



LONDON POLITICA

REPORT

# Russian Strategic Fires in the Russo-Ukraine War as of January 2024

March 2024

Christopher Dufty



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## Author

### **Christopher Dufty**

Christopher Dufty is a London Politica intelligence analyst focussing on defence topics with specific interests in unconventional warfare, hybrid warfare and the war in Ukraine. His previous work has explored covert and clandestine Iranian naval operations in the Middle East, irregular warfare in Ukraine and intelligence updates for the ongoing conflict in Gaza. He is currently an international relations undergraduate at the University of Durham and a serving officer in the British Army completing his dissertation on the emergence of irregular expeditionary warfare driven by Wagner Group operations in West Africa.



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## EXECUTIVE SUMMARY

- Russia has been using its strategic missile capability throughout the ongoing war to hit a variety of Ukrainian targets to a limited strategic effect.
- Russia has been using a wide scope of systems ranging from Western equivalent, modern cruise missiles to Iranian designed one way attack drones that are far less capable but much cheaper. The introduction of these cheaper systems has allowed Russia to increase the volume and scale of attacks to increase the efficacy of strikes especially in December 2023 and January 2024.
- Ukrainian air defence efforts have been highly successful given the complexity of networking their existing systems and integrating donated Western systems.
- Russian missile attacks are highly likely to continue at scale across Ukraine driving a perpetual cat and mouse game between changing Russian strike tactics and improving Ukrainian air defence systems.

## INTRODUCTION

A key feature of the ongoing Russo-Ukraine conflict since its outset in February 2022 has been the use of strategic fires from both sides. This research aims to examine exclusively the systems, capabilities,



successes and failures of the Russian strategic strike systems and draw out lessons that can be used both to examine Russian strategic weakness and advise planning and acquisition suggestions for other global military forces. This report will firstly provide the scope for the systems covered and further provide definitions for key terms concerning the Russian fire capability in order to be consumable by a non-military-jargon-literate audience.

## Scope

This report will cover strategic Russian strike systems. This means systems that operate in strategic depth (the area behind the front line where logistics, command and control, training and other non-front-line combat activities take place). As defined by the USAF College of Aerospace Doctrine,<sup>1</sup> the nature of the strategic level of conflict ‘focuses on defining and supporting national policy and relates directly to the outcome of a war or other conflict as a whole.’ Essentially this can be translated to systems used to strike targets at a national level, whether that be decision-making centres, government buildings, critical infrastructure such as power plants, bridges or ports, civilian residential targets or military targets in depth such as training bases. Russia has demonstrated its ability to (and has) hit all of these target types.<sup>2</sup> These systems tend to be larger, more expensive, with longer ranges and larger warheads. This report will only be covering systems confirmed to have been used in Ukraine and, further, will focus on five key, frequently used systems that can be used as allegories for the entire scope of Russian systems utilised in Ukraine. It is important to note that these systems are often not exclusively used at a strategic level, but that does not preclude them from making the list as strategic systems

## DATASET

This report will pull data from two sources. Firstly, the Ukrainian Air Forces (UAF)<sup>3</sup> tally of Russian strategic strike systems used in Ukraine and anecdotal evidence pulled from X (formally Twitter) and Telegram to illustrate the effect these systems have. The use of Ukrainian Air Force data comes with some issues. This data cannot be verified independently but also comes with some incentives for

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<sup>1</sup> USAF College of Aerospace Doctrine, Research and Education (CADRE). 1997. Three Levels of War. Maxwell AFB, AL: Air University Press (excerpt). URL: <https://faculty.cc.gatech.edu/~tpilsch/INTA4803TP/Articles/Three%20Levels%20of%20War=CADRE-excerpt.pdf>

<sup>2</sup> Harward, Christina, Karolina Hird, Kateryna Stepanenko, Nicole Wolkov, George Barros, and Frederick Kagan. 2023. “Russian Offensive Campaign Assessment.” December 28, 2023. URL: [https://understandingwar.org/sites/default/files/Dec%2028%20Russian%20Offensive%20Campaign%20Assessment%20PDF.docx\\_.pdf](https://understandingwar.org/sites/default/files/Dec%2028%20Russian%20Offensive%20Campaign%20Assessment%20PDF.docx_.pdf).

<sup>3</sup> Повітряні Сили ЗС України / Air Force of the Armed Forces of Ukraine. Telegram. URL: <https://t.me/kpszs>.





falsification from the UAF. This UAF data consists of daily updates on strikes against Ukraine, with the information provided on how many Russian systems were used, what systems were used and the interception rate by the UAF. There exist two principal issues with using the UAF's data on strikes and interception rates: firstly, the UAF has an incentive to overreport the interception rate in order to overstate the efficacy of Western air defence systems and highlight their continued importance. Conversely, there is also an incentive to underreport the interception rate in order to suggest to Western backers that further air defence systems are required to get the Ukrainian air defence to a point where it poses a credible threat to Russian long-range fires. This, however, DOES NOT mean this data is inaccurate or false rather that there is a credible reason to distrust exact figures given by the UAF. This report is not trying to suggest that the UAF is misleading in the data that it's producing; there is no evidence to support this, but rather is establishing that this data is potentially not fully accurate. As such, this report will focus on the trends in systems used as well as the independently verifiable usage of systems to draw analysis from rather than specific exact figures.

## KEY SYSTEMS

Russia has utilised a vast assortment of strategic strike systems during the war ranging from cutting-edge air-launched cruise missiles (ALCM) to early-Soviet era, repurposed anti-ship missiles (ASM).<sup>4</sup> This report will cover the five most significant and prominent systems used. These systems are the Kh-101 ALCM, Kalibr cruise missile, Kinzhal 'hypersonic' missile, Shahed 136 attack drone and the Iskander-M ballistic missile. These systems will be explored in detail below.

NAME	COST PER UNIT (\$)	RANGE (Kg)	PAYLOAD (Kg)	LAUNCH PLATFORM
Kh-101	10000000	2800	450	Aircraft (various)
Kalibr	980000	2500	500	Aircraft, naval, land-based
Iskander-M	3000000	500	800	Land-based

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<sup>4</sup> Hoffmann, Fabian (@FRHoffmann1), "Approximately 12 months ago, RU initiated a large-scale long-range strike campaign against Ukraine..." October 3, 2023, 3:00 PM. URL: <https://twitter.com/FRHoffmann1/status/1709191669630058527>

Kinzhal	10000000	2000	480	Aircraft (Mig-31K/Tu-22M3)
Shahed-136	20000	2500	50	Land-based

Table 1: Characteristic data for the five primary strike systems used by Russia using publicly available data on system characteristics.



[Photo source](#)

Kh-101<sup>5</sup> - The Kh-101 is a modern, expensive and highly capable ALCM. These systems are deployed from aircraft at stand-off range, meaning the aircraft that launch these weapons fire them from within Russian territory. The system also incorporates a level of 'stealth design' reducing its radar cross-section -decreasing the ability to detect it with radar systems -thus making it more difficult to intercept. The Kh-101 is part of a family of missiles used in Ukraine that also includes the Kh-555. The Kh-555 is an older system with a lower price tag and lower range. As the approximate capabilities of these two systems are comparable - and UAF reporting often does not specify between the two systems - this report will aggregate them into a single data point using a median price tag of \$10,000,000.



[Photo source](#)

Kalibr<sup>6</sup> - The 3M14 Kalibr cruise missile has been a heavily publicised weapon system that forms the majority of the modern Russian cruise missile capability. Based on the launch platform used, the systems can be deployed from land, air, surface vessels, and submarines with small differences in range, payload and cost. This report will simply refer to the system as 'Kalibr'. This system is comparable to the US Tomahawk system.

<sup>5</sup> Military Today. "Kh-101 Air-Launched Cruise Missile." MilitaryToday.com. URL: [https://www.militarytoday.com/missiles/kh\\_101.htm](https://www.militarytoday.com/missiles/kh_101.htm).

<sup>6</sup> Military Today. "Kalibr Naval Cruise Missile Family." MilitaryToday.com. URL: <https://www.militarytoday.com/missiles/kalibr.htm>.



[Photo source](#)



[Photo source](#)

Iskander-M<sup>7</sup> (NATO reporting name SS-26 Stone) - is a theatre ballistic missile system. The name Iskander refers to the launcher, while Iskander-M refers to the specific missile. The system has generally been used in Ukraine to strike strategic and operational targets of all types.<sup>8</sup> The system is ground-launched and utilises a ballistic trajectory to engage targets. These characteristics illustrate this system as a shorter-range but highly capable missile.

Kinzhal<sup>9</sup> - The KH-47M2 Kinzhal (AS-24 Killjoy) is an air-launched 'hypersonic' ballistic missile. It is so-called because it reaches speeds of Mach 10 (3430m/s) in its terminal phase.<sup>10</sup> This missile is essentially an Iskander-M that has been modified to be fired from an aerial platform giving it a longer range and a much higher speed. It is important to note that Ukrainian air defence operators have claimed the system only travels at Mach 3.6 (1234.8m/s),<sup>11</sup> a third of the claimed Russian figure. This system is the most capable in the Russian inventory but has been sparingly used in the war due to its very high cost and, more importantly, very low quantity of units in Russian stockpiles.<sup>12</sup>

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<sup>7</sup> Military Today. "Iskander (SS-26 Stone) Short-Range Ballistic Missile." MilitaryToday.com. [www.militarytoday.com](https://www.militarytoday.com/missiles/iskander.htm). URL: <https://www.militarytoday.com/missiles/iskander.htm>.

<sup>8</sup> Defense Express. 2023. "How Many Iskander-M Ballistic Missiles Could Be Piled up by Russia to Strike Ukraine in Winter." Defense Express. Accessed October 21, 2023. URL: [https://en.defence-ua.com/analysis/how\\_many\\_iskander\\_m\\_ballistic\\_missiles\\_could\\_be\\_piled\\_up\\_by\\_russia\\_to\\_strike\\_ukraine\\_in\\_winter-8315.html](https://en.defence-ua.com/analysis/how_many_iskander_m_ballistic_missiles_could_be_piled_up_by_russia_to_strike_ukraine_in_winter-8315.html).

<sup>9</sup> Military Today. "Kh-47M2 Kinzhal Air-Launched Ballistic Missile." MilitaryToday.com. URL: [https://www.militarytoday.com/missiles/kh\\_47m2\\_kinzhal.htm](https://www.militarytoday.com/missiles/kh_47m2_kinzhal.htm).

<sup>10</sup> Ibid.

<sup>11</sup> "How Kyiv Fended off a Russian Missile Blitz in May." The Economist. <https://www.economist.com/europe/2023/06/13/how-kyiv-fended-off-a-russian-missile-blitz-in-may>.

<sup>12</sup> Williams, Ian. 2023. "Russia Isn't Going to Run out of Missiles." CSIS, June. <https://www.csis.org/analysis/russia-isnt-going-run-out-missiles>.



[Photo source](#)

Shahed-136<sup>13</sup> - The Shahed 136 or (Geran-2 in Russian service) is an Iranian-designed and (initially) Iranian-manufactured one-way attack drone. These types of systems are commonly referred to as suicide drones or kamikaze drones due to their single-use nature. It has a flying wing design and is very cheap to manufacture. This puts it in an entirely different category from the other four systems mentioned. The Shahed-136 has the same target set as the other systems mentioned; however, the nature of its low price means that this system can be acquired and used in much higher quantities.

With these systems in mind, let us start by examining the UAF-provided data between 30th September 2022 and 30th September 2023. This dataset gives information, as provided by the UAF, on interception and total launch numbers, alongside open-source data on each strike system's physical and fiscal characteristics. It also calculates an estimate for the dollar

<b>Shahed 136</b>	20000	2500	50	0.879	2096	253.616	1842.384	12680.8	3305.79
<b>Iskander-M</b>	3000000	500	800	0.8	30	6	24	4800	18750.00
<b>Kinzhal</b>	10000000	2000	480	0.4	50	30	20	14400	34722.22

<sup>13</sup> Military Today. "Shahed 136 Loitering Munition." MilitaryToday.com. URL: [https://www.militarytoday.com/aircraft/shahed\\_136.htm](https://www.militarytoday.com/aircraft/shahed_136.htm).



System	Unit Cost (\$)	Range (km)	Warhead (kg)	Interception Rate	Number Launched	Hits	Interceptions	Weight delivered (kg)	Cost per kg delivered (\$)
Kalibr	980000	2500	500	0.786	266	56.924	209.076	28462	9158.89
Kh-101/555	10000000	2800	450	0.868	728	96.096	631.904	43243.2	168350.17

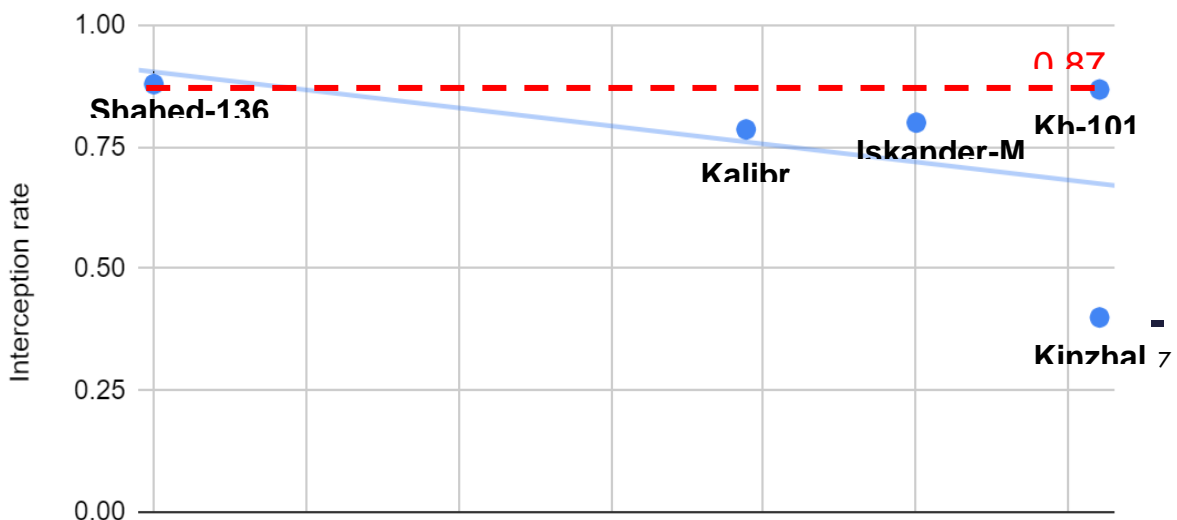
value amount of each kg of warhead that successfully strikes a Ukrainian target.

Table 2: Characteristic data for the five primary strike systems used by Russia using publicly available data on missile characteristics and interception data to estimate a cost per kilogram of warhead successfully delivered by each system.

## ANALYSIS

Examining the dataset, some trends become immediately obvious, and some outliers raise questions. For starters, conventional logic would suggest that as a missile becomes more expensive, its probability of hitting would increase, whether that be due to superior stealth, better countermeasures (systems to jam or deploy decoys to hinder air defence interceptions), or more complex flight paths. This data, however, suggests that this logic is not the case here as the Kh-101, despite having a five-hundred times higher price tag, has a similar interception rate to the far simpler and less capable Shahed-136.

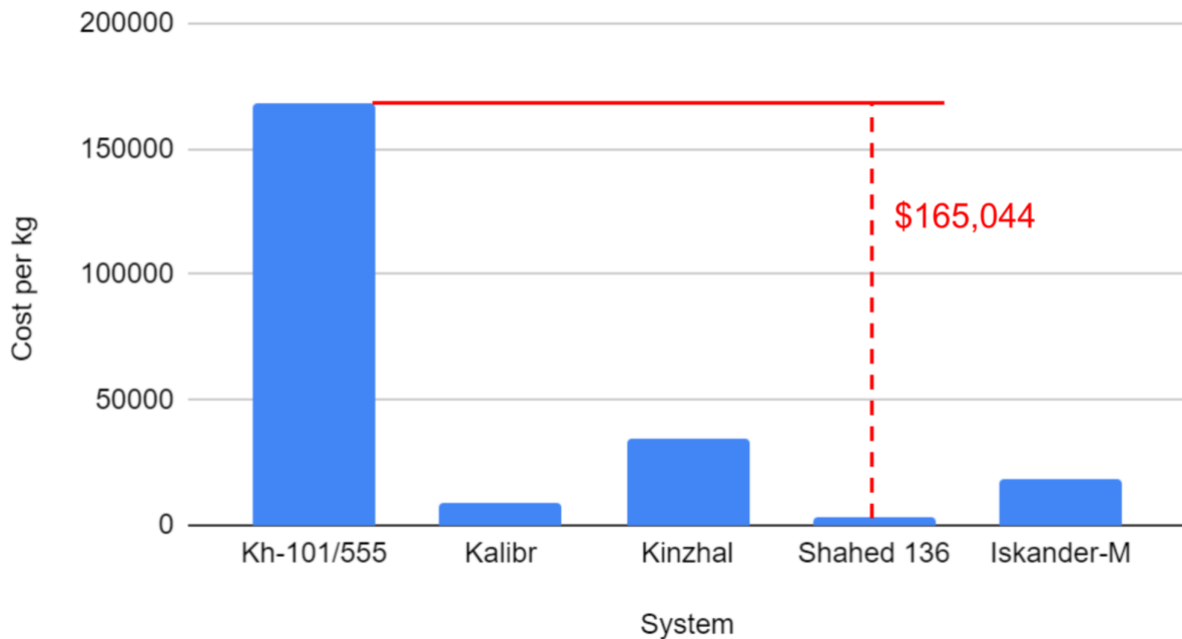
### Interception rate vs. Cost (logarithmic) (k\$)





Graph 1: Data from Table 1 plotted logarithmically to show the interception rate against the total cost per missile. A higher cost would logically suggest a lower interception rate, and this trend is true but very weak, with exceptions analysed below.

### Cost per kg vs. System



Graph 2: Cost per kilogram of warhead successfully arriving at a target for each of the five systems.

This parity in interception rate is surprising. If there was a parity in total cost to deliver warheads to the target, i.e. it took 500 Shahed systems to achieve one hit while it only took one Kh-101, then this would make sense in terms of the stated capability of each system. However, this is not the case, instead, a \$20,000 dollar fibreglass, piston-engine powered drone has the same probability of hitting its target as a \$10,000,000 semi-stealth, modern cruise missile. It costs approximately \$165,044 more to deliver each kg of warhead with the Kh-101 than the Shahed, representing a cost increase of 5092%. This suggests a number of things. Firstly, it indicates that Ukrainian air defence systems are well developed. Clearly, the Western transfers of air defence systems combined with the pre-existing ex-Soviet Ukrainian air defence systems are capable of providing an impressive level of air defence



coverage. Secondly, it indicates that Ukraine has a well-developed and layered air defence network because it is highly unlikely that the same types of air defence systems are being used to shoot down both the Shahed and the Kh-101. Rather, the Ukrainians are using a variety of systems to address each threat effectively, and this will be explored below.

## Interception

At first glance, this cost disparity may have military planners rushing to start a procurement program for their own cheap, disposable one-way attack drones. However, there are some considerations in favour of the Kh-101. Western air defence aid to Ukraine has included a full spectrum of systems ranging from pick-up trucks<sup>14</sup> armed with early Soviet-era ZSU-23 anti-aircraft guns all the way to cutting-edge Patriot Pac-3<sup>15</sup> systems and many in between. These systems come with a cost associated with actually destroying Russian missiles, both in ammunition and vehicles. While the cost of ammunition for the ZSU-23 is negligible,<sup>16</sup> a single PAC-3 interceptor missile costs approximately \$3,000,000.<sup>17</sup> Therefore, the Shahed is a far slower system that can be, and frequently is, destroyed<sup>18</sup> by very cheap air defence systems, while the Kh-101 will require a greater investment to shoot down. While the UAF doesn't release exact data on which of their own systems have been used to shoot down Russian systems, it can be reliably assumed that the cost to shoot down a Kh-101 is, on average, significantly higher than that to shoot down a Shahed. This additional interception cost somewhat offsets the cost disparity in delivering payloads with these two systems.

## Employment

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<sup>14</sup> OSINTtechnical (@Osinttechnical), "Ukrainian anti-drone air defense battery, comprised of a truck mounted searchlight and Ford Ranger mounted DShK HMG." January 2, 2023, 12:20 AM. URL: <https://twitter.com/Osinttechnical/status/1609675914966695942>.

<sup>15</sup> Santora, Marc. 2024. "Ukraine's Patriot Defenses at Work: Shuddering Booms and Bursts of Light". New York Times. 2024, January 6, 2024. <https://www.nytimes.com/2024/01/06/world/europe/ukraine-patriots-us.html>.

<sup>16</sup> Lord of Weapons. 2018. "23mm Ammunition for ZSU 23-4, the Price in Syria Is \$ 1.5 per Piece." Lord of Weapons - Syria Black Arms Market, Guns and Ammunition Prices. April 8, 2018. <https://weaponslord.wordpress.com/2018/04/08/%D1%81%D0%BD%D0%B0%D1%80%D1%8F%D0%B4%D1%8B-23%D0%BC%D0%BC-%D0%B4%D0%BB%D1%8F-%D0%B7%D1%81%D1%83-%D1%86%D0%B5%D0%BD%D0%B0-%D0%B2-%D1%81%D0%B8%D1%80%D0%B8%D0%B8-15-%D0%B7%D0%B0-%D1%88%D1%82/>.

<sup>17</sup> Cancian, Mark F., and Tom Karako. 2022. "Patriot to Ukraine: What Does It Mean?" CSIS, December 16, 2022. <https://www.csis.org/analysis/patriot-ukraine-what-does-it-mean>.

<sup>18</sup> Militarnyi. 2023. "Ukraine's Air Defense Intercepts 71 Shahed UAVs in Russia's Overnight Attack." Militarnyi. November 25, 2023. URL: <https://mil.in.ua/en/news/ukraine-s-air-defense-intercepts-71-shahed-uavs-in-russia-s-overnight-attack/>.



There are issues of how and where these systems are employed. Shaheds tend to be employed in large wave-like attacks with dozens of systems launched together.<sup>19</sup> This can be assumed to have the aim of overwhelming Ukrainian air defences to allow that final 13% of Shaheds to slip through the web of air defences and hit their target, which implies that a greater number of Shahed systems are required to achieve this parity on interception rate. As such, a greater logistical burden can be assumed from Shahed launches, as the resources required to move dozens of these systems to a firing location are not insignificant, while Kh-101s are deployed from aircraft whose sole purpose is to launch the Kh-101. The logistical burden refers to the fact that resources have to be diverted to get these Shahed drones to a point where they can be launched. This means transport from Iran or Russian factories to the front, personnel to the crew, and launch the systems that could have been used elsewhere, while the Kh-101 relies upon a pre-existing framework of personnel and equipment designed explicitly to serve the purpose of launching these missiles. Further, while these Kh-101s may come with a \$10,000,000 price tag, the vast majority were already in Russian stockpiles before the 2022 invasion, meaning they were a sunk cost. Using these Kh-101s does not actually incur a financial cost for the Russian government; instead, they incur the strategic cost of depleting their long strange missile supply that would be used in the event of another conflict, such as a hypothetical conflict with NATO. While it can be assumed that the Russian MoD will seek to replenish this supply in the future, using a \$10,000,000 missile does not currently impose a \$10,000,000 cost on the budget. Shaheds, on the other hand, were not part of the Russian inventory before the conflict; instead, they have been procured from Iran through a number of military equipment agreements,<sup>20</sup> the nature of which is unclear. This will incur an immediate cost for the Russian MoD.

## Targets

A further question can be raised in terms of their targets. Shaheds have generally targeted critical infrastructure and other 'soft' targets where air defences may be less robust,<sup>21</sup> while Kh-101s are used to target areas densely covered with modern, capable air defences. Again, however, if the UAF ever releases comprehensive data on the systems used to conduct intercepts and the designated targets of Russian strike systems, it will be impossible to go further than this educated speculation.

*What is clear here is that the Shahed fills a gap between hugely expensive, full-featured ALCMs and conventional, cheaper artillery systems, giving the Russian forces the capability to strike strategic targets without breaking the bank.*

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<sup>19</sup> BBC. 2022. "Ukraine Conflict: How Are Drones Being Used?" BBC News. December 29, 2023. URL: <https://www.bbc.co.uk/news/world-62225830>.

<sup>20</sup> USIP. 2023. "Timeline: Iran-Russia Collaboration on Drones." 2023. United States Institutes of Peace. The Iran Primer. March 1, 2023. URL: <https://iranprimer.usip.org/blog/2023/mar/01/timeline-iran-russia-collaboration-drones>.

<sup>21</sup> Airwars. 2023. "Reported Shahed Drone Launches in Ukraine: August 2022-September 2023." Airwars. Accessed March 5, 2024. URL: <https://airwars.org/research/shahed-map/>.



It has given Russian commanders another tool in their strategic arsenal that can be deployed to cause massive impact across a huge geographical area for a relatively insignificant cost while depleting Ukrainian air defence and attriting Ukrainian infrastructure. The extent of these strikes can be seen on the map below produced by Rybar (*note: Rybar is a pro-Russian pro-war telegram channel with Russian subject-matter experts posting detailed daily updates on the Ukraine conflict. It is not a direct Russian MoD mouthpiece but can be assumed to take a pro-Russian stance although their data tends to be the most accurate of all the pro-war Russian telegram accounts and is regularly cited by major Western news outlets*). While the long-term efficacy of these strikes is debatable, the ability of Russia to threaten Ukrainian utilities is not insignificant.



Image 1: Rybar-produced map showing strikes on Ukrainian critical national infrastructure in 2022.

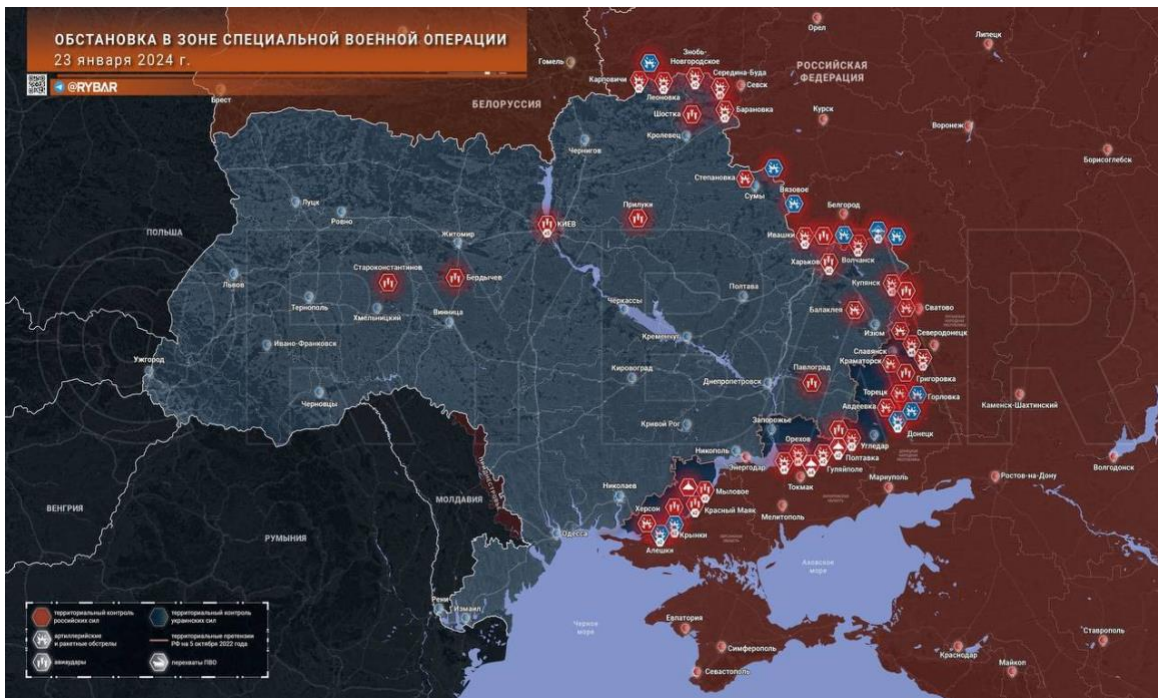


Image 2: Rybar map showing engagements and strikes on Ukrainian forces on January 23rd 2024.  
(Translation: Situation in the zone of the Special Military Operation as of January 23, 2024)

The Kinzhal system also stands out in the data due to its very low interception rate of 0.4. While a very limited number of these systems have been produced<sup>22</sup> and used, this number is still notable given that the targets that have been confirmed hit have been those that could be considered to be heavily protected with air defence systems. A good example of this is the Kinzhal strike that damaged a Patriot battery in Kyiv.<sup>23</sup> These systems are reportedly similarly priced to the Kh-101 but appear more capable. This is due to a number of factors. Firstly, they are a more modern system likely to have better countermeasures, including ECM (electronic countermeasures). Secondly, this system is far faster, being labelled by the Russian MoD as a ‘hypersonic’ system due to its reported top speed of Mach 10,<sup>24</sup> which makes it far more challenging to intercept.<sup>25</sup> The term ‘hypersonic’ here is questionable as, while it may meet the requirement for speed, the term is more widely imagined in the context of hypersonic glide vehicles. These vehicles are designed to use their speed and increased manoeuvrability to evade air defences and strike from unexpected directions.

<sup>22</sup> Williams, Ian. 2023. “Russia Isn’t Going to Run out of Missiles.” CSIS. June 28, 2023. URL: <https://www.csis.org/analysis/russia-isnt-going-run-out-missiles>.

<sup>23</sup> Kim, Victoria. 2023. “Ukraine Thwarts Intense Attack on Capital.” The New York Times, May 16, 2023. URL: <https://www.nytimes.com/live/2023/05/16/world/russia-ukraine-news>.

<sup>24</sup> Connolly, Richard. 2021. “03 Putin’s ‘Super Weapons.’” Chatham House. September 23, 2021. URL: <https://www.chathamhouse.org/2021/09/advanced-military-technology-russia/03-putins-super-weapons>.

<sup>25</sup> Smutok, Bohdana. 2023. “«Kyndzhal» — shcho vidomo pro hiperzvukovyi raketnyi kompleks rosiiskoi armii (“Kinzhal” - what is known about the hypersonic missile system of the Russian army).” Chas. December 14, 2023. URL: <https://chas.news/current/kindzhal-scho-vidomo-pro-giperzvukovii-raketnii-kompleks-rosiiskoi-armii>.



*The Kinzhal is not this, and can better be understood as a very high-velocity ballistic missile that poses an increased difficulty to intercept. However, it is not a magic bullet as the Russian MoD narrative projects.*

Nonetheless, the Kinzhal system is clearly effective. Returning to the previous analysis of interception costs, it is highly likely that only the most advanced Western air defence systems are capable of shooting down this missile. It is also highly likely that these Western systems will have to fire more than one missile in order to achieve a successful intercept, and as such, two PAC-3 interceptors totalling \$6,000,000 shooting down \$10,000,000 worth of missiles may be an economic trade-off that Russian MoD is willing to accept given the disparity between the large Russian missile stockpile and the relatively limited number of interceptor missiles that Ukraine has received from the US.

*With an apparent pause on US aid to Ukraine currently, an opportunity to attrit capable Ukrainian air defences by exhausting their missile supply would be an important strategic move.*

What this demonstrates is that while Russia has seen success employing the cheap and disposable Shahed system, they have still found a valuable use for very capable high-end systems in striking particular high-value targets. Russia has had one major problem with the system, however - the primary launch platform they have for the missile is the Mig-31K interceptor at the time of writing (though they do appear to be seeking to modify Su-34 aircraft to launch this system).<sup>26</sup> These aircraft have been converted for the role and can no longer complete their role as an interceptor aircraft which is particularly important because the Mig-31K has proved to be a particularly effective aircraft in combating Ukrainian aircraft due to its superior radar and longer-range air-to-air missiles.<sup>27</sup> What this means is that Russia has had to sacrifice ten of its more capable aircraft in order to facilitate launching the Kinzhal. On top of this, the Mig-31 is an older aircraft that went out of production in 1994, and with limited spares and flight hours left on the aircraft.<sup>28</sup> These ten modified aircraft cannot support

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<sup>26</sup> Goldstein, Lyle, and Waechter, Nathan. 2024. "China Evaluates Russia's Use of Hypersonic 'Daggers' in the Ukraine War." RAND. January 12, 2024. URL: <https://www.rand.org/pubs/commentary/2024/01/china-evaluates-russias-use-of-hypersonic-daggers-in.html>.

<sup>27</sup> Axe, David. 2023. "With F-16s, Ukrainian Pilots Could Finally Beat Back Russia's MiG-31s." Forbes. May 30, 2023. URL: <https://www.forbes.com/sites/davidaxe/2023/05/30/with-f-16s-ukrainian-pilots-can-finally-beat-back-russias-mig-31s/>.

<sup>28</sup> Suci, Peter. 2023. "Russia's MiG-31: Hypersonic Missile Truck or Obsolete?" The National Interest. November 27, 2023. <https://nationalinterest.org/blog/buzz/russias-mig-31-hypersonic-missile-truck-or-obsolete-207538>.



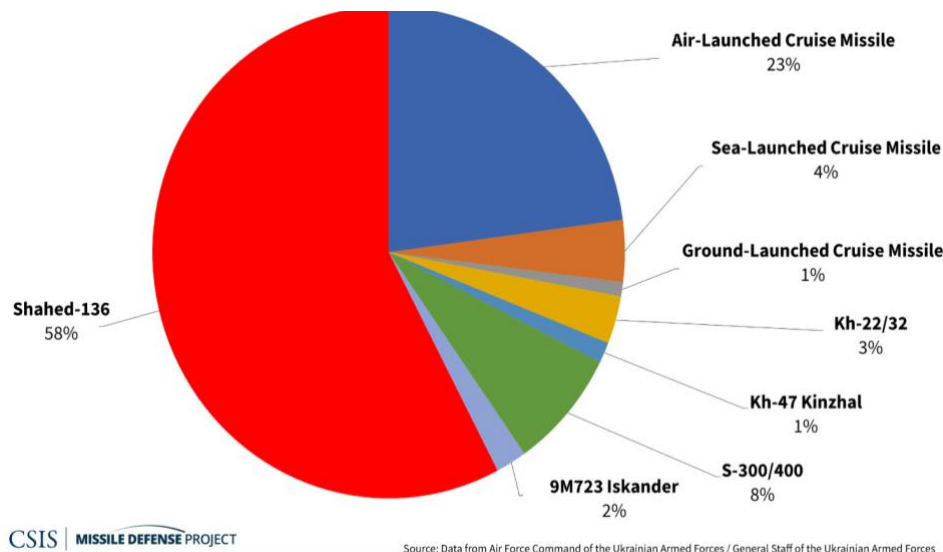
the Mig-31 fleet by contributing their remaining hours for interceptor duties due to their modification, posing a huge opportunity cost for the RuAF.

## LESSONS

This analysis can be drawn out into three main lessons that can be applied when looking at force structure and procurement decisions in other military forces with a question for military planners for each lesson identified.

Firstly, the idea of cheap mass fires vs expensive precision fires. This idea stems from the classic defence economic issue that while a huge military composing the most modern equipment would be ideal, economic restraints mean that, generally, militaries are forced to adopt either a strategy of a smaller, better-equipped force or a larger, poorly equipped force. Following the Cold War, Western militaries (with the US as an exception) have tended to focus on procuring a smaller force, offset by a focus on modern technology both for force protection and to make up for the lack of mass. The introduction and successes of the Shahed system have challenged this logic as the Russian missile arsenal is effectively an arsenal of cheap mass with a limited quantity of high-cost, high-precision weapons.

Image 3: CSIS plotting of data showing the percentage share of strikes by the system used. Air-Launched Cruise Missile here



refers primarily to the Kh-101/555 system.<sup>29</sup>

This chart shows the share of strikes by missile variant by June 2023, with over 50% of strikes being conducted with the Shahed system.

*It means that Russia has found the Shahed to be a practical addition to its arsenal both for economic, availability and logistical reasons.*

No Western military to date has this capability; instead, they rely on a smaller number of very capable (likely more capable than the Kh-101) systems. The war in Ukraine has shown that this on its own is likely not enough. Western nations need to look to supplement their existing stockpile with a cheap, massed and less capable system without getting lost in trying to make the system more capable than it needs to be.

<sup>29</sup> Williams, Ian. 2023. "Russia Isn't Going to Run out of Missiles." CSIS. June 28, 2023. URL: <https://www.csis.org/analysis/russia-isnt-going-run-out-missiles#:~:text=Moreover%2C%20Russia%20has%20repurposed%20various>.



Further, much of Western doctrine relies on the efficacy of its long-range strike capability through cruise missiles and air superiority, but this idea of air dominance has not manifested over Ukraine despite the on-paper overmatch of the RuAF. As such, to assume that - through a limited quantity of superior equipment alone - one could negate the need for mass (quantity of equipment of personnel) seems questionable in the complexity of an air defence network like that in Ukraine. A commonly used allegory here is the shaping operation conducted by coalition air forces during Desert Storm, where total air supremacy was achieved within one week. This was achieved due to a mass of highly capable aircraft and missile systems, but a majority of Western militaries no longer possess this mass, for example, the UK is estimated to have ordered only 700-1000 Storm Shadow cruise missiles which reflect the entire UK stand-off missile capability.<sup>30</sup> Accounting for systems used in Iraq and Syria along with those donated to Ukraine, if we were to estimate the current inventory to sit at 700, the UK would have a woefully inadequate stockpile given the 10,000 missiles fired thus far by Russia have been described as 'too few'<sup>31</sup> and Russia had already conducted 1000 precision strikes by day ten of the invasion. In addition, if this Western assumption was correct and they were able to vastly outperform an apparently credible force like the RuAF, the value of these cheap Shahed systems would be vastly increased as the enemy air defence became degraded or jammed, giving an interception rate far lower than that seen in Ukraine.

*If enemy air defence is degraded (or overwhelmed), there is scope for a cheap system to do as much damage as a far more expensive weapon, as this conflict has demonstrated.*

A second lesson is that the system itself is not the only factor to consider when procuring strike systems. Systems like Shahed can be launched from the back of a van generating virtually no logistic tail while the Kalibr system can be launched from aircraft, land-based launchers, ships and submarines without compromising the other functions of the equipment. This versatility is essential as it prevents systems that are useful for other purposes from being used for purposes other than those for which they are optimally designed. Similarly, the Russian ALCM campaign has relied on its strategic bomber force to deploy the missiles. These aircraft are solely designed for this purpose and do not present an opportunity cost by being employed this way. On the opposite end of the spectrum, here is the Mig-31s launching Kinzhal, which have been modified in a way that prevents them from conducting their designing activity, intercepting enemy aircraft. As such, every hour they sit on the ground waiting for a mission to launch a Kinzhal is an hour that the dwindling and ageing remainder of the Mig-31 fleet

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<sup>30</sup> Farmer, Ben, Roland Oliphant, and Connor James Ibbetson. 2023. "How British Storm Shadow Missiles Are Defining a New Phase in Ukraine's War." The Telegraph, October 4, 2023. URL: <https://www.telegraph.co.uk/world-news/storm-shadow-cruise-missile-ukraine-war-cost-how-used-uk/>.

<sup>31</sup> Williams, Ian. 2023. "Putin's Missile War. Russia's Strike Campaign in Ukraine." CSIS. May, 2023. URL: [https://csis-website-prod.s3.amazonaws.com/s3fs-public/2023-05/230505\\_Williams\\_Putin\\_Missile.pdf?VersionId=0rahER.P81oo5ispb8.UGcT\\_90DmLoSb](https://csis-website-prod.s3.amazonaws.com/s3fs-public/2023-05/230505_Williams_Putin_Missile.pdf?VersionId=0rahER.P81oo5ispb8.UGcT_90DmLoSb).



must pick up. A similar, albeit not so drastic, issue can be seen in the UK; the highly capable storm shadow missile has the Eurofighter Typhoon as its sole launch platform. While these aircraft are still able to conduct their fighter role unimpeded, they are a highly inefficient platform to use for launching stand-off (long-range without threat of enemy retaliation) munitions. Similarly to the Mig-31k, every hour these aircraft spend conducting sorties to launch storm shadow is an hour where a fully featured fighter aircraft is being funded to effectively transport a missile into the air, launch it then leave but still incurring the personnel, maintenance and fuel costs as if it was conducting its normal fighter duties. The lesson here is not to advocate for a return to purchasing strategic bombers but rather to examine the launch platform as part of the system itself and pick a launch platform that does not compromise the combat effectiveness of the force in general.

### *Does a cruise missile need to be launched from a fully-featured fighter aircraft, or would a converted commercial aircraft acting as a launch platform be more cost-effective?*

The credit for the third lesson lies solely with the Ukrainian Air Defence Forces. They have demonstrated that layered air defence can be incredibly effective when employed correctly. They have managed to integrate an incredibly intricate array of Western and legacy Soviet systems from a variety of countries with a radar network within which most of the systems were not designed to function together. On top of this, the Ukrainian Air Defence Force have integrated a variety of mobile air defence systems ranging from the German Gepard to civilian pick-up trucks armed with Maxim guns designed in the 1880s to create a fully layered system. This means that the UAF have the resources to counter the full spectrum of Russian missile systems with an appropriate economic interception system, whether that be shooting down a hypersonic Kinzhal with a patriot or a cheap Shahed with a machine gun. This layered air defence means that the Ukrainian forces can continue to deal with both the most advanced Russian missile systems and the threat of the mass of strategic fires that the Shahed presents. Western military forces do not have this capability; instead, they rely solely on the high-end systems that, while easily capable of shooting down the Shahed, would do so at an unacceptable economic cost while also depleting stockpiles of interceptor missiles for when the more capable missiles like the Kinzhal are used.

### *The lesson here is the necessity of procuring a layered and integrated air defence system in order to economically destroy threats.*

The US has started this process with trials of systems relying on laser-based weaponry<sup>32</sup> or systems like the LIDS<sup>33</sup> but so far, there has been no success in rolling these systems out on a large scale, especially

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<sup>32</sup> Howard, Brad. 2023. "Why the Pentagon Is Spending Billions to Bring Laser Weapons to the Battlefield." CNBC. November 15, 2023. URL: <https://www.cnbc.com/2023/11/15/why-pentagon-spending-billions-to-bring-laser-weapons-to-battlefield.html>.

<sup>33</sup> Vislocky, Jana. 2023. "Meet the U.S. Army's LIDS: A Sure Shot against Drones." Breaking Defense. August 22, 2023. URL: <https://breakingdefense.com/2023/08/meet-the-u-s-armys-lids-a-sure-shot-against-drones/>.



in European militaries. The UK or German militaries currently have no answer for the mass that the Shahed system provides and would be incredibly vulnerable if it came to facing the system in conflict.

## INSERT - DECEMBER 23/JANUARY 24 STRIKES

A significant development in the Russian missile campaign occurred during the months of December 2023 and January 2024. This period saw two major attacks on December 29th and January 2nd, which involved a combination of strike systems, with a total of 158 and 134 used, respectively.<sup>34</sup> The UAF claim an interception rate of 72% for the December 29th strike and 73% for the January strike.<sup>35</sup> The January strike involved an initial wave of 35 Shahed-136s that were all claimed to have been destroyed,<sup>36</sup> followed by a mass ALCM/ALBM attack of 10 Kinzhal and 70+ Kh-101s. The UAF claims the vast majority of these missiles were targeted at the Ukrainian capital,<sup>37</sup> which has already demonstrated that it has effective, layered air defences. The UAF claims of these 80+ missiles, all 10 Kinzhals were destroyed, along with 60 Kh-101s.<sup>38</sup> Three observations can be made here; firstly, Shaheds appear to have been used in an attempt to exhaust air defence systems before the ALCMs arrived. Secondly, when targeting a well-defended location like Kyiv, Russia is opting for a strategy of mass to overwhelm air defences in an effort to get at least some missiles to their target. Thirdly, Ukrainian air defences are clearly robust enough to counter this threat, as the destruction of the 10 Kinzhal missiles alongside the other threats demonstrates an ability to prioritise targets with the most effective air defence systems while assigning less-capable air defences to target less-capable missiles.

A more interesting development can be seen in the other, smaller strikes that occurred in January. These other strikes have avoided targeting areas with robust air defences, instead opting for targets closer to the front lines outside the bubble of protection offered by strategic air defences. These attacks occurred on January 5th, with 21/29 Shahed-136s destroyed,<sup>39</sup> and January 7th, with 21/28 Shahed-136s destroyed.<sup>40</sup> Both of these attacks demonstrate a lower-than-average interception rate, with the UAF noting these systems targeted largely operational targets which were not protected to

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<sup>34</sup> Повітряні Сили ЗС України / Air Force of the Armed Forces of Ukraine. Telegram. URL: <https://t.me/kpszsuz/9078>.

<sup>35</sup> Ibid.

<sup>36</sup> Повітряні Сили ЗС України / Air Force of the Armed Forces of Ukraine. Telegram. URL: <https://t.me/kpszsuz/9288>.

<sup>37</sup> Повітряні Сили ЗС України / Air Force of the Armed Forces of Ukraine. Telegram. URL: <https://t.me/kpszsuz/9331>.

<sup>38</sup> Ibid.

<sup>39</sup> Повітряні Сили ЗС України / Air Force of the Armed Forces of Ukraine. Telegram. URL: <https://t.me/kpszsuz/9454>.

<sup>40</sup> Повітряні Сили ЗС України / Air Force of the Armed Forces of Ukraine. Telegram. URL: <https://t.me/kpszsuz/9541>.





the same degree as strategic targets like Kyiv and further, that the majority of those shot down were destroyed by 'mobile fire groups' i.e. small air defence teams with limited capabilities compared to the larger and more capable systems that protect major population centres. In this way, this marginally lower interception rate is not unexpected.

More significantly, two larger attacks on January 8th and January 13th demonstrate a change in tactics from Russian forces. The January 8th attack comprised a combination of 8 Shahed-136, 38 Kh-101 and other assorted air-launched missiles and 4 Kinzhal missiles.<sup>41</sup> Of these, all Shaheds were destroyed, 18/38 ALCMs were destroyed, and no Kinzhals were destroyed.<sup>42</sup> These strikes did not target Kyiv but rather targeted facilities within smaller population centres.

*The significantly lower-than-average interception rate of ALCMs shows that these less-populated targets are clearly not protected with the same degree of air defence capability as larger cities, and so demonstrates that while Ukraine does possess highly capable air defence systems, they are limited in number and cannot protect the entirety of the country with sites to be protected selected carefully.*

Further, the lack of interceptions of Kinzhal missiles suggests that only the most capable Ukrainian systems (Patriot) are able to destroy these missiles and areas not protected by Patriot are, therefore, essentially defenceless against these strikes. This pattern continues with the January 13th strikes, where 8/24 ALCMs and 0/6 Kinzhals were destroyed.<sup>43</sup> Interestingly, Ukraine claims that of the missiles not shot down, 20 were prevented from hitting their targets through the use of electronic warfare systems.<sup>44</sup> The truth of this is impossible to determine, but given anecdotal evidence of Shahed-136s that have been brought down in-tact,<sup>45</sup> Ukraine likely possesses some electronic warfare capability able to assist its kinetic air defences in countering Russian strikes.

*In summary of these December and January strikes, Russia appears to have taken a new approach to targeting Ukraine.*

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<sup>41</sup> Повітряні Сили ЗС України / Air Force of the Armed Forces of Ukraine. Telegram. URL: <https://t.me/kpszs/9609>.

<sup>42</sup> Ibid.

<sup>43</sup> Повітряні Сили ЗС України / Air Force of the Armed Forces of Ukraine. Telegram. URL: <https://t.me/kpszs/9766>.

<sup>44</sup> Ibid.

<sup>45</sup> Ukrainian Front (@front\_ukrainian). 2024. "Russian kamikaze drones Shahed 136/131 downed/landed by radio-electronic warfare". January 26, 2024. 11:09 PM. URL: [https://twitter.com/front\\_ukrainian/status/1750989249195675806](https://twitter.com/front_ukrainian/status/1750989249195675806)



The efficacy of Ukrainian air defences in the capital and other major cities has led to a decision that attacks on these cities must involve a mass of missiles in order to overwhelm air defences and achieve some effect on the ground. Secondly, recognising the difficulty of penetrating these air defences, Russia has focussed its attention on smaller, more permissible targets where air defences are less capable of countering missile attacks. This is especially true in the case of the Kinzhal, where Patriot PAC-3 appears to be a completely effective counter and so targeting areas without PAC-3 gives a far higher chance of strike success. All figures used in this section can be accessed on the UAF telegram.<sup>46</sup>

## LOOKING FORWARD

Predicting how Russian strategic fires may evolve in the coming months of the war is difficult, but some things are clear. Firstly, claims beginning at the very start of the conflict that Russia would run out of offensive missile systems have been proven false. Through partners, increases in domestic production and the recommissioning of missiles in storage, Russia has managed to maintain a powerful missile capability. This is highly likely to continue as further international purchases are made from Iran or North Korea, Russian industry continues to expand production capability, and more missiles are brought back out of storage. The recent large-scale attacks have shown that while Russia has not exhausted its missile supply, it is being forced to build up missiles before launching a large attack by conducting smaller-scale attacks in the weeks and months prior. This pattern could be seen in both winter 2022 and 2023. It is also likely that missile strikes will continue to have a minor role in the wider strategic picture of the war because outside of a limited number of successful strikes on Ukrainian infrastructure, the strikes have been ineffective at decreasing Ukrainian military capability or the will of the Ukrainian population to fight. To put this into perspective, Covert Cabal (an open source

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<sup>46</sup> Повітряні Сили ЗС України / Air Force of the Armed Forces of Ukraine. Telegram. URL: <https://t.me/kpszs>.



intelligence researcher) estimated, as a thought experiment, that to have a decisive strategic effect in the war, Russia would have to launch AT MINIMUM 31,201 missiles at Ukrainian targets but likely far higher.<sup>47</sup> Given that Russia has stretched its industrial capacity, recommissioned a majority of its capable, but out of serial production, missiles and has sought international purchases from the only two willing states and has only launched 7,400 missiles so far, 31,201 is entirely unachievable.<sup>48</sup> Overall therefore, while missile strikes will continue at scale across Ukraine, they will achieve limited effects and continue to serve as a harassing tactic whose effects are seen primarily in the media rather than through changes on the frontlines.

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<sup>47</sup> Cabal, Covert. 2024. "How Many Kalibr and Kh0191 Cruise Missiles Would Russia Need to Win in Ukraine?" YouTube. URL: <https://www.youtube.com/watch?v=INVrmEkDYDo>.

<sup>48</sup> Hunder, Max, and Dysa, Yuliia. 2023. "Russia has fired 7,400 missiles, 3,700 Shahed drones in war so far, Kyiv says." Reuters. December 21, 2023. URL: [https://www.reuters.com/world/europe/russia-has-fired-7400-missiles-3700-shahed-drones-war-so-far-kyiv-says-2023-12-21/#:~:text=Europe-,Russia%20has%20fired%207%2C400%20missiles%2C%203%2C700%20Shahed%20drones,war%20so%20far%2C%20Kyiv%20says&text=Dec%2021%20\(Reuters\)%20%2D%20Russia,scale%20of%20Moscow's%20aerial%20assaults](https://www.reuters.com/world/europe/russia-has-fired-7400-missiles-3700-shahed-drones-war-so-far-kyiv-says-2023-12-21/#:~:text=Europe-,Russia%20has%20fired%207%2C400%20missiles%2C%203%2C700%20Shahed%20drones,war%20so%20far%2C%20Kyiv%20says&text=Dec%2021%20(Reuters)%20%2D%20Russia,scale%20of%20Moscow's%20aerial%20assaults).



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