

# “HYBRID ADAPTATION”

Russia’s Military Innovations  
in the War of Attrition  
Against Ukraine



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### “Hybrid Adaptation.” Russia’s Military Innovations in the War of Attrition Against Ukraine

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## Introduction

The issue of defense innovations is extremely media-driven at the moment, but lacks systemic research in the Ukrainian academic and expert environment. In the context of the full-scale Russian-Ukrainian war, it is necessary to investigate the nature of Russian military innovations. The search for an answer to this question leads to the need to understand the institutional, historical, resource and other reasons why Russian military innovations work. But do they have “red lines”, as evidenced by the reshuffle and even periodic repressions against the Russian high command?

The research was carried out using formal logical and descriptive approaches, and some examples were also considered as case analyses.

Particular attention was paid to examining the features of innovative activity and related military-political events and phenomena, in the context of the ongoing Russian war of attrition against Ukraine.

## Theoretical framework

### Concept of innovation

The study concerns the problem of innovative solutions that Russia introduces in the creation of new and improvement of existing types of weapons and military equipment (WME) during the Russian-Ukrainian full-scale war. It makes sense to start reviewing this topic and searching for options to answer its main question with the basic concept of innovation by appealing to economic theory. Regarding the definition of the concept of innovation, in an effort to achieve a balance between the understanding of innovations as individual engineering solutions and the institutional capacity of the defense and security sector (in Russian-Soviet terminology - “military organization of the state”) and the country as a whole, we apply three complementary approaches: Schumpeter's classical approach, Christensen's approach to innovation management as a

discipline in the field of business management and the definition used in the OECD practice (the OECD Oslo Manual).

Schumpeter considered innovations as “new combinations” (a new product, process, market, resource, organization). Schumpeter is the founder of the theory of creative destruction, according to which innovations (technologies, products, business models) enter the market and make old technologies, companies and even entire industries obsolete. This leads to bankruptcies, job losses and depreciation of capital in “old” sectors. At the same time, these innovations create new markets, new jobs, new investment opportunities and new sources of profit. Resources (labor, capital) released from old industries flow into new, more productive ones. The central figure in Schumpeter’s theory is the entrepreneur-innovator - the “agent of change” who introduces innovations:

- A new product (today it is, for example, a smartphone)
- A new production method (for example, Henry Ford's assembly line)
- A new market (reaching a previously unreached audience)
- A new source of raw materials
- A new form of organization (for example, the transition to e-commerce in the 2000s)<sup>1</sup>

Christensen, a renowned researcher of business innovation, formulated the concept of disruptive innovations in firms that change the rules of the game. In contrast, sustaining innovations improve existing products and processes in a business.

This understanding of innovation well illustrates the practical definitions of innovation in government institutions. In particular, the OECD understands innovation as a new or significantly improved product, process or method that is implemented in practice. In the current legislation of Ukraine, innovations are defined as “newly created (applied) and/or improved competitive technologies, products or services,

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<sup>1</sup> Шумпетер, Йозеф А. Теорія економічного розвитку: Дослідження прибутків, капіталу, кредиту, відсотка та економічного циклу / Пер. з англ. В. Старка. - К.: Видавничий дім «Києво-Могилянська академія», 2011.-242с.

as well as organizational and technical solutions of a production, administrative, commercial or other nature that significantly improve the structure and quality of production and/or the social sphere”.

Accordingly, with regard to the military field, it is primarily about providing modern weapons, military and special equipment.

The main legal act regulating innovation activity in Russia is the Federal Law of 23.08.1996 No. 127-FZ "On Science and State Scientific and Technical Policy". According to this law, innovation is a new or significantly improved product (goods, services) or process introduced into practice, a new sales method or a new organizational method in business practice, workplace organization or in external relations. The Fund for Advanced Research (FPD) has been established in accordance with the Federal Law of 16.10.2012 No. 174-FZ. The purpose of the Fund is to promote scientific research and development in the interests of defense and security of the state, which is associated with a high degree of risk. The FDP activities, in fact, are the embodiment of the concept of defense innovations, since it is aimed at achieving qualitatively new results in the military-technical sphere, developing and creating innovative technologies, producing high-tech military, special and dual-purpose products. In 2024, Putin issued the Decree of the President of the Russian Federation of 28.02.2024 N 145 "On the Strategy of Scientific and Technological Development of the Russian Federation". This is a strategic document that defines the priorities of innovative development.

### [Incremental and disruptive innovations in the military field](#)

The theory of innovation founded by Joseph Schumpeter who relied largely on the concept of waves of Nikolai Kondratieff, was developed in the direction of business innovation by Everett Rogers, Henry Chesbrough, Clayton Christensen and other scholars. Schumpeter's well-known classic definition - "Innovation is a historically irreversible change in the way things are produced" has not lost its relevance to this day. In fact, in Christensen's approach, which is popular in business schools and who studied innovation within the discipline of business

management, two main types of innovative changes are distinguished: incremental (marginal) innovations are gradual improvements to existing systems; and disruptive (radical) innovations are fundamental changes that create new paradigms and make old approaches obsolete.

We will propose a new term of “hybrid adaptation” in Russia. This is a strategy in which the country combines different sources of innovation: Soviet/historical heritage, technology imports, localization, point breakthroughs. This is not just improvement, but a mixed strategy that attempts to fill the gaps through a combination of different approaches.

### [Does the Gerasimov doctrine matter?](#)

The theoretical foundations of modern Russian military strategy, formulated by 2022, and the harsh practice of launching a full-scale war have revealed a deep gap between military doctrines and reality, leading to a crisis of control in the Russian occupation forces – but also to changes in tactics, as part of the actual strategic transition to a war of attrition.

However, the most famous strategic doctrine attributed to the Russian armed forces, which a number of experts and the media associate with the RF's Chief of the General Staff Valery Gerasimov, envisaged conducting a "hybrid war", where the emphasis was placed on non-military methods to achieve strategic goals, blurring the line between war and peace. However, the realities of the full-scale conflict showed the Russian army's unpreparedness for such operations and revealed a deep crisis of command and military management.

It was this crisis that prompted the search for a solution to strengthen the capabilities of the Russian Federation. On the battlefield, over time, the main tactical innovation, probably borrowed from the tactics of small groups of the Ukrainian defense forces during the “Battle for Kyiv”, became Prigozhin’s meat assaults. It is worth noting that the history of the use of Wagner PMCs during the full-scale Russian-Ukrainian war illustrates the phenomenon of parallel armies. And from the very beginning, this role was largely envisaged at the highest level of the Russian regime.

In relation to the enemy, through communications for different target audiences, inside and outside the country, the Russian-Ukrainian war has two dimensions for the military-political leadership of the Russian Federation – a “special military operation” and a proxy confrontation with NATO. Western researchers note that “one would expect a departure from the view that indirect strategy will be the dominant form of future wars. However, the studied Russian articles prove this not to be true”. This applies to concepts such as the strategy of indirect actions, battlefield transparency, war of attrition and Russia’s hybrid war against the West. Such views form the theoretical basis of Russian military innovations – namely, adaptive, asymmetric improvements, modernization of weapons, or the creation of new organizational forms of units and the use of new tactics.

Researchers at the American think tank CNA also agree that Russian military theorists interpret the war against Ukraine as a confirmation of their pre-war doctrinal approaches, rather than a challenge to these concepts. The central place is occupied by the “threat period” and the “initial period of the war”, designed to ensure the rapid achievement of political goals before the transition to protracted hostilities: these are key components of planning. The failure of the 2022 invasion is interpreted as a problem of execution, not a problem of theory. Despite losses and failures on the battlefield, Russian strategists “advocate for the restoration of the ability to conduct deep maneuver operations, supported by massive artillery strikes and electronic warfare to suppress Ukrainian intelligence (ISR)”.

Particular attention is paid to technologies designed to compensate for organizational and management shortcomings. Future concepts focus on AI battle management systems, the massive use of UAVs, and the development of counter-ISR means. At the same time, Russian analysts remain committed to the idea of short, decisive military campaigns: “A war of attrition is seen as a failure scenario that should be avoided”.<sup>2</sup>

These observations support the thesis of “incremental adaptation” at the heart of military innovation. Instead of rethinking the doctrine,

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<sup>2</sup> Ibid, p. 31

Russia is improving the existing model of war through technological solutions. The Kremlin is trying to restore its ability to conduct a rapid initial strike and maneuver warfare, relying on innovations in the field of UAVs, artificial intelligence and counter-ISR. Thus, the “war of the future” in the Russian vision is not a revolution in military affairs, but an evolution of an old paradigm adapted to the “transparent” modern battlefield.

This adaptive innovation strategy has its theoretical foundations in the theory of catch-up development. “Catch-up development” is a strategy of late industrializing countries that import technologies, institutions, and management practices of the leaders, compensating for the “lack of prerequisites” with state intervention (development banks, protectionism, mobilization planning). The key ideas are as follows:

- Gerschenkron: the greater the “backwardness”, the greater the role of the state and financial institutions in rapid modernization.<sup>3</sup>
- Abramowitz: the success of catching up depends on “social capacity” — education, management, institutions that allow to absorb and adapt foreign technologies.<sup>4</sup>
- Amsden: “late industrialization” relies on purposeful industrial policy and discipline of implementation (“learning by doing”).<sup>5</sup>

### Empirical cases of innovation in the Russian-Ukrainian war

A number of researchers and practitioners, both Ukrainian and Western, noted that it was Ukraine that initiated the drone revolution during this war. It is worth noting that the first combat use of FPV drones in the war after 24.02.2022 concerns the experiments of the SIGNUM unit as part of the 93rd Motorized Rifle Brigade and dates back to June 2022.<sup>6</sup> Another example of disruptive innovation was the development

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<sup>3</sup> Gerschenkron A. (*Economic Backwardness in Historical Perspective*). – URL.: <https://www.caluniv.ac.in/academic/History/Study/Economic-Backwardness.pdf>

<sup>4</sup> Abramowitz M. (*Catching Up, Forging Ahead, and Falling Behind*). – URL.: <https://www.cambridge.org/core/journals/journal-of-economic-history/article/catching-up-forging-ahead-and-falling-behind/E0FA8944FFE9930844D755768E9D0106>

<sup>5</sup> Amsden A. (*Asia's Next Giant: South Korea and Late Industrialization*). – URL.: [https://feas.metu.edu.tr/tr/system/files/alice\\_h.\\_amsden\\_-\\_asias\\_next\\_giant\\_south\\_korea\\_and\\_late\\_industrialization\\_oxford\\_paperbacks\\_1992.pdf](https://feas.metu.edu.tr/tr/system/files/alice_h._amsden_-_asias_next_giant_south_korea_and_late_industrialization_oxford_paperbacks_1992.pdf)

<sup>6</sup> Історія з фронту: бойові будні пілотів FPV-дронів 93-ої ОМБр Холодний Яр із Дніпропетровщини, 24.11.2023. – URL.:

and combat use of naval drones. As noted by General Mick Ryan, Australian military strategy expert, Ukraine “has pioneered the combination of different drone systems to perform specific missions”: pointing to the use of naval drones as platforms for UAVs during attacks on Russian oil rigs and surveillance systems in the Black Sea, the shooting down of aerial targets with naval drones, and the combination of ground and air systems in the battle for the village of Lyptsi near Kharkiv.<sup>7</sup>

Instead, Russia has taken the path of borrowing technology from its de facto allies.

### Mass "sufficiency": the Shahed/"Geran" case

Iranian drones "Shahed-136", localized in Russia as "Geran-2", have become a key tool of the Russian strategy of attrition. Their main advantage is not technological perfection, but mass production and low cost. "Shaheds" have become a basic tool of the strategy of attrition: the decisive advantage is mass production and low cost, not technological perfection. This imposes on the Ukrainian air defense an unprofitable cost-per-kill economy (expensive interceptor missiles against cheap targets) and allows maintaining a high rate of air attacks for a long time. From 2025, the Russian Federation additionally introduced Shahed-238/"Geran-3" jets into combat, which reduce the time of approach and complicate interception.

The model's history demonstrates the borrowing of technology. The Shahed is of Iranian origin - it was developed at a research and development center affiliated with the Islamic Revolutionary Guard Corps.<sup>8</sup> Shahed also has a “German” trace regarding the engine: technical examination shows that the MADO MD-550 installed on the Shahed-136

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<https://opentv.media/ua/istoriya-z-frontu-bojovi-budni-pilotiv-fpv-droniv-93-oyi-ombr-hol-odnij-yar-iz-dnipropetrovshini>

<sup>7</sup> Ryan M. Why No One Is Winning in Ukraine. 2025. -

<https://www.foreignaffairs.com/russia/why-no-one-winning-ukraine-ryan>

<sup>8</sup> U.S. Department of the Treasury, OFAC (Treasury Sanctions Transnational Procurement Network Facilitating Iran’s UAV Program). - URL.: <https://home.treasury.gov/news/press-releases/jy2073>

Також див. Russia’s Iranian-Made UAVs: A Technical Profile. RUSI. - URL.:

<https://rusi.org/explore-our-research/publications/commentary/russias-iranian-made-uavs-technical-profile>

is a reverse engineering of the German Limbach L550E.<sup>9</sup> In the jet version, Russia uses a Chinese engine - according to the Main Intelligence Directorate of the Ministry of Defense of Ukraine, it is the Telefly JT80 turbojet engine, thanks to which the drone is able to move at a speed of 300 to 370 km/h.<sup>10</sup>

The conceptual origins of the Shahed - a small "kamikaze" UAV, launched from a truck, hunting by radar - can be traced back to the German experimental Dornier DAR UAV developed in the 1980s and the Israeli IAI Harpy UAV developed in the 1990s. However, this is a borrowing of the concept, not a "purchase of a model". Additionally, the Shahed's onboard electronics are largely of commercial origin, which explains the presence of Western components in captured samples.

The Russian adaptation consisted of applying incremental innovative solutions and scaling up production: to reduce the cost and speed up production, the hulls are made mainly of fiberglass with polystyrene foam used as a filler (instead of more expensive composites); simplified engines without a starter/flywheel were used to simplify the engine. In terms of navigation and maintaining survivability, various navigation systems are used. Minor technological improvements are also used, in particular, "black" painting, micro-modifications to reduce visibility and increase resistance to electronic warfare. Piston engine versions have been upgraded to 290 km/h (the originals had 185 km/h), and the Geran-3 jet demonstrates a cruising speed of 300–370 km/h.

To ensure protection of satellite navigation from electronic warfare, the Geran-3 uses a jamming-protected satellite navigation system with an adaptive antenna array (CRPA) of 12 elements - "Kometa-M12". In total, out of 45 identified foreign components, half are from American manufacturers, eight from Chinese, seven from Swiss, three from German, two from British and one from a Japanese manufacturer.

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<sup>9</sup> Conflict Armament Research (Evidence on MAD0 Engines in Shahed-136). – URL.: <https://www.conflictarm.com/field-dispatches/>

<sup>10</sup> UAV Geran-3. - URL.: <https://war-sanctions.gur.gov.ua/page-geran-3>

The Russians continue to improve the Shahed, in particular, they used a new model of this UAV with a night camera to search for and destroy a Ukrainian railway train while the train was moving.

The tactics of Russian combined air strikes on Ukrainian territory increasingly correspond to the general Russian strategy of a war of attrition. This strategy is aimed not only at destroying military and infrastructure facilities, but also at depleting Ukraine's economic and defense resources by forcing the use of expensive air defense assets against relatively cheap targets. In addition to night attacks, the enemy sometimes carried out air strikes on Kyiv and the region (as well as other regions of Ukraine) and several times during the day, disrupting the usual life of large cities.

In the course of modernization, the enemy has achieved an increase in the warhead from 30-50 kg to 90 kg. The use of a heavy warhead allows the enemy to inflict serious damage to the target, even in case of an inaccurate hit. The composition of the warhead has also been modified: the use of fragmentation charges with tungsten carbide elements to increase the striking effect has been recorded.

The largest production of Shaheds was deployed at the enterprises of the Alabuga Special Economic Zone in Tatarstan, and they are also produced at the Kupol defense enterprise in Izhevsk. The total daily production of Shahed-136 strike UAVs is about 190 units and, according to some forecasts, by the end of 2025 it may increase to 6,000 UAVs per month. At the same time, according to other estimates, full-scale serial production of the Geran-3 UAV will probably begin only in the summer of 2026 - today individual samples and small batches are being produced.

Geran demonstrates the "economy of sufficiency": cheap mass strikes that impose an unfavorable "interception cost/target" ratio on the enemy.

The Geran-2 strike UAV has become a basic tool in Russia's air terror strategy. Its massive use since the fall of 2022 has gradually turned into systematic combined air strikes, during which the Geran is used both as the main carrier of the warhead and as a tool to saturate the Ukrainian

air defense forces. Also, especially during daytime attacks and the destruction of civilian targets, the enemy is trying to achieve a destabilizing effect through terrorizing the civilian population of the Ukraine's capital and other large cities.

Hundreds of UAVs attack simultaneously from different directions and on different flight levels. The scale has increased to the simultaneous use of 500-700 or more air attack vehicles during one night. Enemy UAV attacks have a complex, multi-wave structure. The first wave, often consisting of kamikaze drones and a significant number of decoy drones (such as Gerbera with angled reflectors), aims to detect Ukrainian air defense positions and deplete its ammunition. It is estimated that up to 50% of launched UAVs may be decoys. After the air defense systems of the Ukrainian Defense Forces have exposed themselves and partially expended expensive missiles, a second wave of strike drones and cruise and ballistic missiles follows, striking at already weakened and detected targets.

In addition, the command of the Russian occupation forces is actively improving flight routes. Drones are programmed to fly along complex trajectories, often along riverbeds or at extremely low altitudes, in order to avoid detection by air defense radars. Recently, the opposite tactic has also been recorded: flights at much higher altitudes (up to 4 km), which takes them out of the effective range of many mobile fire groups. In July 2025, Ukrainian military expert Serhiy “Flash” reported that the Shahed began to perform complex evasive maneuvers specially programmed to counter Ukrainian interceptor drones, which indicates an active analysis by the enemy of Ukrainian countermeasures and rapid adaptation.

During the approach to the target, enemy UAVs can perform a dive. Attacking at a high angle (60 degrees or more) is not an accident, but a calculated tactic that makes the work of air defense as difficult as possible, leaving a minimum of time for detection, tracking and destruction. This tactic turns the drone from a simple slow target into a much more complex one, resembling the behavior of a ballistic missile in the final section of its trajectory. That is why the fight against such UAVs

requires not only means of destruction, but also powerful radars and automated control systems capable of responding instantly. Attacks by Shahed-type UAVs often occur in waves from different directions, which complicates the identification of targets and the coordination of air defense.

The period from January 2023 to August 2025 is characterized by a consistent evolution of air attack tactics of the Russian Armed Forces, which is manifested both in the quantitative and qualitative indicators of the means of destruction used. The main vector of changes is the strategic focus on the massive use of strike UAVs to exhaust Ukraine's air defense system.

In 2023, enemy air strikes focused on energy infrastructure facilities. During this period, 1,335 missile launches and 3,149 UAV launches were recorded.

During 2024, the enemy's tactical adaptation was observed: the number of missile launches remained at a comparable level (1,405), but the number of UAVs used increased significantly - up to 5,470. This indicates a shift in emphasis to drones as the main tool of pressure. In addition, in 2024, the enemy began to actively use more complex routes, increasing the number of combined air strikes involving ballistic missiles, in particular North Korean-made (KN-23), which increased the load on the air defense.

During January-August 2025, the high intensity of the use of UAVs (3,418 units were used) and missiles (950 units) of various types during combined air attacks remained. A qualitative innovation was the use of the Geran-3 jet UAVs. According to data in publications and media appearances by representatives of the Air Force Command of the Armed Forces of Ukraine, as of August 31, 2025, 61 launches of these UAVs were recorded. The relative rate of their destruction or neutralization is approximately 56%, which is significantly lower than the average value for Shahed-type UAVs with piston engines (85%). This indicates emergence of a new threat that requires involvement of more technological and innovative air defense means.

In particular, on the night of July 18-19, 2025, the enemy made a combined attack, in which Shahed-238 jet UAVs were used as the first wave. Their main goal was to detect positions and overload the support channels of Ukrainian air defense systems before a strike with cruise missiles was carried out. It was on that night that the launch of 15 Geran-3 units was recorded, of which 9 were destroyed by the Air Force of Ukraine.

Despite the consistently high overall percentage of UAV interceptions, the absolute number of Shaheds that break through the defense remains significant - even with a small percentage of breakthrough during the mass launch of cheap weapons, this leads to significant damage.

The geography of Shahed UAV launch sites is constantly expanding. While previously the enemy used five launch sites (in the Kursk region, Krasnodar Territory, and Crimea), their number may soon increase to 12–15, media reported, citing a source in the Main Intelligence Directorate of the Ministry of Defense of Ukraine.

At the initial stages of the full-scale invasion, the main areas for launching the Shaheds were temporarily occupied territories of Ukraine, in particular Crimea (Belbek airfield, Cape Chauda) and the southern regions of Russia (Krasnodar Territory, in particular Primorsko-Akhtarsk airfield). Subsequently, the Russian occupation forces began to actively use airfields and specially equipped sites in the western and central regions of the Russian Federation bordering Ukraine. These include the Kursk Region: the Khalino airfield and other sites, the Bryansk Region: the Seshcha airfield and newly created launch positions in the Oryol and Voronezh regions, and Tatarstan, in particular the Alabuga district, where drone production has been established. Such dynamics indicate Russia's efforts to reduce the time it takes for drones to reach targets in Ukraine, to disperse launchers to complicate their detection and destruction, and to keep air defense systems on alert along the entire length of the northern and eastern borders.

## Use of basic UAV platforms: Orlan-10, Lancet, Molniya

What makes the Russian occupation forces and the military-industrial complex significantly different from the practice of the Ukrainian Defense Forces is the focus on the use and modification of several standardized unmanned platforms in the reconnaissance and strike cycle.

### Orlan-10 as a prime example of import dependence

Among such platforms is the old basic model of the Orlan-10 reconnaissance UAV, designed for reconnaissance/fire control; manufacturer: OOO "Special Technological Center" (St. Petersburg). This UAV is a demonstration case of import dependence of microelectronics and control units. The Orlan-10 was originally designed as a "workhorse" for tactical reconnaissance and fire control. Its strength is its low price and the possibility to quickly scale production, rather than a unique electronics or sensor package. Structurally, the device is built around modularity and the widespread use of commercial components that are purchased "off the shelf" and integrated into the on-board complex with minimal adaptation. This approach speeds up iterations and reduces the cost of production, but also makes the critical functions of the device dependent on external supply chains.

Western GNSS navigation modules for GPS/GLONASS, STM32 microcontrollers (STMicroelectronics) and power management devices and interface chips from Texas Instruments (USA) have been repeatedly found on downed Orlan-10s. These elements ensure the stability of the autopilot, shooting coordination, the operation of data transmission channels and fire correction; without them, the device sharply loses its combat value. Camera units and optics in early and "low-budget" configurations were also typically "off the shelf" (including serial cameras), which confirms the philosophy of "take ready-made — integrate — mass-produce".

Logistics are indicative. To maintain serial production, Russian manufacturers build networks of "bogus firms" and small-batch purchases through third jurisdictions, redirect chains through trade

intermediaries in Turkey, the UAE, and China, disperse the range of supplies, and change the designation of boards in order to bypass export controls. This has turned the circumvention of sanctions from one-time schemes into an operational routine for Orlan-10 production. At the same time, Russia has not been able to consistently substitute high-quality imported microelectronic components, which determines the “brain” and “nervous system” of the aircraft — so the “ceiling” of incremental improvements to the Orlan-10 is set not by the fuselage or airframe, but by the availability of a modern component base.

Thus, the Orlan-10 is an illustrative model that confirms the prevailing approach of “hybrid adaptation.” Minor improvements and modular assembly of the product from available parts allow for a rapid increase in the number of mass-produced UAVs, but the strategic capability of the Russian military-industrial complex rests on the external environment — sanctions, problems with providing microelectronics, and difficulties in supplying product components (navigation modules, microcontrollers, radio frequency components).

#### Basic platforms of Lancet, ZALA, Italmas, Molniya: standardization, seriality and dependence on commercial components

The strike UAV, which is classified in NATO reviews as a "barrage munition" type UAV Lancet (manufacturer - ZALA Aero, Kalashnikov Group) has become the basic "disposable" platform of the strike UAV. Its advantages are not in high technology, but in the standardization of the hull, power unit, navigation and communication with "video feedback", which allowed the Russians to organize assembly line production with a short cycle from development to implementation of improvements to this platform (UAV variants with a larger ammunition, modified optics, control using a video camera during the approach to the target). During 2023–2025, the Kalashnikov Group increased the production of Lancets despite sanctions by diversifying supplies of off-the-shelf electronic components, making purchases in small batches through third countries,

and also using the preferences of a preferred state customer to quickly resolve problematic issues.<sup>11</sup>

In addition to the Lancet, ZALA Aero very quickly launched production of reconnaissance unmanned aerial vehicles of the 421-16 series "wing" type<sup>12</sup> equipped with a commercial GNSS (global navigation satellite system) microcontroller, power management device and optics. The captured samples studied by the Main Reconnaissance Directorate and other organizations of the Defense Forces of Ukraine confirm that the critical components of this system - navigation, computing, video transmission - are built on a foreign element base and are integrated into the modular architecture of the UAV according to the principle "install what is available".

This approach allows the enemy to implement rapid incremental improvements and allows for mass replication of “good enough” solutions, but at the same time it ties the manufacturer to global chains of COTS components.

Since the fall of 2023, the Russian Federation has begun using a new long-range strike UAV, the Italmas, a lighter, cheaper platform for strikes on the rear. Its purpose is also to load the Ukrainian air defense system during massive combined air strikes.

Another basic UAV platform is the Molniya, a simple and cheap aircraft-type FPV drone designed for mass production. With a combat load of 3-5 kg and a flight range of up to 30-40 km, the Molniya is the answer to the need for cheap means of destruction. The Russians have recently begun to use these strike UAVs as carriers of FPV drones. The Molniya flies to attack the target and enables the use of a cheap strike FPV drone, thus extending its radius of combat use.<sup>13</sup>

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<sup>11</sup> Reuters, Exclusive/Investigations on Kalashnikov's Lancet production and sanction evasion – <https://www.reuters.com/world/europe/russias-kalashnikov-boosts-lancet-kamikaze-drone-outrout-despite-sanctions-2023-09-20/>

<sup>12</sup> Під Ізюмом знешкодили новий БПЛА РФ “ZALA 421-16E2”. – 2022. – Мілітарний. <https://military.com/uk/news/pid-izyumom-zneshkodyly-novyj-bpla-rf-zala-421-16e2/>

<sup>13</sup> On the connection from Serhiy "Flash". [https://t.me/serhij\\_flash/5711](https://t.me/serhij_flash/5711)

Recently, the enemy has published information about the development of a prototype of the Molniya-2 strike drone with a 40 km long fiber-optic cable coil. According to the enemy's propaganda media, their flight speed reaches 70-90 km per hour, which is quite unusual given the risks of cable breakage. The usual Molniya-2 with radio frequency communication has a flight radius of up to 40-50 km and is used for delivering heavy warheads weighing up to 10 kg, remote mining with anti-personnel and anti-tank mines, and as a carrier of FPV drones over long distances.<sup>14</sup>

### Fiber-optic drones: the claim to “disruptive” innovation and its limits

The idea of fiber-guided UAVs is simple: instead of a radio channel that is “jammed” by electronic warfare, commands and video are transmitted via a fiber-optic cable. In the simplest version, this is a tethered quadcopter, in a more advanced version, a bundle of a basic drone repeater and a strike drone connected by a thin microfiber cable. In theory, such an architecture makes the control channel insensitive to radio interference and allows it to operate near powerful electronic warfare equipment.

Scientific and engineering prototypes of this concept were published long before its combat application: from systems developed by CyPhy Works in the mid-2010s to experiments with optical power and control over fiber (demonstrating simultaneous power/data transmission over optics) in peer-reviewed scientific publications in 2022.<sup>15</sup>

From the perspective of the UAV components market, the novelty did not appear “from scratch”. Commercial products of fiber-optic data transmission modules, compact LED and laser sources, miniature fiber drums (coils), as well as low-budget autopilots and sensors were available for purchase before 2022, which simplified the integration “from

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<sup>14</sup> Black mirror #25. The Defender Media.

<https://thedefender.media/uk/2025/09/black-mirror-25/>

<sup>15</sup> Shindo, N. et al. “Optically Powered and Controlled Drones Using Optical Fibers for Airborne Base Stations.” *Photonics* 9(11): 882 (2022). DOI: 10.3390/photonics9110882.

ready-made parts” for military experiments. For states that rely on rapid incremental innovations, this is a typical path: use existing nodes, add winding mechanics, adapt autopilot software - and get a working product without a full R&D cycle. In this sense, fiber-optic FPV can be considered an organizational/integration innovation rather than a technological breakthrough.

However, to be considered disruptive, an innovation must break the rules of the game at the doctrinal/organizational level, as the mass FPV drone with cheap radio control did. The fiber-optic approach has not yet demonstrated this for a number of reasons. First, the physical limitations of the cable: the mass and maneuverability of even microfibers add air resistance and reduce the range and maneuverability of the drone; every turn or ricochet of the cable limits the flight geometry. Second, logistics and vulnerability: coils, winding blocks, connectors are an additional “zoo” of parts that break, get wet, freeze; the cable is easily cut by debris, branches, or intentional obstacles that have already been developed in the Ukrainian innovation ecosystem. Third, scalability: simultaneous operation of dozens of “links” in dense urban or forested areas creates cable clutter, need for altitude and trajectory separation, and risks of mutual “overlap”. Fourth, there is a cost-effectiveness issue: even if the cable itself is cheap, designing a reliable winder, maintaining stable thrust, and the need to compensate for the additional load on the engines increase the end costs of completing the combat mission compared to typical FPV-kamikaze UAVs.

Historical analogies also show: fiber targeting in itself is not a guarantee of a “revolution.” In the 1990s, the US and European armies tested missile systems with a fiber-optic channel: the idea provided an electronic warfare-protected channel, but faced mechanical complexity, mass, tactical inflexibility — and ultimately did not become the basis for mass rearmament.<sup>16</sup>

Fiber-optic FPV is a targeted niche tool for specific tasks (working under dense EW, short raids at low altitudes, engineering missions next to

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<sup>16</sup> Federation of American Scientists. “Enhanced Fiber Optic Guided Missile (EFOG-M).” - <https://man.fas.org/dod-101/sys/land/efog-m.htm>

friendly EW devices). But its scaling through serial production and positioning as the main class of strike UAVs is unlikely. Therefore, despite the loud rhetoric, this is not a game-changing disruptive innovation, but an incremental engineering and organizational adaptation that does not replace mass FPV drones. The Ukrainian Defense Forces and innovators are developing both Ukrainian fiber-optic UAVs and active and passive countermeasures, looking for weaknesses in the enemy's fiber-optic FPV systems.

### "Prestigious" weapon systems - radical innovations or a propaganda tool?

Unlike mass incremental innovations, in the field of strategic weapons, Russia is betting on radical, breakthrough projects that aim not so much for tactical, but for political and psychological advantage. In fact, the influence activity component prevails. As Oles Lisnychuk notes, “since such a practice mainly concerned corrupt gifts of state funding for innovative weapon projects and, ultimately, as the first year of the war with Ukraine showed, did not bring any tangible added value to the Russian army, it was followed by mocking markers in the discourse of war – Putin’s “designed and produced in Russia” or “wunder waffles”<sup>17</sup>. Among such developments during the full-scale phase of the Russian-Ukrainian war, the Kinzhal, Zircon<sup>7</sup>, and Oreshnik stand out. Moreover, Putin’s recent statements simply mention weapons of an unspecified type.

The first public mention of the combat use of the Oreshnik dates back to November 2024 (strike on Dnipro). Vladimir Putin then described the system as a “hypersonic ballistic” missile, virtually “uninterceptable”, with claimed speeds of up to about Mach 10, stating: “We warned that we have such systems, and we will use them... This is a forced response

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<sup>17</sup> Лісничук О. У пошуках справжнього імені рафінованого зла. в кн. Удавана Росія: імітація величі і могутності / Зеленько Г. (керівник проєкту, науковий редактор), Лісничук О., Нагірний В., Павленко І., Рябчук М., Стародуб А. Ніжин : Видавець Лисенко М. М., 2024. 288 с.

<https://eurasiatransformation.institute/wp-content/uploads/2024/03/udavana-rosiya.pdf>

measure”. Russian media attributed the missile a long range and even a distribution of warheads. In the public domain, this created an image of a “new level” of threat, but independent technical verification of the parameters remained limited, and some of the characteristics were subject to skepticism from Western experts and specialized observers<sup>18</sup>.

In terms of “innovation”, Russian formulations refer rather to the combination of a medium-range ballistic trajectory with possible maneuvers in the terminal section and the potential separation of warheads. It is important to distinguish between the rhetoric of “hypersonic” as a physical speed regime (which is typical for most ballistic missiles in the midcourse section) and the presence of a unique technological solution that would make interception impossible. The latter is directly questioned in Western assessments. The declared or interpreted characteristics of the Oreshnik from open sources fit into the range for which Israeli and American high-altitude interceptors (Arrow-3, SM-3 Blk IIA) already exist in the corresponding configurations. This does not make interception trivial, but it calls into question categorical statements about “uninterceptability” as such. Later, the Russians made statements about the continuation of the "combat tests" of the system, but there are few signs of stable and confirmed tactical and technical characteristics or serial production in public access. Alexander Lukashenko said that the Russian Oreshnik missile systems in Belarus are planned to be placed in such a way that the distance to the targets is minimal.<sup>19</sup>

The Russian narrative since the beginning of the full-scale war also features the Kinzhal missile, which is an aeroballistic version of the Iskander. This is an incremental improvement on already known

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<sup>18</sup> Reuters (Putin says Russia used new Oreshnik hypersonic missile in Ukraine). – URL.: <https://www.reuters.com/world/europe/what-is-russias-oreshnik-missile-2024-11-22/>  
Reuters Graphics (Inside Russia’s new missile, ‘Oreshnik’). – URL.: <https://www.reuters.com/graphics/UKRAINE-CRISIS/RUSSIA-MISSILE/gdpzknajgvw/>

<sup>19</sup> Лукашенко розповів, де в Білорусі хоче розмістити «Орешнік». -. 2024. - URL.: <https://www.radiosvoboda.org/a/news-lukashenko-oreshnik/33234716.html>

technology, not the “new physics of flight,” and the cases of successful interceptions by Patriot systems remove the halo of its “invulnerability”<sup>20</sup>.

Zircon is a sea-based cruise missile with supersonic characteristics and high speed. However, despite the Russians' claims to a "miracle weapon", this missile was successfully shot down over Kyiv in 2024. Expert opinions confirmed the discrepancy between the actual effectiveness and the declared properties (conclusions of Kyiv Scientific Research Institute of Forensic Expertise).<sup>21</sup> In September 2025, Russia launched a Zircon missile at a target in the Barents Sea during the Zapad-2025 exercises, as an element of pressure on the US and NATO.

It is worth noting that Russia plans to increase the mass production of powerful weapons. This is the recently announced plan for annual deliveries of 80 units of Zircon during 2024-2026, as well as an order for the production of 44 Kinzhals in 2024 and another 144 missiles in 2025.<sup>22</sup>

At the end of October 2025, the Kremlin once again raised the topic of “super-weapons” into the public domain. Vladimir Putin and Valery Gerasimov announced the successful testing of the nuclear-powered cruise missile 9M730 Burevestnik<sup>23</sup> (supposedly “uninterceptable” due to the ability to evade air defenses during an extremely long flight) and the unmanned underwater vehicle Poseidon with a nuclear installation (“nuclear torpedo”)<sup>24</sup>. In the media coverage of this new weapon, representatives of the Russian military-political leadership did not disclose its technical characteristics, which does not

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<sup>20</sup> CSIS Missile Defense Project (Kh-47M2 Kinzhal). – URL.: <https://missilethreat.csis.org/missile/kinzhal/>

<sup>21</sup> Керівник лабораторії КНДІСЕ про ракету "Циркон": "Летить не туди, куди треба". [https://suspilne.media/714650-kerivnik-laboratorii-kndise-pro-raketu-cirkon-letit-ne-tudi-kudi-treba/?utm\\_source=copylink&utm\\_medium=ps&fbclid=IwAR27twNYJMDYVDfBfCsq1yV1Yy\\_FOJspoRWwwfXEuYBcYcCtTq3DZkedYg\\_aem\\_AR4PtWbnUZLssiCa-1yTgfhOpRIk9L-PWaj1g3\\_JkSEEdkj0bGKDjRTUnOneEL0vebYoOPhU70rsqHjI77BYTfnF](https://suspilne.media/714650-kerivnik-laboratorii-kndise-pro-raketu-cirkon-letit-ne-tudi-kudi-treba/?utm_source=copylink&utm_medium=ps&fbclid=IwAR27twNYJMDYVDfBfCsq1yV1Yy_FOJspoRWwwfXEuYBcYcCtTq3DZkedYg_aem_AR4PtWbnUZLssiCa-1yTgfhOpRIk9L-PWaj1g3_JkSEEdkj0bGKDjRTUnOneEL0vebYoOPhU70rsqHjI77BYTfnF)

<sup>22</sup> Ян, О. Від «Калібра» до «Кинжала»: скільки насправді коштують російські ракети. <https://militaryni.com/uk/articles/vid-kalibra-do-kinzhala-silky-naspravdi-koshtuyut-rosijski-rakety/>

<sup>23</sup> Russia tested new nuclear-powered Burevestnik cruise missile, top general says. – <https://www.reuters.com/world/china/russia-tested-new-nuclear-powered-cruise-missile-top-general-says-2025-10-26/>

<sup>24</sup> Putin Says Russia Tests New, Nuclear-Capable Remote Torpedo Dubbed ‘Doomsday Machine’. – <https://www.rferl.org/a/russia-putin-torpedo-poseidon-burevestnik-missile-nuclear/33575625.html>

allow experts to independently assess the real performance characteristics or the degree of readiness for serial deployment. At the same time, leading media in both Ukraine and the West, as well as Russian military observers opposed to the Kremlin, noted the distinct informational and psychological function of statements addressed to both the internal Russian audience (maintaining the image of "technological power") and the external one (psychological pressure on the West).

It is noteworthy that Putin's speech on the "National Unity Day" on November 4, 2025, which was replicated by Russian propaganda, was entirely devoted to the said Russian weapons. Today, the independent expert consensus is that these new Russian weapons are not capable of immediately changing the balance of power (which, however, does not eliminate the need for close monitoring of these Russian developments).

### Systemic constraints on innovation and "pockets of efficiency"

It is known that a state's ability to innovate directly depends on its political and economic model and the level of development of its institutions.

Sergey Guriev and Daniel Treisman, among other scholars, have investigated the systemic constraints on innovation in the Russian Federation. In their concept of "spin dictators," these researchers argue that modern autocracies maintain power through manipulation of information and creation of the illusion of competence. Such a system is oriented towards imitation, not real development, which is incompatible with the environment necessary for breakthrough innovations. This idea resonates with the concept of "Fake Russia" formulated by experts at the North Eurasian Transformation Institute.

Hybrid adaptation also consists in creating so-called "pockets of efficiency". Let us recall Stalin's innovations of secret "post office boxes" or "sharashkas" where repressed scientists worked in slavery. Today, the authorities create such teams primarily using monetary and corruption

incentives. According to the Kremlin's plan, such islands were to be state corporations of the defense industry (primarily Rostec, Kalashnikov, UAC) that would consolidate supply chains, standardize the nomenclature, and ensure mass production. This is reinforced by the import of high-tech production equipment from "friendly" countries. However, Russia also turns civilian corporations and banks into weapons – for example, Sberbank, Rosatom, and the Direct Investment Fund. These organizations receive a political protection, resources, and a special management regime that partially imitates Western corporate practices. At the same time, these enclaves are not able to "pull" the entire system - they coexist with "bad governance" and often degrade or become isolated themselves.

In the past, the Russians have tried to position the newly created Skolkovo, as well as entities such as the Rusnano Corporation, as a center for the development of innovations. Although speculation about embezzlement spread along with these structures, the narratives about them influenced certain business and political circles in the West. Even the well-known McKinsey, for example, in 2014 spoke favorably about the prospects for innovation in Russia (apparently, seeking Kremlin orders or for the purpose of protection) – and cited a successful example from the military sphere: “An example of such innovation in Russia is the Russian satellite navigation system “GLONASS”, which was created for military purposes by state order...”<sup>25</sup>

Central to Russia's state-owned defense corporations is Rostec, headed by Sergei Chemezov, a close ally of Putin. Rostec unites hundreds of defense companies, including the Kalashnikov Group, which produces Lancets. This model allows for the scale-up of production of basic Russian weapons systems, such as the Orlan-10 reconnaissance UAV, but remains plagued by corruption and bureaucracy.

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<sup>25</sup> McKinsey & Company. *Иновации в России – неисчерпаемый источник роста*. Москва: McKinsey & Company, 2014.  
<https://www.mckinsey.com/featured-insights/innovations-in-russia-report>.

## Phenomenon of the Rubicon Unmanned Systems Center

The Rubicon case should be viewed as an institutional “pocket of efficiency” within the Russian army, with elements of integration into the defense industry. The center was established in the summer of 2024 at the behest of Defense Minister Andrei Belousov with a clear mandate to centralize the entire cycle of unmanned warfare — from procurement and R&D to field testing, implementation of tactics, and operator training. Within the first two months after its launch, Russian sources attributed more than four hundred damaged units of Ukrainian weapons and equipment to Rubicon. These statements should be taken with the usual caution, but they well illustrate the center’s ambition: to transform the scattered initiatives of a unified “drone” war into a controlled production and combat machine.

Organizationally, Rubicon is a separate combat unit, but also a kind of superstructure over conventional military units. Thanks to Rubicon, the enemy has the opportunity to standardize the range of platforms and components of unmanned systems and provides short feedback in the cycle "frontline → developer → frontline". Within the center, specialized groups are distinguished - FPV, counter-UAV, "night bombers", a group working with the Molniya UAV, as well as a dedicated segment of electronic intelligence and electronic warfare. The combination of platform standardization and tactical solutions with constant feedback from the tactical formations of the Russian occupation forces makes it possible to implement small technical and tactical changes in a pipeline and quickly scale up the solutions that work.

The factors of Rubicon's effectiveness lie at the intersection of politics and organization. The center received a political protection and special funding as an element of the formation of unmanned forces in the Russian Armed Forces. This reduces transaction costs and speeds up procurement, tests and repairs. Standardization of a small number of platforms reduces the burden on logistics and training, and the constant collection of combat observations allows making constructive changes, improving software and tactics, avoiding lengthy bureaucratic approvals. A separate direction in at Rubicon is training. Rubicon not only fights,

but also deploys operator schools along the frontline, training strike UAV units on the spot, which allows the enemy to replicate uniform standards and practices.

The effect of this approach was manifested in 2024–2025 in two dimensions. First, in the operational sense, the Rubicon capabilities were used by the enemy to disrupt the logistics of the Ukrainian Defense Forces during a special operation in the Kursk region, which could have affected the conditions and pace of the withdrawal of individual Ukrainian units. Second, with the dominance of Ukrainian drones in the air, a significant part of Rubicon's efforts was redirected to countering Ukrainian drones. According to statistics published by the enemy, in 2025, the share of strikes on UAVs increased from approximately a quarter to about half of all strikes carried out by Rubicon in the summer of 2025, which indicates the priority for the enemy of "clearing the sky" for the use of its own UAVs.

In the institutional sense, Rubicon is a structure typical of the Russian model for bypassing inertial departmental structures and state corporations by creating an extra-systemic tool with direct access to solutions and resources. Such “island” efficiency has limitations, as well. The center's activities and its financing depend on administrative priorities. Developers under sanctions must solve the systemic problems of import dependence on components, find personnel for themselves and work in a systemically corrupt environment of Russia. These systemic risks certainly affect the long-term potential in innovation activities.

Of particular note are Rubicon's attempts to achieve integration into the "network battlefield." According to Russian media reports, developing digital communication circuits, Rubicon's FPV crews use secure data transmission networks, using temporary Strela-P base stations to provide communication with artillery and air defense, transmitting target coordinates in almost real time. Target strikes are also coordinated and fire adjustments are made, transmitting video to gunners. Fire coordination implies that FPV drones can be used to strike targets detected by other drones or the Malachite radar stations, which minimizes target search time. These Rubicon innovations increase the effectiveness

of FPV groups and create new tactical capabilities, from intercepting strike UAVs of Ukrainian defense forces to network interaction with artillery and air defense. Thus, the factors of Rubicon's effectiveness lie at the intersection of political support and organizational experiment. However, it is worth noting that the Kremlin is actively using Rubicon as a tool of information warfare, glorifying and, possibly, exaggerating its results. By and large, the Ukrainian defense forces have many more similar or better structures - the question remains of scaling, resource provision and the ability of Russia to authoritarianly manage them.

### System adaptation mechanisms: innovation gap and scaling infrastructure

The fundamental problems of the Russian innovation system are clearly reflected in international rankings. According to the 2024 Global Innovation Index, a ranking list of the World Intellectual Property Organization (WIPO), Russia has continued its decline and ranks 59th, significantly behind not only all G7 countries, but also China.

It is worth noting that although Ukraine ranks 60th out of 133 countries, our country is ahead of Russia in some key indicators. In the 2024 Global Innovation Index, the Russian Federation ranks 56th in terms of Innovation Outputs. For comparison, Ukraine ranks 54th. This may indicate Russia's relatively lower efficiency in transforming its resources and investments (in terms of which it ranks higher) into real technological products, scientific publications, and creative goods, especially under international sanctions. An analysis of the positions of Ukraine and Russia in the Global Innovation Index ranking for three years (2021, 2023, 2024) demonstrates clear dynamics and confirm fundamental differences in their innovation models.

	2021		2022		2023		2024	
Indicator	Ukraine	Russia	Ukraine	Russia	Ukraine	Russia	Ukraine	Russia
General position	49	45	57	47	55	51	60	59
Inputs	76	43	75	46	78	58	78	76

Outputs	37	52	48	50	42	53	54	56
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Source: <https://www.wipo.int/en/web/global-innovation-index>

The data show a steady regression of both countries in the overall ranking over time. This is a direct consequence of the full-scale war, which is depleting the economy of Ukraine, while for Russia, it may be a consequence of long-term sanctions, which degrade its innovative potential. However, Russia consistently maintains high positions in terms of resources, which confirms its resource-based model. Even under the influence of sanctions, the state continues to invest significantly in infrastructure and science, albeit with an increasing bias towards militarization.

Ukraine’s performance on this criterion demonstrates resilience, but also an expected decline due to the enormous pressure on the economy. In the “Outputs”, Ukraine consistently outperforms Russia in terms of efficiency. In 2021, Ukraine’s advantage was the largest during the comparison period (43rd position versus 52nd). In 2023 and 2024, despite the most difficult conditions, Ukraine maintained its advantage (52nd versus 59th and 53rd versus 60th). This proves that Ukraine’s decentralized innovation ecosystem, which relies on the flexibility of the IT sector and private miltech developers, is significantly more efficient than the cumbersome, centralized, and increasingly isolated Russian model.

### "Parallel armies" as a mechanism for organizational incremental innovation in the war of attrition

Russia’s irregular military formations - the Russian government-created and controlled “PMCs” and “volunteer battalions” like Wagner, Redut, and Akhmat - have evolved from a special operations force into units parallel to the enemy’s regular armed forces. In doing so, they play the role of incremental innovations in tactics and operational art after the failure of the initial “special military operation” plan of 2022.

Although at certain times during the full-scale Russian-Ukrainian war, Wagner could be imagined as a substitute for regular military formations, the function of these “parallel armies”, especially after the failure of the “Prigozhin rebellion”, is not so much to “replace the army”, but to create a mechanism for testing and rapid replication of small but massive improvements - from recruiting and motivating Russians with combat, police or criminal experience (a significant number of men in Russia) to the tactical use of UAVs, electronic warfare and assault operations. It is through these formations that Russia “stitches together” what its inert state corporations and departmental structures do slowly or do not do at all, on the battlefield. In the future, successful practices are picked up by regular structures - thus standardized practices are developed.

Wagner in 2022 and early 2023 was a key testing ground for tactical increments, including short assault cycles, dense sensor saturation at the front, coordinated “meat assaults” under massive barrages of fire, and continuous video sharing with UAV units. Due to the high cost of excessive casualties, this model did not become a breakthrough “revolution in military affairs” but it did create procedures and routines for rapid micro-improvements that could be scaled up in the regular army.

Another example of a Russian quasi-PMC is the Redut, which, according to a number of analysts independent of the Kremlin, acts as an operational “umbrella” for the GRU. It is through it that “volunteer” battalions and corporate PMCs (including the Gazprom's Potok and Fakel) are manipulated - combat formations are reformatted and “reflashed” to meet the tasks that arise on certain sections of the front. It is also about testing what can become typical UAVs, unified radios, and instructions on assault tactics in the Russian occupation forces - without lengthy approvals in the classic army bureaucracy. Then the Russian Ministry of Defense selects what can be scaled up.<sup>26</sup>

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<sup>26</sup> RFE/RL, How Russia’s GRU Set Up a Fake Private Military Company ‘Redut’ - URL.: <https://www.rferl.org/a/russia-gru-fake-private-military-company-ukraine-redut-investigation/32630705.html>; Washington Post, Before Prigozhin plane crash, Russia was preparing for life after Wagner - URL.: <https://www.washingtonpost.com/world/2023/08/25/wagner-group-successors-mercenary-companies/>

## How the Kremlin overcomes internal resistance in the military system

In civil-military relations, the Kremlin has built a complex practice of “manual control” of the military vertical, combining personnel rotations, criminal prosecutions, formation of necessary narratives in the information domain and the involvement of the FSB military counterintelligence as a tool of presidential supervision over military leaders. Frequent rotations of the top generals are presented either as a fight against abuses or are simply hushed up or covered in the media with accents formed by a narrow circle of those on whom Putin directly relies. The recent<sup>8</sup> appointment of Colonel General Andrei Mordvichev to the post of Commander-in-Chief of the Ground Forces is presented in military-related publications as “rejuvenation” and technological renewal, but in essence it reflects the Kremlin’s desire to neutralize centers of alternative influence and balance the loyalty of the command with critical demands heard from the front. In the media, his figure is constructed as a “breakthrough general”, while at the same time preserving a decisive role in making decisions for the General Staff and Valery Gerasimov; this format allows the Kremlin to minimize the risks of the emergence of a “second Prigozhin” - a popular “field commander”.

The key means of curbing disloyalty is selective criminal prosecution. The conviction and imprisonment of Major General Ivan Popov, popular among “national patriots”, has become a public signal to all commanders of Russian occupation forces who place “front-line efficiency” above bureaucratic discipline and dare to criticize the leadership of the General Staff. Popov’s case was conducted by the FSB counterintelligence unit, which acts as the presidential “watchdog” over the army’s top brass; thus, the escalation of the conflict between “front-liners” and the staff elite is given legal form and put into a channel controlled by the Kremlin. This has a double effect: the exemplary punishment reduces the level of the open opposition, and the silence in the “patriotic” media prevents the solidarity of disgruntled mid-level officers.

Another tool is “soft expulsions” and demotions to low-impact positions under the guise of planned rotations of army generals. Media

figures who acquire public subjectivity or signal their ambitions are transferred from operational positions to academic or staff positions, thus depriving themselves of access to real levers of control. This technique was used against individual commanders of districts and groups, accompanied by complimentary media explanations about “merits to the Motherland” and “planned appointments”. At the same time, commanders critical of the General Staff are discredited through information campaigns, “showdowns” and attribution of political motives, which makes them toxic within the corporation.

Control over the agenda is ensured by the General Staff’s overwhelming vote in public communications. Even after the appointment of a civilian defense minister, Andrei Belousov, Gerasimov retains symbolic weight: it is he who announces a “truce” or reports on “operational successes”, pushing the minister into the shadows and showing the army who really makes the decisions. For the Kremlin, this is a way to maintain the monolithic center without destroying the facade of “civilian control” in the military organization of the state.

In such a system, military figures like Mordvichev receive career opportunities - quite effective in an operational sense, but not overly ambitious in politics.

At the same time, managed competition is maintained between various elite groups - the General Staff, the FSB, and the presidential administration - that prevents any institution from accumulating excess power. The system of “fine-tuning” appears stable as long as frontline challenges do not exceed the potential of the management balance: the longer the war of attrition continues, the more costly personnel mistakes and inter-factional conflicts become.

This practice of overcoming resistance solves short-term tasks for the Kremlin - it disciplines commanders, centralizes decision-making, blocks the emergence of alternative centers of power. At the same time, it deepens the very cracks it is designed to repair: the gap between political loyalty and professional competence, the lack of trust between the front and the headquarters, and the dependence of effectiveness on the

"manual" decisions of a narrow circle of people involved. As a result, the Kremlin generally controls the army, but due to increasing transaction costs for maintaining loyalty - and with the risk of repeated "explosions" in the event of prolonged failures at the front.

However, the authoritarian machine of the Russian government, which is increasingly taking on totalitarian features, sometimes simply physically destroys agents of high-tech solutions in the Russian occupation forces. The term "Puzikovshchyna" became famous in this context - the commander of the military unit Puzik punished valuable drone pilots by sending them on an assault, where they died - Puzik himself continues to hold his commanding position<sup>27</sup>.

## Conclusions

Russia is not implementing a "military revolution", but a hybrid adaptation - an innovation model that combines the use of Soviet heritage, theft and import of technologies, localization of production, and serial replication of small improvements. This model provides a rapid innovation cycle in certain areas:<sup>8</sup> "front → innovative solutions → front" and provides an operational effect in a war of attrition, but does not exceed the technological "ceiling" of Russia's insufficient potential in segments such as microelectronics, software, and new materials.

Incremental innovations in tactics and operational art are the key to the enemy's resilience during the full-scale war. Standardization of several basic UAV platforms (Shahed/Geran, Orlan-10, Lancet, Molniya), typical assault "packages" that provide fighters, etc. allows scaling "sufficient quality" solutions to industrial volumes. Authoritarian decisions are made quickly. Special services control and utilize the corruption component. This reduces the duration and compensates for the lack of training for recruits, facilitates the enemy's logistics and increases the rate of application of weapons and tactical techniques.

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<sup>27</sup> VD. Розвідка ворога.

<https://t.me/s/VictoryDrones?q=%23%D0%A3%D1%88%D0%BA%D1%83%D0%B9%D0%BD%D0%B8%D0%BA>

Organizational “islands of efficiency” - from state corporations to special military formations like Rubicon - act as accelerators for the implementation of innovative solutions. They accumulate resources, standardize product lines, shorten approval cycles, and transfer feedback from the battlefield to design changes. However, their effectiveness depends on political patronage and access to imported components, which limits the achievement of strategic innovation capabilities by these islands.

“Parallel armies” that have become the mechanics of serial incremental organizational improvements. Through them, the MoD/GRU consolidate covert mobilization, equipping, and implementation of tactical solutions, after which successful solutions are replicated in broader formats. The effect is scaling and pace, and the drawback and byproduct is the erosion of unity of command and heterogeneity of training.

"Prestigious" systems (hypersonic Zircon and Oreshnik) primarily perform a demonstration-escalation and political-psychological function, compensating for Russia's general technological weakness compared to the West.

Russia's innovation activity remains ineffective in the long term: a country that considers itself a great power, ranks low in global indices, is chronically import-dependent, has personnel bottlenecks in radio and microelectronics, and actually operates in conditions of corruption intertwined with power. This makes the model relatively workable against a much smaller Ukraine in a long war of attrition, but strategically unviable in technological competition with the NATO.

The current full-scale Russian-Ukrainian war signals a possible shift in the nature of future conflicts. The era when technological superiority guaranteed victory may be coming to an end. The ability of authoritarian regimes to adapt rapidly through incremental innovation and wage protracted wars of attrition poses a new challenge to Western democracies.