased the blockade.

Ukraine's use of naval drones to strike Sevastopol provided a new way to contest Russian dominance without direct naval engagement. Establishing and securing a western littoral corridor, with targeted war-risk insurance, rapid mine-clearing alongside allies, shifted the tactical balance toward Ukraine. These measures steadily reduced the blockade's effectiveness, decreased Russian naval presence, and ended Russia's visit-and-search operations. As shipping resumed, the corridor's value was confirmed, and legal threats lost their impact.

Despite these gains, hazards persist — most notably, drifting mines, which continue to pose a chronic threat. In response, Turkey, Romania, and Bulgaria have established a Black Sea mine countermeasures group. While Russia can still impose costs through standoff fires, the Black Sea Fleet is continuously attacked, and since mid-2023, ships have been sailing at Ukrainian ports without Russian approval. This demonstrates that sea denial can be contested without matching naval strength. While Russia retains punitive tools, it no longer holds a veto.

106. Kushnikov, K. (2025). Drones Attacked the Port of Novorossiysk. Militarnyi. militarnyi.com

Strategic aviation

Over the course of the war, Russia has repeatedly shifted decisive contests for the Black Sea from the surface to the air. In the war's opening phase, Russian naval and VKS aviation from Crimea treated Ukraine's remaining ships as fleeting targets in a permissive sky. On 3 March 2022, the patrol boat *Sloviansk* (P190), an Island-class cutter, was found off Odesa and destroyed by an air-launched anti-ship missile, widely assessed as a Kh-31. Hours later, Ukraine scuttled its sole frigate, *Hetman Sahaidachny*, at Mykolaiv rather than sail under hostile air and missile coverage it could not counter.

The pattern hardened along the coast and into the Azov Sea. In Mariupol, small craft that tried to move or support the garrison were interdicted from above. One Gyurza-M gunboat (Lubny, P-178) was sunk in the harbor and later raised by Russian forces, while her sister *Kremenchuk* (P-173) was captured when the city fell. Air threat, not gunnery duels, decided their fate. When Ukrainian defenders struck back, they did so from shore or through improvisation. On 22 March, a Ukrainian team used a Fagot ATGM to hit a Russian Raptor-class boat just off the beach. On 2 May, Bayraktar TB2s destroyed two Raptors near Snake Island, forcing Russian pickets to back out of the littoral. Each success trimmed the surface picture, but it did not lift the aerial cover overhead.

Russian aviation then widened its focus from hunting boats to paralyzing bases. On 1 May 2022, a Bastion-launched Oniks demolished Odesa's newly rebuilt runway, an air denial strike with maritime effects that isolated the port's sustainment. In turn, Tu-22M3s pushed in from the Black Sea with heavy Kh-22s. On July 1, a Kh-22 barrage struck Serhiivka in Odesa Oblast with grim civilian tolls, showing how an anti-ship weapon could be used to terrorize coastal cities and port workers. Ukraine's naval aviation suffered as well. On 7 May, naval aviator Col. Ihor Bedzai's Mi-14 was shot down near Odesa after a mission tied to the Snake Island fight. The strategic logic was consistent: use airpower based in Crimea to blind, burn, and box in Ukraine's maritime lifelines while surface forces held steady.

After two years of Ukrainian long-range strikes and steady attrition of the Black Sea Fleet, Russia now has a thinner but still consequential air complex. The Black Sea Fleet's 43rd Naval Aviation Regiment at Saky began the war with 12 Su-30SM multirole fighters and several Su-24M strike aircraft. The explosions at Saky in August 2022 reportedly reduced the number of operational BSF naval aviation combat jets to fewer than six. [107]

Maxar Technologies/Handout via Reuters. An infrared overview of damaged aircraft at Saki Airbase after the attack in Novofedorivka, Crimea August 10, 2022. [108]

Ukraine has maintained pressure on these sanctuaries, most notably with a May 2024 strike that satellite imagery assessed destroyed three fighters and a fuel site at Belbek. Russia has rotated other fighters, including Su-35S and Su-30SM, to sustain combat air patrols from Crimea and Krasnodar. Persistent air patrols, armed with long-range air-to-air and Kh-31/Kh-59 air-to-surface missiles and supported by S-400 systems, continue to threaten anything that approaches the water.

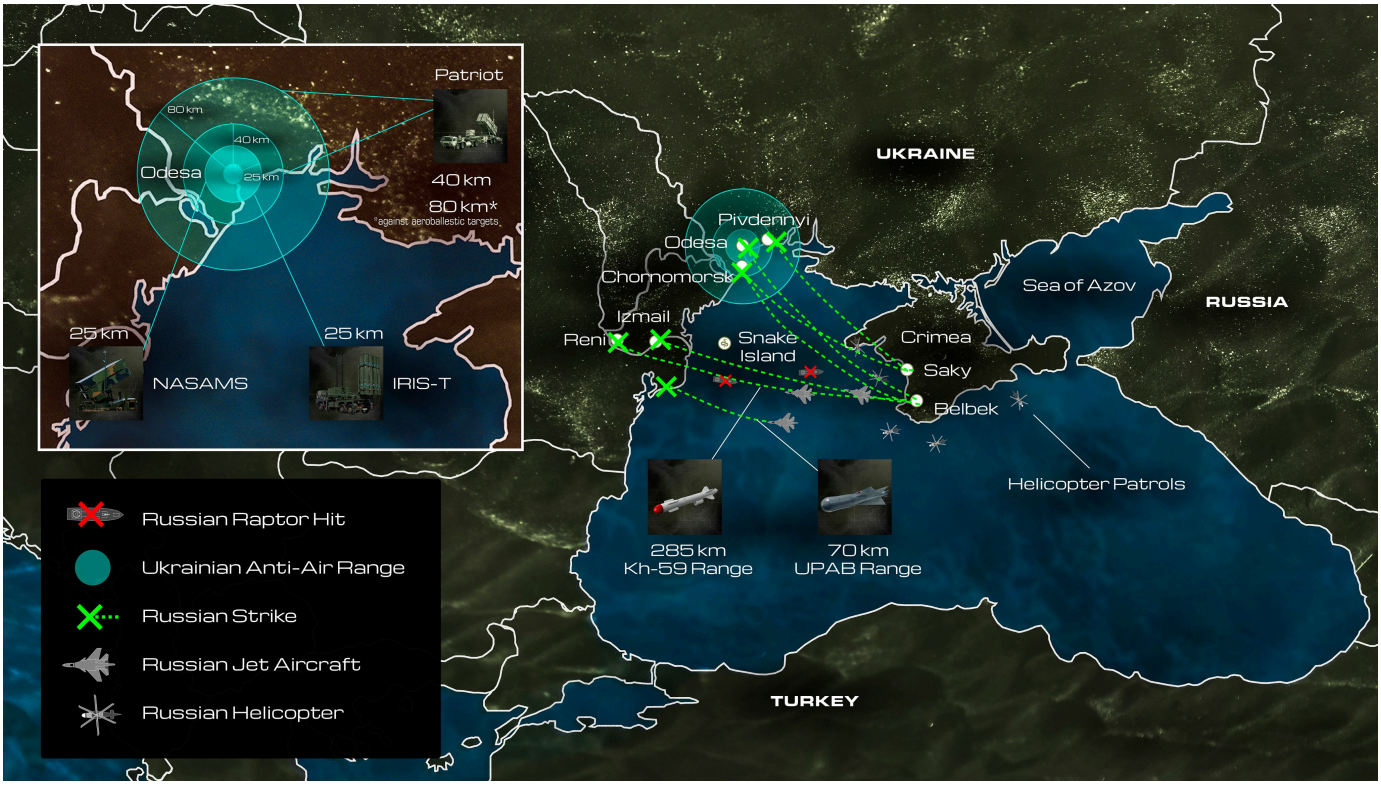
107. Reuters (2022). Half of Russia's Black Sea fleet's combat jets out of operation, Western official says. reuters.com
108. Reuters (2022). Half of Russia's Black Sea fleet's combat jets out of operation, Western official says. reuters.com

Christiaan Triebert. Belbek airfield. **109**

Capabilities matter more than numbers. The strategic focus for Ukraine has shifted as specific Russian capabilities are now countered effectively. Tu-22M3 bombers can still launch Kh-22/Kh-32 from a sanctuary to strike ports and coastal infrastructure, but their impact has been reduced by enhanced air defenses.

Su-30SM/35S fighters remain the fast-response hammer for detected surface targets, yet their operations are increasingly constrained by Ukrainian anti-air measures. Their Kh-31s will destroy a patrol craft or USV with overmatch if cued in time, but the window of opportunity is narrowing.

Guided bombs (UPAB-series) and Kh-59s provide standoff options against piers, depots, and ferries; however, Ukraine's air defense systems have begun to deny these strikes with increasing frequency. Ka-52s and Orlan-class UAVs furnish maritime reconnaissance along the shoreline, but their effectiveness is diminished as Ukrainian Patriots, NASAMS, and IRIS-T have pushed the envelope of air denial around Odesa and the Danube, blunting some 2022-style freedom of action. The air threat over water remains the hardest part of Russia's A2/AD lattice to pry up quickly, yet the ability to strike with impunity has been significantly reduced.



Evolution of air attacks on the Black Sea

109. Ukrainska Pravda (2024). Satellite images of Russian Belbek airfield in Crimea after missile strike appear online. pravda.com.ua

Ukraine has adapted by making risk reciprocal. First, it treated every naval move as an air-sea operation, integrating coastal air defenses with maritime actions. That fusion enabled surprise shots — Neptune and later the Harpoon missiles from shore, as well as TB2s over Snake Island. These tactics gradually forced large Russian warships to operate much farther from the coast, often tens of miles offshore. As a result, Russian aircraft had to fly longer distances and operate with less reliable targeting information, making it harder to launch quick strikes against small Ukrainian boats.

Second, Ukraine took the offensive into Crimea's sanctuaries. ATACMS-class strikes and deep-reach drones turned locations like Saky and Belbek, formerly safe staging points, into zones of attrition. This strategy decreased sortie rates and forced the dispersal of Russian aviation at critical times when it was needed to shield vulnerable logistics and tugs.

Third, Ukraine advanced the technological front. In May 2025, Kyiv claimed a world first by reporting that maritime drones armed with AIM-9s shot down one, and later reportedly two, Su-30SMs over the Black Sea. The significant point was underscored: even a minimal, expendable presence at sea now poses a threat to the fighters that once dominated these waters.

GUR. The view from the targeting system of a Magura naval drone shows the moment of engagement with a Russian Su-30 fighter jet over the Black Sea near Novorossiysk, Russia, on (May 2, 2025). ***110***

None of this diminished the surface fight — instead, it reframes it. By 2025, the air umbrella is patchier, the sanctuaries leakier, and the risk more two-sided. Ukraine did not win command of the air, but it denied Russia the habit of it long enough and often enough to reopen narrow corridors for trade and keep maritime operations alive at the edge of an adversary's range.

110. GUR. (2025). World First: Defence Intelligence of Ukraine Destroys Russian Su-30 Fighter Jet with a Sea Drone Strike,. gur.gov.ua

Cruise-Missile and Ballistic Missile Attacks

Russia has steadily regained the Black Sea initiative with ongoing, long-range strikes on Ukraine's ports, fuel, runways, and uncrewed naval infrastructure. The attacks started around Odesa and Mykolaiv, reappeared after any Ukrainian maritime success, and later expanded to the Danube after Ukraine bypassed the blockade. This shows Moscow's ability to shape the maritime theater even without freedom of maneuver. By targeting ports and infrastructure, Russia exerts economic and strategic pressure while avoiding direct naval encounters.

From early spring 2022, at the war's start, sea-adjacent launchers acted as long-range artillery. Black Sea Fleet Kalibrs struck from sea, while Bastion-P batteries fired from Crimea. Long-range bombers launched missiles over the Black Sea. On May 1, 2022, a Bastion-launched P-800 Oniks cratered Odesa's rebuilt runway, briefly isolating the city by air and signaling that coastal airbases were targets [111]. By early summer, Tu-22M3s with Kh-22s hit Serhiivka in Odesa Oblast, killing civilians. Russia showed it would trade accuracy for destruction in port cities.

When Ukraine forced the Black Sea Fleet out of Crimea and opened a grain corridor, Russia began targeting Danube ports like Reni and Izmail in August 2023. These strikes aimed to raise insurance costs and choke exports, all without endangering its ships. The pattern returned in 2025. Ballistic strikes hit Odesa's container and grain terminals from late May to July.

These included a two-missile Iskander attack on May 23 and another deadly strike on July 3. These were not prestige attacks; they were economic warfare. They disrupted USV hubs, split air defenses, and reminded shippers that corridor safety depends on insurers.

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Russia now builds these salvos with a clear logic. Attack waves mix cheaper Shahed-131/136s and other missiles. Kalibrs are used when stocks allow. Supersonic Oniks from Bastion batteries are hard to intercept, moving at about three times Tomahawk speed. Kh-22/-32 from Tu-22M3s bring brute force and move faster than normal cruise missiles. Iskander-M missiles are used to outrun point defense and send a message. Analyses show Kalibr use dropped sharply after 2023, and Russia now relies on air-launched cruise missiles and drones for volume. Inventory and production tempo shape the mix more than preference.

Projected strike zones of Russian air targets

What matters is not Russia's arsenal in February 2022, but what it can fire in 2025. Despite losses, only the Admiral Grigorovich-class frigates — Admiral Makarov and Admiral Essen — are the main Kalibr surface shooters when leaving Novorossiysk. Each has eight UKSK cells, giving a combined notional 16-round salvo. Russia's smaller Kalibr ships have declined.

The brand-new Karakurt corvette Tsiklon, based at Sevastopol, was destroyed in May 2024. Another Karakurt, Askold, suffered heavy damage at Kerch in November 2023. Buyan-M corvettes still appear intermittently in the eastern Black Sea and Sea of Azov as weather and risk allow. The fleet's Kilo-class submarines, historically six modern 636.3 boats in theater, have been a swing factor for sea-launched Kalibr. One of them, Rostov-on-Don, was likely a total loss after the September 2023 Sevastopol strike. Others continue to operate from safer waters. On any given day, Ukraine's Navy has reported zero to five Kalibr carriers at sea. On May 2, 2025, it counted five, with a combined volley of up to 34 missiles [112]. The exact mix fluctuates with repair cycles and risk tolerance. Still, the ability to mass a volley of likely 25–35 ready Kalibr missiles persists.

Russia supplements its afloat assets with shore and air strikes. Bastion-P units in Crimea often fire P-800 Oniks at Odesa infrastructure. Their speed and flight paths reduce response time and complicate interception. Tu-22M3s with Kh-22/-32, and sometimes MiG-31K Kinzhals, strike deep inland, staying outside most coastal GBAD defenses. Moscow saturates targets by adding more Shaheds. In short, there are fewer Kalibrs, but a broad mix of threats. This keeps ports under pressure while Russia's surface fleet remains cautious.

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Type of missile	Payload	Speed	Range	Launch sites
Bastion-p — p-800 oniks	300kg	3180km/h	600km	Crimea
Tu-22m3 — kh22/32	500kg	4,290–5,640 km/h	600km	Engels/Caspian Sea
Mig31k – kinzhals	480kg	12,250 km/h	2000km	Savasleika

Technical characteristics of Russian air crafts

111. Russia knocks out Odesa runway, Zelenskiy says it will be rebuilt, May 1, 2022, https://www.reuters.com
112. Ukrinform (2025). Russia keeps five Kalibr carriers in Black Sea, total volley up to 34 missiles. ukrinform.net

Ukraine has taken away much of the Fleet's freedom of movement. Ropucha-class landing ships were critical for military logistics and, in peacetime, served as coercive signaling tools. They have been attrited in port and at sea. Saratov was destroyed at Berdiansk in March 2022. Novocherkassk was wrecked at Feodosia in December 2023. Caesar Kunikov sank off Crimea in February 2024. Olenegorsky Gornyak was badly damaged at Novorossiysk. The net result is fewer Russian hulls close to Odesa. This has led to a greater reliance on land- and air-based fires to achieve maritime objectives.

Russia has demonstrated that, even when ports are spread across different locations, they can still be systematically targeted and put out of action. Knocking out Odesa's runway with a Bastion-launched Oniks on May 1, 2022, briefly severed the city's air link. After Ukraine worked around the Black Sea blockade via the Danube, Russian drones repeatedly hit grain facilities at Reni and Izmail to raise costs and slow loading. The practical counter has been to make the target set smaller and mobile: floating or near-shore storage, quick-turn barges, portable loaders, and dual-use civilian piers. Naval-drone launch sites are treated the same way, kept mobile, camouflaged, and quiet. The more distributed the nodes, the less Moscow gains per missile.

Russia also builds strike packages to force a defensive dilemma. It uses cheap Shahed drones and air-launched cruise missiles for volume, then adds faster, harder-to-intercept weapons like Oniks from coastal Bastion batteries, Kh-22/-32 from Tu-22M3 bombers, and sometimes Iskander ballistic missiles for effect. The counter works best when split by threat band. Long-range surface-to-air systems focus on the hardest flyers. Guns and electronic warfare stay close to moving cargo and work sites. Decoys, pre-planned work-arounds, and rapid repair keep stoppages to hours, not weeks. Open-source tallies indicate Russia has fired far fewer sea-launched Kalibr missiles since 2023, relying more on drones and air-launched cruise missiles to sustain pressure.

At sea, the long-range threat now depends on a handful of Kalibr-capable ships and Kilo submarines operating from the Novorossiysk bastion. That posture reflects both preference and damage. Ukraine's strikes forced relocations from Sevastopol, with submarines moving as early as September 2022. Recent hits have reduced the launcher pool: the new Karakurt corvette *Askold* was badly damaged at Kerch in November 2023, the Karakurt *Tsiklon* was destroyed at Sevastopol in May 2024, and the Kilo submarine *Rostov-on-Don* was mauled in dry dock in September 2023.

Defense Express. The results of the attack on the Russian corvette Askold as a result of the attacks on the Zaliv shipyard in the temporarily occupied Kerch, November 6, 2023. [113]

Expect the pattern to shift with these rotations. When more Kalibr carriers sortie together from Novorossiysk, mixed salvos get larger and harder to defend. When they do not, Russia relies on drones and air-launched missiles while keeping big hulls cautious behind booms and barges.

113. Defense Express (2023). Ukraine Destroyed an Enemy Missile Ship That Had Not Even Left Shipyard For the First Time in History. en.defence-ua.com

Domestic USV Development

After Ukrainian naval drones repeatedly proved effective against the Russian fleet, Russia also began developing its own unmanned surface vessels. However, their combat use was recorded for the first time only on August 28, 2025.

The Ukrainian Navy's reconnaissance ship Simferopol was struck in the Danube Delta, near the town of Vylkove, and just a few meters from the Romanian border. A Russian naval drone traveled about 25 km along the Danube before hitting the ship, roughly 200 km from the nearest Russian-controlled coastline. The vessel, originally based on a fishing boat and used in a support reconnaissance role, is relatively small — 55 meters long and 10 meters wide — so even a modest explosive charge was enough to cause serious damage. The strike left a hole in the hull, and the ship rolled onto its side; one crew member was killed, and several were injured. The Ukrainian Navy confirmed the incident, marking the first officially confirmed use of Russian naval drones against Ukraine. Defense Express suggested the drone could have been a modified Katran, originally designed for reconnaissance but converted into an attack craft. Unlike Ukrainian drones, Katrans lack satellite guidance, relying instead on radio control with a limited range of 150–200 km, which also makes them vulnerable to electronic warfare. The article notes the launch might have been carried out from occupied gas platforms or with the help of a relay via an Orion UAV.

Back in 2023, a video appeared allegedly showing a naval drone attack on the Dniester Estuary bridge, but officials did not confirm its authenticity — if real, that case would have been the first known episode.

France24. Footage of a Russian USV approaching the Simferopol reconnaissance ship. ***114***

Rob Lee, blinzka; Naval News. Site of Russian USV hitting Ukrainian intelligence ship, west of Vylkove (Odesa Oblast), August 2025. ***115***

Russia's slow pivot to naval drones reflects doctrine, procurement inertia, and jamming realities, not a lack of money. For most of 2022–2023, the Navy relied on static defenses and standoff missiles, underestimating Ukraine's USV campaign. Only after repeated port strikes and ship losses did Moscow shift from ad-hoc countermeasures to purpose-built programs and units. The formal order to create a separate "unmanned systems" arm came in June 2025. **116**

114. France24. Ukrainian warship sunk by naval drone, killing 2 crew members. france24.com
115. Naval News (2025). Ukrainian Signal Intelligence Ship Destroyed Meters From Romanian Border. navalnews.com
116. Reuters (2025). Russia's Putin calls for quick development of drone forces. reuters.com

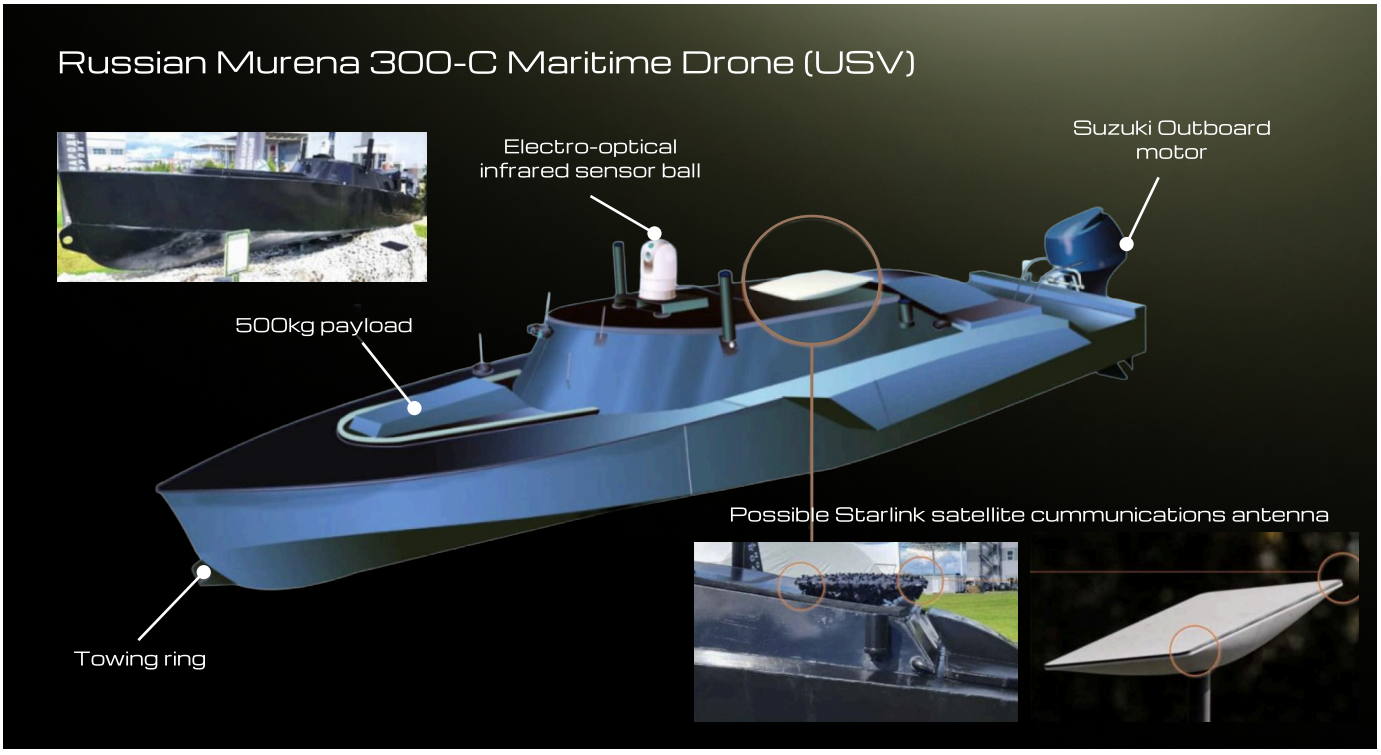
The Kremlin and major outlets framed it as a new branch with fleet-level regiments for reconnaissance, strike, ship protection, counter-USV, and mine work [117]. Industrial plumbing lagged, too. A dedicated marine-drone production center at the Kingisepp Machine-Building Plant (St. Petersburg) was announced only after prototypes like "Oduvanchik" surfaced. [118]

As the industry struggled to catch up, the training programs are experiencing similar challenges. The Ministry of Defense is establishing a Higher Military School for Unmanned Systems in the Moscow region, with the first class expected in 2027 [119]. These measures, coming several years after Ukraine's deployment of naval drone formations, highlights the ongoing efforts to align Russia's capabilities with emerging technological advancements.

As of September 2025, at least four families of Russian USVs are publicly documented.

While the USV model that downed the Simferopol ship has not been identified, it likely draws on this emerging portfolio.

The **Murena-300S** is designed as a direct-attack platform. Presented at ARMY-2024, it boasts an advertised range of approximately 500 km, a top speed of around 45 knots, and a payload capacity of about 500 kg. Subsequent displays featured light torpedoes and, notably, a flat panel on deck resembling a Starlink-type antenna. This suggests the vessel employs beyond-line-of-sight control and human-in-the-loop terminal steering — the same operational approach pioneered by Ukraine. In June 2025, Ukrainian intelligence reported that experimental Murena-type boats attempted to reach Pivdenne in Odesa Oblast but detonated before entering Ukrainian waters [120]. This failure, likely caused by link loss or interception, occurred several weeks before the successful Danube operation.



H. I. Sutton. Features of the Russian Murena-300S kamikaze boat. [121]

117. Militarnyi (2025). Russians Claim Formation of Unmanned Systems Regiments in the Navy. militarnyi.com/en
118. Safronov, T. (2025). Russians test naval strike drone during July storm exercises. Militarnyi. militarnyi.com/en
119. Kretsul, R. (2025). A military school for unmanned systems troops may appear in Russia. Izvestiya. en.iz.ru
120. The New Voice of Ukraine (2025). Ukraine intelligence suspects Russia used experimental Murena-300 unmanned boat during attack in Odesa Oblast. english.nv.ua
121. Sutton, H. I. (2024). New Russian Navy 'Murena' maritime drone shown with possible Starlink. Naval News. navalnews.com

Katran, by contrast, is a coastal carrier and picket rather than a long-reach assassin. Developed by the Russian Center for Unmanned Systems and Technologies (RCUST), Katran prototypes do two things. Some carry racks of ship-launched FPV drones — the Skvorets-VMF — able to sprint 5–10 km at ~150 km/h with ~1.5-kg warheads, recharging between sorties. Others mount a stabilized 12.7-mm Kord as a gun picket to sit on boom lines and convoy entrances. In theory, this makes it a strike-capable system.

However, Katran relies on radio relays for control, which limits its range to about 100–200 kilometers. This means it can't reach far-off targets unless Russia sets up a series of relay stations ahead of time — a use the system was not designed for. The Skvorets-VMF drones launched from Katran are small, with a practical range of just 5–10 kilometers, also limited by radio control. Therefore, Katran boats have to stay close to the shore, making them easier to spot and attack. 122

Defense Express. Russian Katran naval drone. **123**

Briz should be seen primarily as a workhorse or relay rather than a strike boat. Introduced in July 2025 by Sea Project and Unmanned Logistics for cargo runs to remote White Sea sites, it features an internal cargo bay and a Simrad marine radar on its mast. The mast dome contains the RS-30M, a SATCOM communications terminal (not GNSS), which Russia also tested on a railway train. Since RS-30M connects via geostationary satellites, latency can reach about 800 ms, data rates are limited to a few Mbps, and the antenna requires mechanical pointing. Therefore, Briz is ill-suited for split-second, camera-guided steering at speeds over 40 knots. 124

Militarnyi. Briz unmanned surface vessel. **125**

Ushkuynik's fiber-optic naval drone should be viewed primarily as a tethered coastal asset rather than a long-range strike platform. The Russian Black Sea Fleet has received the drone for trials, with combat tests scheduled for September, according to the developer's statements to TASS 126. The vessel is equipped with a reel of protected fiber-optic cable that sinks and settles on the seabed as it is deployed. This reel can be armored or enlarged, enabling jam-resistant, human-in-the-loop control without the need for radio or LEO SATCOM communication.

Images reveal a small, roughly finished hull designed for three main purposes: kamikaze attacks, carrying FPV drones, and countering USVs near harbor entrances. Analysts estimate its effective range to be no more than 100 km, constrained by the cable's weight and length as well as the absence of in-line optical repeaters. Therefore, it is most suitable for near-shore launches or use from picket boats, rather than deep-water operations. While the fiber tether offers protection against electronic warfare, it also restricts the drone's maneuverability to the length and path of the cable, introducing the risk of snagging or being cut. As a result, its most credible roles are coastal escort, gatekeeping, and FPV shepherding within defended port approaches. 127

122. Defense Express (2025). Which russian Naval Drone Could've Struck Ukraine's Simferopol Ship and Potential Countermeasures. en.defense-ua.com
123. Defense Express (2025). A Closer Look at Katran, russia's "Own" Naval Drone. en.defence-ua.com
124. Defense Express (2025). Starlink Analog For russian Naval Drones: Instead of Breakthrough, Backflip Into the 1990s. en.defense-ua.com
125. Militarnyi (2025). Russia develops Briz Maritime drone, possible military variant expected. militarnyi.com/en
126. TASS (2025). The Black Sea Fleet is testing the latest fiber-optic unmanned boat. tass.ru

Defense Express. Ushkuynik naval drone. **128**

Russia has begun integrating these designs in joint exercises, demonstrating progress beyond the prototype stage. During the Baltic "July Storm" fleet drill in July 2025, the Defense Ministry released footage of a naval strike USV destroying a ship-sized target, alongside demonstrations of FPV and underwater drones **129**. Russian coverage connected the event to newly formed unmanned regiments, indicating that mixed drone packages are moving from isolated tests to formation-level practice.

Russian Ministry of Defense. Russian drone demonstration during the July Storm exercises. **130**

Together with the August 2025 attack on the Ukrainian *Simferopol* intelligence ship, the drills mark a shift from trials to operational use. It also signals a pivotal escalation in maritime warfare, as both sides now possess and are willing to use offensive explosive drone boats. With Russia integrating uncrewed surface vessels into its tactics, the strategic risks for Ukraine and NATO have fundamentally changed.

For Ukraine, harbor entrances, river mouths, and fragile port infrastructure are now targets for Russian uncrewed surface vessels, missiles, and drones. NATO navies are adapting too. Western commanders increasingly treat small, fast uncrewed craft as a standing problem, drawing on experience with small-boat swarms in the Strait of Hormuz and recent counter-drone combat in the Red Sea.

The Baltic's geography extends these concerns beyond the Black Sea. With only one access route through the Danish Straits, USVs launched from Russia's Kaliningrad enclave can reach both the Straits and the Gulf of Finland. In this environment, USVs do not need to defeat a fleet to have an impact: disrupting transits, forcing escorts to slow and close ranks, and raising insurance risks can still create significant operational and economic effects.

Still, USVs are an added threat, not a decisive one. In Russia's hands, they sit alongside coastal anti-ship missiles, aircraft, and mines, raising the cost of operating close to shore, especially in the opening phase of a crisis. Effective defense tends to combine three elements: persistent ISR over the chokepoints; a close-in layer around traffic (EO/IR watch, soft-kill EW and decoys, then guns and CIWS when missiles would be a costly overmatch); and harbor protection that is wired into the air-defense picture rather than left as static guard duty. Recent Red Sea fighting has already nudged navies toward this mix.

In summary, Russia's naval drone program is still maturing, but is already shaping how forces operate — first in the Black Sea and potentially in the Baltic, where geography makes small systems more powerful. Whether the program moves past occasional harassment will depend less on official claims and more on how quickly Moscow can train crews and produce drones, and how rapidly allied forces adapt at key maritime chokepoints.

127. Syngaivska, S. (2025). russia Introduces Fiber-Optic Naval Drone, but Its Capabilities Remain Questionable. Defense Express. en.defense-ua.com
128. Syngaivska, S. (2025). russia Introduces Fiber-Optic Naval Drone, but Its Capabilities Remain Questionable. Defense Express. en.defense-ua.com
129. Safronov, T. (2025). Russians test naval strike drone during July storm exercises. Militarnyi. militarnyi.com/en
130. Safronov, T. (2025). Russians test naval strike drone during July storm exercises. Militarnyi. militarnyi.com/en

Physical defenses

After the October 2022 Sevastopol raid, Russia embarked on an unprecedented defensive engineering campaign across its Black Sea bases. At Sevastopol, protective booms were deployed across the bay entrance, layered with nets designed to foul and detonate unmanned surface vessels (USVs). Parts of the anchorage were physically sealed by repositioned floating dock sections, narrowing the channel and forcing potential attackers into predictable lanes of approach. At Novorossiysk, defensive layouts expanded after the August 2023 raid: floating barriers, controlled minefields, and reinforced guard posts were installed. Similar though smaller-scale measures appeared in Feodosia and even the logistical hub at Tuapse.

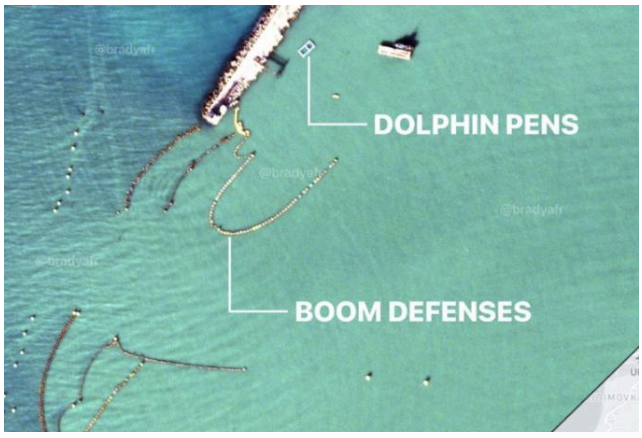
These static defenses, while formidable on paper, suffered from structural and operational weaknesses. Floating booms required constant upkeep in the Black Sea's turbulent waters, with storms and currents frequently displacing sections. Nets, meanwhile, were only as effective as the vigilance of watch crews; in several cases, Ukrainian USVs reportedly found or created seams in barriers by ramming weak points or simply riding over partially submerged chains.

Ukrainian uncrewed surface vessels first breached boom defenses on October 29, 2022, when fast USVs broke through a single line in Sevastopol Bay and struck at least three ships, including the frigate Admiral Makarov and the minesweeper Ivan Golubets. The next breakthrough occurred on March 22, 2023, when drones successfully passed two boom lines in Sevastopol Bay: one was stopped by the barriers at the harbor entrance and exploded, while two others, gaining high speed, managed to jump over the booms.

In early 2024, it became known that the main base of the Black Sea Fleet is surrounded by four lines of booms, reinforced by semi-submerged barges, and tugboats and floating cranes are constantly involved in their maintenance. During 2023, similar barriers began to appear elsewhere — in Feodosia, Kerch, Novorossiysk, Uzka Bay near the settlement of Chornomorske, and on Lake Donuzlav.

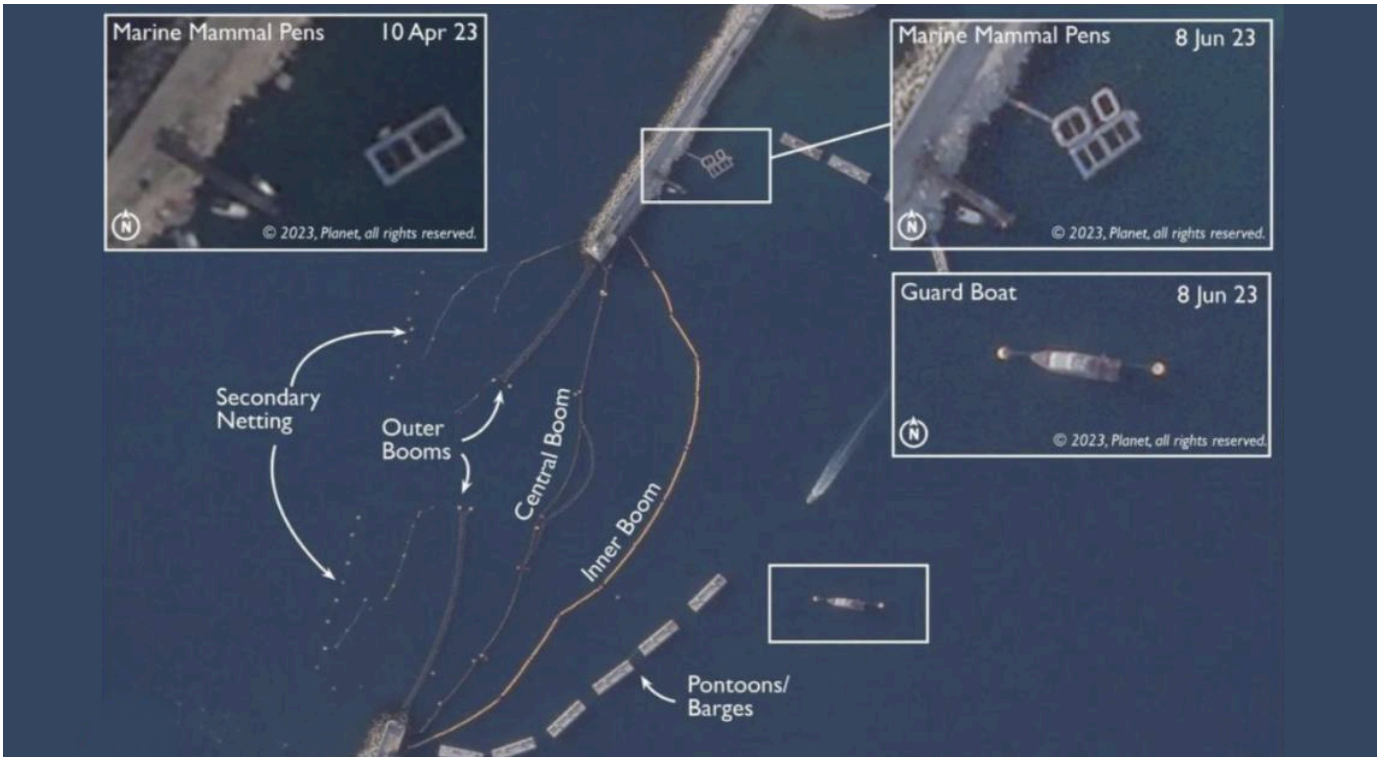
Meanwhile, in the Kerch Strait, the first boom defenses were documented as early as 2022, and by 2023, OSINT researchers recorded the installation of a second line of barges, each section measuring 90–100 meters, along the Kerch Bridge [131]. As Ukrainian intelligence chief Kyrylo Budanov remarked, *"Sevastopol Bay is heavily fenced off. Yes, this complicates our work; it definitely complicates it. But it does not make it impossible... Take the example of the frigate Essen. Boom defenses were passed. And what then?"* [132] The GUR employs a tactic in which the first drone breaches a naval fortification, enabling the next to strike the target directly. In June 2024, this method was used to hit four Tunets-class boats and the tug Saturn.

Boom barriers approximately in the bay of the city of Chornomorske, TOT, AR Crimea.



Krymskiy Veter (2024). Boom defenses installed on the entrance to Sevastopol Bay. [134]

131. Syngaivska, S. (2023). The UK Defense Intelligence: russian Navy Employs Marine Mammals to Safeguard Sevastopol Harbour. Defense Express. en.defence-ua.com



The UK Ministry of Defence. Russia strengthens its defenses by deploying nets, booms, and trained dolphins to prevent potential threats from Ukrainian divers (June 8, 2023).

In an interview for SII, representative of Group 13, Main Intelligence Directorate (GUR), stated: *"In the coastal zone, there is an additional risk of drones being detected by the enemy and struck with coastal defense systems, small arms, artillery, FPV drones, or being affected by electronic warfare systems. In the open sea, however, the main adversary of naval drones is primarily enemy aviation, which we have learned either to counter or to evade…There are many cases where Russian countermeasures have both worked and not worked. For example, the enemy closed the entrances to the ship and boat parking areas with boom barriers. However, we were able to overcome them in one case by simply jumping over them with a drone at speed, in another case, the explosion of one drone made a passage through the barriers for other drones."*

Every new barrier required weeks of construction, heavy resources, and manning, while each Ukrainian counter was improvised within days and launched at a fraction of the expense. Russia's fortifications amounted to "defensive Maginot Lines at sea" — static investments drained by a nimble, adaptive opponent. In practice, physical defenses bought Russia reaction time but not protection. They signaled to NATO observers a key strategic lesson: static obstacles in littoral warfare impose costs on the defender as much as the attacker, and without active, adaptive layers of defense, they risk becoming symbols of vulnerability rather than deterrence. [135]

132. Krym.Realii (2023). Budanov evaluated how effective the barricades near the Kerch Bridge are, according to media reports. ua.krymr.com
133. GUR (2024). "Saturn" Will Sail No More: Ukrainian Intelligence Special Forces destroy a Russian tugboat. t.me/DIUkraine
134. Krymskiy Veter (2024). The entrance to Sevastopol Bay is blocked by four rows of boom barriers. t.me/Crimeanwind
135. Kurdyuk S. (2025). The influence of the experience of the Russian-Ukrainian war at sea on the naval theory of NATO countries. Maritime Security and Defense. https://doi.org/10.32782/msd/2025.1/10

Detection and patrols

Beyond static defenses, Russia turned to persistent patrolling in an effort to spot and neutralize Ukrainian USVs before they could reach their targets. By late 2023, fast attack craft were conducting near-continuous sweeps around Crimea, supplemented by rotary and fixed-wing aviation. Ka-27 naval helicopters, armed with rockets and door-mounted machine guns, became a mainstay of anti-drone patrols, while Su-30SM fighters and Su-24MP reconnaissance aircraft were tasked to fly at low altitude over the Black Sea to visually identify small surface contacts. Patrol boats and Raptor-class fast craft added an additional layer close to harbors, using searchlights and rapid-fire weapons to guard boom barriers at night.

This doctrine imposed costs on Ukraine, forcing its USVs to become more stealthy and autonomous. Magura and Sea Baby variants were modified to ride extremely low in the water, presenting only a small camera mast and antenna, with some units camouflaged to resemble driftwood or fishing debris. Attacks were increasingly launched at night or in poor weather, exploiting the difficulty of maintaining visual or radar contact with such small targets. The duel escalated in 2025 when Ukraine fielded missile-armed USVs, capable not only of striking ships but also of contesting the airspace above them. In May 2025, a Magura-based platform armed with modified R-73 infrared-guided missiles shot down two Russian Su-30SM fighters patrolling low over the Black Sea. This incident demonstrated the dangers of relying on low-level flights to hunt drones, forcing Russian pilots to alter their behavior. Subsequent patrols were flown at higher altitudes, reducing their ability to detect USVs visually, or required scarce long-range munitions to engage at a safer distance. At the same time, the Russians began deploying small boats capable of detecting naval strike drones and countering them with FPV drones. It is also reported that the Rubicon unit plays a role in counter-USV operations, employing the ZALA Aero reconnaissance-strike complex. The system combines Z-16 surveillance drones with Lancet loitering munitions, enabling detection of naval drones from the air and the rapid targeting of strike UAVs against them [136]. According to the Russian Ministry of Defense, on the night of 19–20 August, one such operation resulted in the destruction of a Ukrainian uncrewed surface vessel 72 kilometers off the coast of Crimea, allegedly en route from Odesa toward Cape Tarkhankut.

Aerial patrols offer temporary coverage but are logistically exhausting and expose high-value assets to asymmetric counters. In practice, Ukraine exploited this by forcing Russia into a war of endurance: every hour of helicopter flight, every combat air patrol sortie, represented costs in maintenance, fuel, and pilot fatigue, while the drones they hunted cost a fraction of a single sortie. NATO observers noted that this inversion of cost-benefit marked a key lesson in the Black Sea theater: persistent patrols against attritable platforms are sustainable only for short durations and become self-defeating over time. Thus, while patrols reduced the freedom of Ukrainian USVs in open waters, they also opened a new dimension of adaptation: the weaponization of stealth, the integration of surface drones with land-based air defenses, and, eventually, the transformation of USVs themselves into air-denial platforms.

136. Lutovych, D. (2025). 400 vessels at ports in a single day: Russia has equipped itself with new unmanned boats. Focus. focus.ua

Electronic warfare and signal jamming

Russia entered the conflict with a strong electronic warfare (EW) arsenal, and by 2023 began deploying it aggressively against Ukrainian unmanned surface vessels (USVs). GPS jamming and spoofing, often from Pole-21 and R-330 Zhitel systems deployed near naval bases, sought to sever satellite navigation, forcing USVs off course or causing premature detonation. In several raids around Sevastopol, Ukraine, reported abrupt disruptions in Starlink coverage. A 2022 incident suggested either direct Russian interference or a geofenced denial by SpaceX at a critical moment, causing multiple drones to fail mid-mission. [137]

Ukrainian operators responded by making USVs more autonomous and resilient. Redundant communications were introduced — satellite links supplemented with high-frequency radio and even cellular relays where coastal coverage allowed. More critically, inertial navigation systems (INS) were programmed to carry a drone forward on a pre-set attack path even if all external signals were lost. Some vessels ran "blind strike" profiles, continuing toward their last known target even when cut off. This ensured that Russian jamming, while disruptive, rarely nullified an entire attack wave.

By late 2023, the EW battle had become two-sided. Ukrainian units integrated their own jammers and cyber tools into drone raids, reportedly disabling CCTV feeds in Sevastopol and scrambling Russian coastal radars just before attacks.

This layered electromagnetic assault reduced Russian situational awareness, allowing USVs to close distance under the cover of digital fog. This move-countermove cycle was accelerating, with both sides fielding adaptive systems and rapidly iterating new modes of resilience.

The inherent self-defeating nature of powerful jamming also constrained Moscow's hand. Blanket interference around ports risked blinding Russian naval crews and degrading their own command-and-control. Reports indicated instances of disrupted Russian communications during heavy jamming operations — a vulnerability Ukraine exploited by timing raids for maximum EW overlap. [138]

The tactical balance is striking. Ukraine's reliance on civilian-derived satellite internet revealed vulnerabilities but also underlined adaptability: within months, improvised systems were hardened into wartime-grade resilience. Meanwhile, Russia's expensive EW complexes imposed as many costs on its own operations as on the adversary. The episode underscored a key lesson: in littoral warfare, EW is not an optional layer but a decisive battlespace of its own, where resilience and redundancy matter more than raw jamming power.

137. Roulette, J., Bryan-Low, C., & Balmforth, T. (2025, July 27). Musk ordered shutdown of Starlink satellite service as Ukraine retook territory from Russia. Reuters. https://www.reuters.com

138. Sabanadze, N. Dalay, G. (2025). Understanding Russia`s Black Sea strategy. Chatham House.

Strategic and operational shifts

At the state level, Ukraine's maritime posture has undergone a fundamental change. In July 2024, President Volodymyr Zelenskyy approved the Strategy of Maritime Security of Ukraine by Decree No. 468/2024. The document became the first full-fledged strategic framework adopted in wartime, setting out the principles, objectives, and mechanisms for protecting national interests at sea and on inland waterways. Its central objective is *"Enhancing the capabilities of the components of Ukraine's security and defense sector, in particular the Naval Forces of the Armed Forces of Ukraine and the Maritime Guard of the State Border Guard Service of Ukraine, to effectively counter aggression and adequately respond to other threats to Ukraine's maritime security, as well as to eliminate or minimize them."* [139] This Strategy embodies a paradigm shift shaped directly by the realities of full-scale war: Ukraine's strategic response now prioritizes **resilience**, **deterrence**, and **sea-denial**, with a focus on **asymmetric tools** such as coastal missile systems, unmanned maritime platforms, and reinforced international security partnerships. These partnerships have produced tangible results: the United States supplied Harpoon anti-ship missiles and intelligence support, significantly enhancing Ukraine's ability to hold Russian naval assets at risk; the United Kingdom and Norway established a Maritime Capability Coalition to train personnel, deliver fast patrol craft, and shape the long-term recovery of Ukraine's navy; and EU instruments such as the European Peace Facility have funded procurement of drones and mine-countermeasure equipment. Regional cooperation has also been crucial — coordination with Türkiye, Romania, and Bulgaria enabled the functioning of alternative export corridors across the Black Sea after the collapse of the grain deal.

The contrast with earlier approaches is stark. The National Maritime Doctrine until 2035, [140] adopted in 2009, was primarily development-oriented. It framed the maritime domain chiefly as an economic and commercial asset, emphasizing shipping, port infrastructure, shipbuilding, and environmental protection. Security challenges were acknowledged but treated largely in the context of international cooperation and economic development, rather than as an urgent requirement for robust military defense.

An intermediate step between these two documents was the Strategy of the Naval Forces of the Armed Forces of Ukraine 2035, [141] adopted in 2019. Unlike the broad developmental focus of the 2009 doctrine, this was a branch-specific vision document aimed at redefining the structure and role of the Ukrainian Navy in a post-2014 security environment. The reform of the Navy was framed as a long-term effort aimed at restoring Ukraine's naval capabilities, ensuring reliable defense of the homeland, and developing the capacity to counter a stronger adversary — a process that would inevitably require new thinking, time, and significant resources. This Strategy advanced the concept of a force structure centered on small, fast, and relatively inexpensive vessels such as missile boats, patrol craft, and unmanned systems. It underscored that emerging technologies would not only simplify logistical support — enabling operations in areas previously inaccessible — but also lower the barriers for non-state actors to field cheap, high-precision weapons, thereby reshaping the maritime threat environment and requiring new legal frameworks [142]. In practical terms, the Strategy envisaged the creation of dedicated Unmanned Systems Forces, tasked with developing relatively low-cost, rapid, and powerful strike capabilities. The rationale was that, given resource limitations and the overwhelming superiority of the Russian Black Sea Fleet, Ukraine could not realistically pursue a symmetrical blue-water navy. Instead, an emphasis on mobility, dispersion, and precision-strike capabilities would allow the Navy to impose costs on Russia and maintain deterrence in the littoral environment.

In practice, the Strategy of the Naval Forces 2035 was only partially implemented. Although it provided a clear conceptual framework, Ukraine lacked the financial, industrial resources and the political will to translate this vision into a fully developed force structure. By the eve of Russia's full-scale invasion in February 2022, the Ukrainian Navy remained small, underfunded, and

139. Presidential decree №468/2024. (2024). On the decision of the National Security and Defense Council of Ukraine of July 17, 2024 "On the Maritime Security Strategy of Ukraine". president.gov.ua

unevenly modernized. The actual ability to implement it was constrained by severe losses following Crimea's annexation (Ukraine lost about 70–75% of its fleet) and outdated platforms, as the modernization programs were suspended or cancelled due to lack of resources. For instance, Project 58250 corvette *(Volodymyr Velykyi)* which began back in 2011, was temporarily halted in June 2014 by a decision of the Ministry of Defense. At that time, the program was only 32% complete, with the hull about 80% finished; between 2009 and 2013, a total of UAH 569.2 million was spent on design and construction. [144]

In sum, Ukraine's evolving maritime strategies reflect the gradual but necessary adaptation to a radically altered security environment.

Yet Ukraine has not consolidated a clear consensus on what kind of navy it ultimately seeks to build. The unresolved question remains whether Ukraine requires large surface combatants or whether the future lies solely in a force structure optimized around smaller, agile platforms and advanced maritime technologies. At present, some of the most critical projects shaping Ukraine's fight in the Black Sea are being developed by intelligence services rather than through an integrated naval procurement framework. This blurring of responsibilities highlights the urgency of defining clear institutional boundaries and ensuring that strategic guidance is translated into coherent capability development.

	2018-2025	2025-2030	2030-2035
1st Priority	Intelligence, surveillance and reconnaissance system / Maritime domain awareness (ISR/MDA) (Coastal zone)	ISR/MDA (EEZ)	Sea Control (Blue waters)
2nd Priority	Sea Denial (coastal artillery, mine laying)	Sea Control (control over EEZ)	Strike (anti-ship and cruise missiles)
3rd Priority	Sea Control (riverine, ports, coastal area)	Strike (anti-ship missiles)	Sea Denial
Personnel	Recruiting		
		Motivation and retention	
			Education and Leadership
Partnership	Maritime domain awareness		
		NATO/EU Operations	
			Maritime security

News of the Ukrainian Navy. Stages and priorities of the Navy development by 2035. [145]

140. Cabinet of ministers of Ukraine (2009). Resolution №1307. Naval doctrine of Ukraine until 2035. kmu.gov.ua
141. News of Ukrainian Navy (2019). Strategy of the Naval Forces of the Armed Forces of Ukraine 2035. navy.mil.gov.ua/en
142. Ibid.
143. Çetiner, Y. (2024). From Stability to Asymmetry: The Ukrainian Navy. Overt Defense. overtdefense.com

Category	Russian Measures	Limitations	Ukrainian Responses	Outcome
Physical Defenses	Booms, nets, floating docks, mines at Sevastopol, Novorossiysk, Feodosia	High upkeep, storm damage, exploitable seams, reliance on vigilance	Swarm tactics (6–10 USVs), sacrificial drones to breach barriers, night raids, insider/pre-positioned drones	Static defenses delayed but did not stop raids; costly and resource-draining for Russia
Detection & Patrols	GPS/Starlink jamming (Pole-21, R-330Zhitel), blanket EW near ports	Interfered with own comms/radars, not decisive against autonomous drones	INS, backup comms, semi-autonomous "blind profiles," Ukrainian jamming of CCTV/radars in Sevastopol	EW duel emerged; resilience and redundancy favored Ukraine
Strategic Shifts	Fleet relocated east to Novorossiysk/ Feodosia, drills & counter-USV cells, fallback base at Ochamchire	Reduced operational reach, Ochamchire shallow draft, reactive posture	Expanded targets to ports/infrastructure, kept pressure constant, reopened grain corridor from Odesa	Black Sea Fleet reduced to "fleet in being"; Russia lost freedom of action in NW Black Sea

Russian countermeasures after Ukrainian attacks on the Black Sea fleet

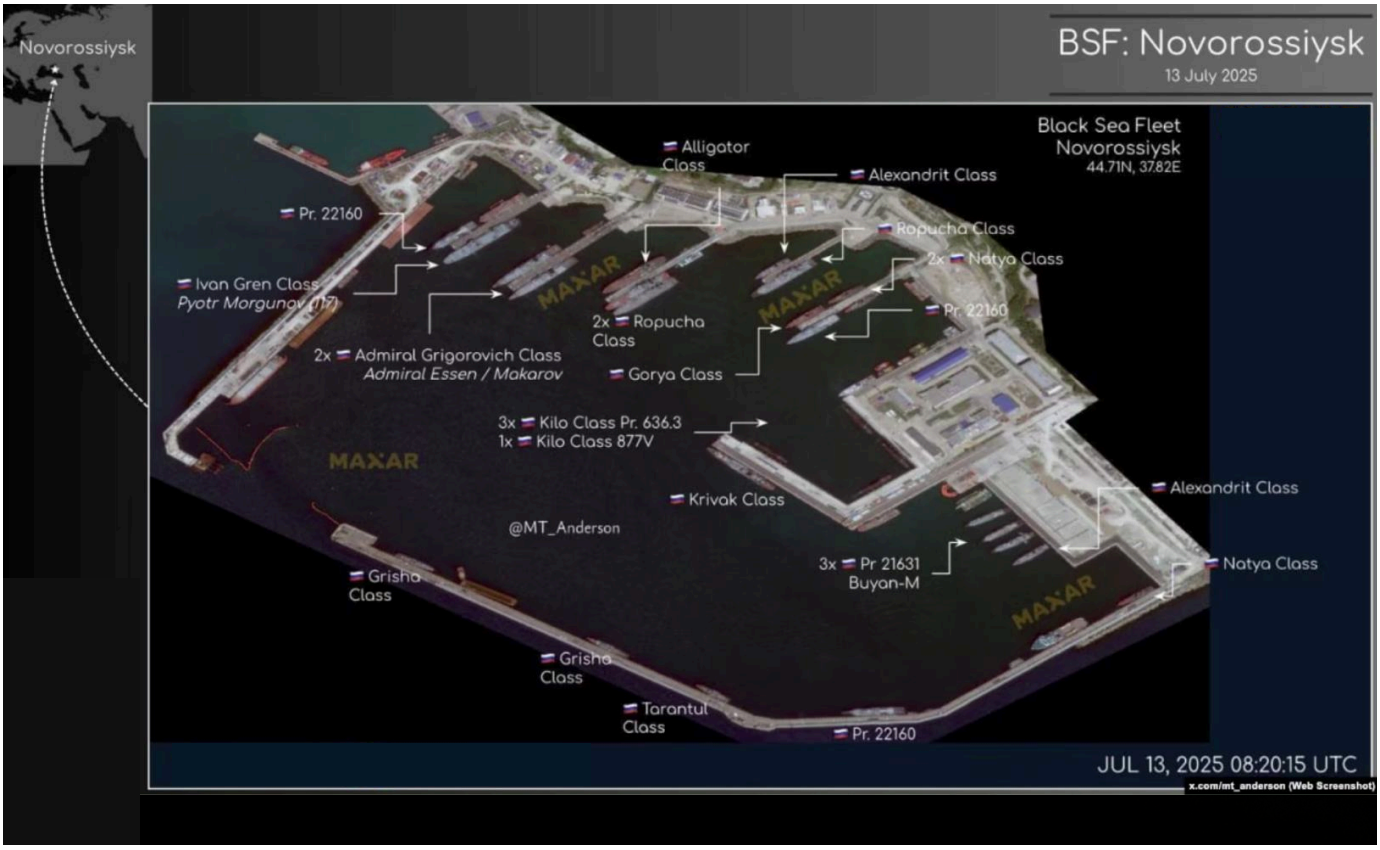
144. Defence Express. (2020). The Ministry of Defense has once again taken up the completion of the corvette. Well, for now, in my thoughts... defence-ua.com
145. News of Ukrainian Navy (2019). Strategy of the Naval Forces of the Armed Forces of Ukraine 2035. navy.mil.gov.ua/en

The back-and-forth nature of this contest has provided a trove of lessons for both sides. Russia has learned — painfully — that traditional naval defenses must be radically updated to handle swarming, explosive drones. Close-in weapon systems (CIWS) and small caliber guns, designed to shoot down anti-ship missiles or repel small boat attacks, have proven of limited effectiveness against tiny, nimble USVs. In some encounters, Russian ships expended large volumes of gunfire to hit a single drone, and even then one or two others slipped through.

This has reportedly pushed Russia to experiment with new countermeasures, from heliborne sonar/lidar to spot low-profile drones, to explosive reactive barges deployed at harbor entrances as sacrificial interceptors. Conversely, Ukraine has shown adaptability and persistence — whenever the Russians plug one gap, the Ukrainians find or create another. It is a stark illustration of asymmetric adaptability in wartime.

Ukraine's experience with uncrewed surface vessels (USVs) has demonstrated how a state with no conventional navy can fundamentally alter the balance of power at sea. What began as experimental raids in 2022 evolved into a sustained campaign that forced the Russian Black Sea Fleet into retreat, reopened vital economic corridors, and reshaped modern maritime doctrine. The war has become a 21st-century case study in asymmetric naval warfare, challenging navies to rethink assumptions about seapower, force protection, and the role of unmanned systems.

The **strategic transformation of the Black Sea** has been profound. Once described by Russian commanders as a "domestic lake," the basin has become a contested environment where Moscow no longer holds the initiative. By mid-2024, Russia had abandoned amphibious plans against Odesa and withdrawn most high-value units from Sevastopol to Feodosia and Novorossiysk. Satellite imagery showed these ports crowded with inactive ships, most venturing out only to launch Kalibr missiles before quickly returning. This marked the conversion of the Black Sea Fleet into a "fleet in being" — intact on paper but unable to maneuver freely under the persistent threat of Ukrainian naval drones.



M. T. Anderson. Naval Vessels in Novorossiysk (July 13, 2025) **146**

146. Koval, S. (2025). Novorossiysk: A Deadlock for the Russian Black Sea Fleet. Krym.Realii https://ua.krymr.com/a/novorosiyskyi-tupyk-chornomorskyi-flot-rosii/33480138.html

The **scale of attrition** is striking. By mid-2025, Ukrainian and Western assessments indicated that over a third of the Black Sea Fleet's combat vessels had been destroyed, disabled, or rendered inoperable — including missile corvettes, large landing ships, and high-value patrol vessels. Russia cannot replace these losses, constrained both by sanctions and by Turkey's enforcement of the Montreux Convention, which bars reinforcement from outside the Black Sea. Sevastopol, once the jewel of Moscow's naval presence, has been reduced to a liability, ringed with barriers and patrols that highlight not strength but vulnerability.

Ukraine's approach rested on **attrition through persistence**. Each loss was accepted as part of an iterative cycle: serial production, rapid feedback, and short innovation loops ensured constant improvement in platforms like the MAGURA and Sea Baby. Swarms of six to ten drones became a defining feature — first waves absorbing defensive fire or breaching barriers so that subsequent craft could reach their targets. Static defenses in ports bought warning time but were repeatedly saturated or bypassed. Patrols by aircraft and small vessels imposed high costs on Russia, while electronic warfare disrupted both sides but failed to halt Ukrainian strikes.

The **strategic consequences extended beyond the battlefield**. By forcing Russian units eastward, Ukraine created conditions for reopening the Odesa grain corridor. By late 2024, food exports reached near-prewar levels, stabilizing both Ukraine's economy and global grain markets. Analysts point to this as one of the clearest dividends of asymmetric naval warfare: drones not only eroded Russia's fleet but also preserved Ukraine's economic sovereignty.

For the wider naval community, Ukraine's campaign carries global implications. First, it shows that even a "navy-less" state can contest the seas with creativity and technology, echoing the Jeune École doctrine of using small, agile craft against larger ships — now updated with 21st-century drones. Small states like Taiwan are watching closely, seeing how shore-based missiles and unmanned swarms can complicate stronger navies.

Non-state actors have already employed similar methods, as in Houthi and Iranian proxy attacks on shipping.

Second, the **vulnerability of large warships** has been underscored. Relatively cheap drones disabled or destroyed Russian cruisers, amphibious ships, and corvettes, validating concerns that large surface combatants are increasingly exposed to asymmetric threats. This strengthens the case for distributed maritime operations: dispersing combat power across smaller, harder-to-hit platforms, including unmanned vessels, rather than concentrating it in a few major hulls.

Third, **unmanned systems are a force multiplier, but only if scaled and integrated**. Ukraine showed that quantity has a quality of its own, and that drones must be fielded in significant numbers to be decisive. This lesson resonates in U.S. debates about procurement priorities: while initiatives such as Replicator and the Navy's LUSV/MUSV programs exist, most resources remain tied to traditional ships. Analysts warn that the imbalance risks slowing adaptation just as Ukraine has proven the effectiveness of attritable uncrewed systems in combat.

Finally, **allied and partner navies are already adjusting**. NATO observers have studied Ukraine's example closely, and countries from the UK and France to Taiwan are exploring armed USVs for combat roles. Middle Eastern navies facing Iranian swarm tactics are likewise interested. These developments raise new requirements for interoperability, common standards, and revised port defenses. The Black Sea campaign has thus accelerated a doctrinal shift across multiple regions.

In sum, Ukraine's use of USVs has reduced the Black Sea Fleet from an instrument of coercion to a force under siege. Without a conventional navy, Ukraine achieved what once seemed impossible: denial of a regional sea against a superior fleet. The implications stretch well beyond the Black Sea. They signal a paradigm shift in naval warfare — from dominance through capital ships to denial through distributed, unmanned, and adaptive systems.

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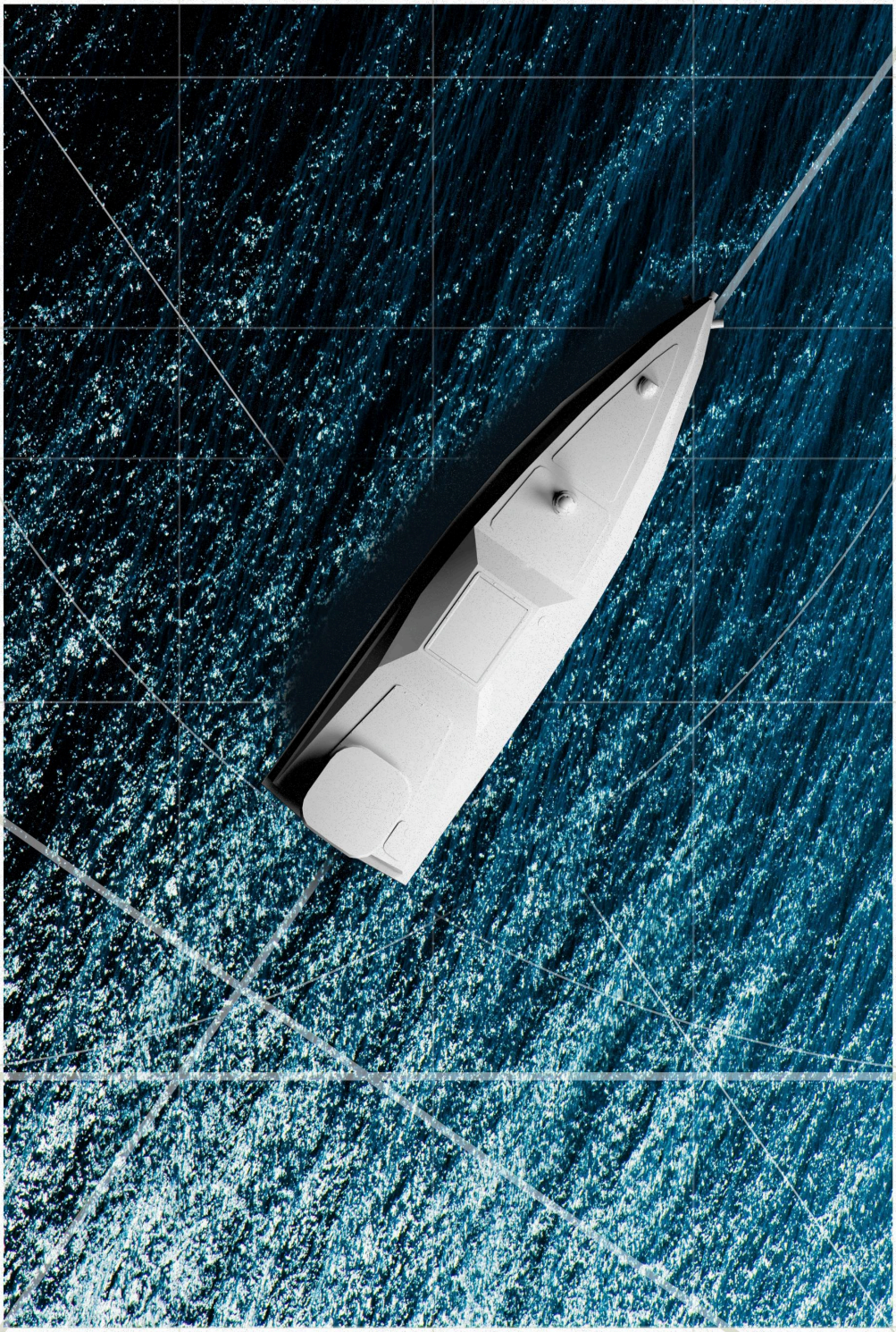

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