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Strategy. Possible Portrait of the Russian Oreshnik Missile Fired at Ukraine on November 21st, 2024

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What can be said about a missile we know nothing about, except for its name and a poor-quality video showing, in the middle of the night, unknown projectiles falling to the ground at very high speed ?

By reintroducing this type of missile into its strategic arsenal, Russia has opened a door through which other nuclear-weapon States, led by the United States, but also France and Great Britain, might be tempted to enter (SS-20 vs Pershing contest !), risking, while major international strategic agreements are in disarray, reigniting the arms race, particularly on the European theater, more than thirty years after the end of the Cold War.

Original version in French

Political launch, but an operational missile

ON NOVEMBER 21st, 2024, two days after publicly releasing the latest version of its nuclear doctrine (November 19th, 2024), the Russian army fired an unknown missile at the Ukrainian industrial complex of PivdenMash/YuzhMash (formerly Plant 586), near the city of Dnipro. The Kremlin's propaganda named this missile "Oreshnik" and presented it as a medium-range ballistic missile (MRBM) or intermediate-range ballistic missile (IRBM), meaning it does not exceed the 5500 km range [1] set by the 1987 Intermediate-Range Nuclear Forces Treaty (INF). It is worth noting that this plant, under the USSR, and until the mid-2010s, built intercontinental missiles (SS-24, SS-N-20, SS-19, SS-18, etc.) and Russian space launchers (Rokot, Zenit...), before participating in various international programs (United States, Saudi Arabia... and even North Korea).

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On November 21st, 2024, the Oreshnik was not alone in striking Dnipro. According to the Ukrainian Ministry of Defense, it was accompanied by at least one Kinzhal and seven Kh-101 (air-to-surface missiles), likely indicating that the plant is still operational and continues to produce for the Ukrainian army. The ground damage is not known at the time of writing these lines, so it is too early to say whether the Oreshnik's payload (presumably six reentry vehicles, each carrying six submunitions) was in operational configuration [2] or if this launch (in the case of inert/demilitarized reentry vehicles) was merely a political warning to NATO allies in a tense international context : new Russian nuclear doctrine, Russia's withdrawal from the CTBT, the upcoming arrival of D. Trump **[3]** at the White House, Joe Biden's authorization for Ukraine to fire its ATACMS missiles at Russian territory, and the political-economic crisis in France, Great Britain, and Germany, country where Olaf Scholz could, in the coming weeks, be replaced by a chancellor favorable to the delivery of Taurus cruise missiles to Kyiv.

Whatever the answer to these questions may be. it remains that the operational capabilities of this unknown missile will have been demonstrated.

The Kremlin has, in fact, unusually not leaked any images, videos, montages, or technical data on this "new missile." As for the Russian articles dedicated to it, they largely - likely a sign of heavy censorship - regurgitate data from Western press and relay Kremlin's propaganda ("hypersonic and indestructible missile, heat of the sun, plasma bubble, meteorite effect, Mach 10, Mach 20", etc.), propaganda mainly aimed at Western public opinion (negative effect) and Russian public opinion (positive effect). Therefore, due to the lack of precise data or technical references on the system, the following remarks and reflections will be written conditionally.

What can be said about a missile we know nothing about, except its name and a poor-quality video showing, in the middle of the night, unknown projectiles falling to the ground at very high speed ?

Let's start by examining Russian propaganda : the Oreshnik is said to be a medium- or intermediate-range ballistic missile, dual-capable, meaning it would carry either a nuclear military payload (like the Pioneer/SS-20 during the Euromissile crisis) or a conventional one, depending on the mission. The strike on Dnipro confirms this hypothesis. Images of the debris, recently released by the Ukrainian army, show what could be, among others debris, the debris of the propulsion section of the submunition carrying canister, which would have fallen in the same place as the submunitions. Thus, the question arises whether there is a recent MRBM/IRBM development program in Russia ? Officially, the answer to this question is negative - albeit ambiguous as we shall see - but the Russian withdrawal from the INF Treaty (2019) and geopolitical tensions related to the Ukrainian conflict make it possible. The question remains as to which program the Oreshnik might be related to.

What program behind the Oreshnik ?

Let's immediately dismiss the idea of a fundamentally new missile, which does not make sense from a technological and economic standpoint, and instead, study other more credible possibilities. The first that comes to mind is the RS-26 Rubezh, primarily because this missile, derived from the RS-24 Yars, was specifically developed and tested in its MRBM/IRBM version (without a military payload) from the very beginning of its program in 2008, while being declared under New Start as an ICBM.

Table 1 - Evolution of Russian strategic missiles in service
Gloaguen/Diploweb.com

In 2018, the program was officially postponed until 2027 – probably to prioritize the development of the enormous RS-28 Sarmat (10 to 15 warheads) – but the system seemed mature as the commander of the RVSN (Strategic Missile Troops) had declared it operational in March 2015 before announcing its (possible) deployment at the Irkutsk base. Far, therefore, from the European theater, facing China, and in violation of the INF Treaty provisions ! The RS-26 was thus initially developed with the bus of the RS-24 Yars (4 MIRVs) to counter the threat of Chinese IRBMs like the DF-21/26, a threat that may have led Russia to leave the INF Treaty, even though the US ABM/CPS program remains the official reason. After Russia's withdrawal from the INF Treaty in 2019, the RS-26 was brought out of oblivion or dusted off under the name *Oreshnik*, but this time with a specific military payload, adapted for conventional strikes from the upper atmosphere (see below), and directed towards the European theater.

According to the Ukraine's military intelligence service (GUR), Oreshnik (hazelnut) is the name of the experimental project, with the system itself being named Kedr (cedar) **[4]**. Oreshnik/Kedr, still according to the GUR, was tested (probably in its final MRBM/IRBM version with its specific military payload) at the Mayak experimental center of the 4th State Central Test Range of Kapustin Yar in October 2023 and June 2024. To my knowledge, if a missile test failure did occur in October 2023, it concerned, based on cross-referenced sources, an RS-28 Sarmat. As for the June 2023 test, no specialized documentation mentions it, unless I am mistaken. This does not mean it did not happen, possibly hidden amid the numerous space launches and other ICBM tests/launches.

Several other weapon systems have been suggested as possibly being behind the Oreshnik. Let's set aside the recent New York Times article [5] that seems to confuse the Rubezh-ME coastal missile system (four anti-ship missiles with a range of 260 km mounted on a light truck) with its namesake, the IRBM RS-26 Rubezh, and go directly to the Short-Range Ballistic Missile (SRBM) Iskander, cited by several sources, notably Russian expert Dmitri Kornev [6], editor-in-chief of MilitaryRussia.ru. He believes that the Oreshnik is an evolution of one of the missiles of the Iskander system, specifically equipped with a new generation solid-fuel engine. More than the classic M version, whose missile has a range of less than 500 km, Kornev is likely thinking of the Iskander-K version capable of firing the famous 9M729/SSC-8 cruise missile (land version of the Kalibr-NK naval missile with a range of 2000 km), whose deployment led the United States to withdraw from the INF Treaty in 2019.

It remains to be seen, naturally, if this 9M729, with a length of 6-8 meters, a diameter of 53 cm, and a launch weight probably less than 2.3 tons (compared to 36 tons for the RS-26), is capable, without significant and costly modifications, of carrying the military payload (6

reentry vehicles with 6 submunitions each) that fell on Dnipro, or even several nuclear warheads ? The flight configuration of the 9M729, which is the one of a classic subsonic cruise missile, does not make it, far from it, the "missile invulnerable " to the enemy air defense as touted by Russian propaganda since November 21st, 2024. The modified Iskander-K is therefore (barring any surprises) not the Oreshnik.

Another candidate, cited by several sources, notably French ones : the Topol-E or ME. Here, the snake bites its tail. Mentioning the Topol-E or ME, an old SS-25 specially modified to test, according to the Russian General Staff, the "new warheads of the future ICBM" (the RS-28 Sarmat ?), actually revisits the RS-26 Rubezh hypothesis, as this missile itself is a (distant) modernization/evolution of the SS-25. Launches of this Topol-E, which have been occurring sporadically since May 2014 between Kapustin Yar and Sary-Shagan, further reinforce the hypothesis that this missile is indeed used to test new warheads and not new-generation stages/engines. Sary-Shagan is indeed equipped with specific trajectory measurement systems dedicated to this mission. Therefore, the Topol-E can also be set aside.

Another hypothesis worth considering, even if it is fragile or risky, is the one of a missile of a foreign origin, Iranian, Chinese, or even North Korean. It is known, for example, that Iran has been developing maneuverable reentry vehicles with submunitions [7] for its Shahab-3/Ghadr systems (variant of the Chinese DF-21) and Shahab-6 (variant of the North Korean Taepodong 2) for several years. Chinese and North Koreans, other privileged allies of Russia, who already supply missiles and drones to Russia, of course have identical or even more advanced weapon systems *[8]*.

Possible Broad-Strokes Portrait of the Unknown Missile

At the end of this brief overview of the potential candidates for the title of "Oreshnik/Kedr Missile of the Year," and at the risk of being contradicted – only reality tells the truth [9] – when precise technical data is published, let’s attempt, based on the few scattered elements at our disposal, to draw, through cross-references and successive refinements, a portrait as close as possible to what this missile might look like :

1. The video footage of the November 21st, 2024 launch shows the very high-speed arrival to the ground of six unidentified objects at a slightly inclined angle, which seem to release smaller objects in turn. Their impact on the target does not appear to cause explosions or fires. Several analysts mention six munitions/reentry vehicles (RV), each equipped with six submunitions. The debris on the ground is from a single missile and not from multiple ones (as in the case of a grouped strike). The device is therefore evidently MIRVed/equipped with multiple RVs (military payload) of an unknown type.

A few hours after the impact, the Pentagon mentioned the launch of an RS-26 Rubezh missile.

2. The Pentagon stated that it was informed by the Russian General Staff thirty minutes before the launch (from the Kapustin Yar test range), as stipulated by the 1988 US-Soviet agreement (see below).

In a rare move since the start of the conflict in Ukraine, writes the New York Times, this notification was preceded by a call from the Russian Chief of the General Staff, General

Gerasimov, to his American counterpart, General Brown.

3. According to propaganda, the Russian president has ordered the mass production of the system, indicating that it might be mature. The fact that the missile on November 21st, 2024, was launched from the Kapustin Yar test range (from a silo ? on a ramp ?) and not from an operational RVSN regiment, and that further tests have been ordered by the Russian General Staff, however, does not suggest a fully operational system (conventional military payload still in the testing phase ?).

4. The reentry vehicles (RVs) are not nuclear, nor do they contain explosives (still to be confirmed). Therefore, they are either inert (falling to the ground by gravity), which would be a purely political demonstration, or "militarized" using metal rods or hardened, penetrating submunitions (see note 2), in which case this launch would have military value while also serving as a warning to Western allies, given the missile's dual capability. The ground effect of these RVs would depend on their angle of impact, speed (kinetic energy : 3 to 3.5 km/s, or Mach 9 to Mach 11), and their nature [10]. In the absence of data on the damage inflicted, if any, on the Dnipro site, we refrain from choosing a definitive interpretation, but a version equipped with a conventional payload would resemble the technical-operational characteristics of the Chinese DF-21/DF-26 IRBM, which can carry either nuclear warheads or a conventional high-explosive (HE) payload or submunitions depending on the mission.

These Chinese missiles are primarily intended to counter American aircraft carrier groups. In Europe, the Oreshnik could target ABM sites, headquarters, command and control (C2) centers, ports, underground sites, aircraft carriers and strategic nuclear missile submarines (SSBNs) docked or in overhaul, etc., which are high-value targets protected by substantial anti-aircraft defenses, making the use of aircraft or conventional air-to-surface or surface-to-surface missiles uncertain and justifying the use of an IRBM worth tens of millions of euros.

From this perspective, the Oreshnik could also be Russia's solution to the vulnerabilities observed in Ukraine of its conventional weapon systems (missiles, including hypersonic ones, and aviation) against Western modern anti-aircraft and anti-missile defenses, enemy jamming, and deficiencies in its C4ISR architecture. By developing the Oreshnik, Russia would be doing what China did in the 1980s to address American military superiority by developing the DF-21.

5. The statements by V. Putin on November 29th, 2024, at the Alma-Ata summit, suggesting that the missile could penetrate fortified/underground/hardened structures to a depth equivalent to "3 or 4 floors," strongly indicate a non-nuclear use of the Oreshnik. Given the wide range of nuclear, tactical, and strategic options in the Russian military arsenal, the Oreshnik should therefore be primarily assigned to conventional missions, while also serving, in case of conflict, and due to its dual nature, as a political marker (i.e., a threshold marker between conventional and nuclear). Consequently, this missile would be primarily deployed on the European theater, as the SS-20 was in the past.

6. The distance of 800 km separating Kapustin Yar (launch site of the Oreshnik on November 21st, 2024) from the Dnipro plant confirms the hypothesis of a "short-legged Oreshnik," with, let's say, two stages, meaning an MRBM/IRBM type missile, likely on a TEL and with solid fuel. In a March 2021 dispatch, the Russia's state-run TASS news agency mentioned an "intermediate-range Oreshnik," under development "for several years" [11].

Officially, the RS-26 Rubezh was only tested in 2011 and 2012 at a minimum range of 2000 km. This is not the missile's minimum capable range but simply the distance between the two test ranges of Kapustin Yar (launch) and Sary-Shagan (receptacle). The short distance between Kapustin Yar (the launch site on November 21st) and Dnipro (the target site) does not therefore disqualify the hypothesis of a modified Oreshnik/RS-26 Rubezh. In the past, for example, the SS-20 was supposed to have had a minimum firing range of 600 km.

The launch on November 21st, 2024, could also have been executed in the "North Korean-style," by giving the vector a maximum altitude to make it fall "short." However, this goes beyond my area of expertise for becoming the aerospace engineers' domain. Let's not venture there.

7. The nature of the payload and the number of RVs carried naturally raise questions. More than the nature of the missile itself, this is, in my opinion, the most important question. If we consider the hypothesis of an Oreshnik developed primarily for conventional missions, its military payload (bus/reentry vehicles/submunitions) would logically have been adapted and designed for these missions. It therefore differs from that of the RS-24 and RS-26 designed to carry a bus with 4 (large) nuclear warheads (plus decoys).

The RVs containing these submunitions are probably smaller [12], lighter (i.e., less protected – ablative coating –against heating due to air/speed = shorter flight through the atmosphere ?) than those of a MIRVed missile and extremely precise. This is confirmed by the clustered impact of the six RVs and their submunitions observed in Dnipro. The Oreshnik's CEP (Circular Error Probable) does not align with that of a nuclear missile [13].

According to the above mentioned Russian expert Dmitri Kornev [14], Russia indeed possesses such hardened munitions capable of penetrating deep into the ground from space. These are munitions developed in the 1980s for one of the versions of the tactical missile OTR-23 Oka/SS-23, dismantled under the INF Treaty. This version, known as 9M714K, did indeed carry a 700 kg conventional submunition warhead, containing nearly a hundred submunitions, each weighing 3.80 kg. The air-to-surface Kinzhal missile, according to the researcher, also has a penetrating warhead.

8. Question : could the Oreshnik military payload have benefited from researches done on the warheads of the Kinzhal, or even the naval 3M22 Zircon missile (why not ? given these missiles are supposed to be hypersonic), or are they mere copies of the Oka munitions ? The ongoing analysis of the debris from the November 21st, 2024 launch should provide an answer.

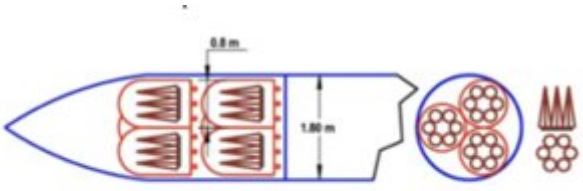

Table 2 - Configuration Possible configuration of the arrangement of the 36 submunitions canister in the Oreshnik warhead (Source: Moscow Institute of Thermal Technology (MIT), Bulletin of the Moscow Aviation Institute (2020, vol. 27, no. 2), and Professor Ted Postol (video).

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9. In its nuclear version, the Oreshnik/Kedr missile could also, according to some analysts, carry the hypersonic and highly maneuverable Avangard/Anchar-RV [15] warhead intended, when operational, for the new heavy ICBM RS-28 Sarmat [16], whose development has faced setbacks (the latest test in mid-September 2024 resulted in the missile's explosion and the destruction of the silo at Plesetsk).
The deployment of the Avangard would only confirm the hypothesis that the Oreshnik is similar in size and weight to the RS-24 and RS-26, and not to a smaller missile like the Iskander.

10. If the hypothesis of an MRBM/IRBM-type missile seems to prevail, the Oreshnik could be, as far as its engines and stages are concerned, a hybrid resulting from the combination of several existing technologies and weapon systems. The hypothesis of a missile developed ex-nihilo doesn't make sense, as we have seen above. This wouldn't be a new occurrence.
The Oreshnik could thus find its lineage and concept not only in the RS-26 Rubezh but also in the old Soviet systems RT-21 Temp 2S/SS-16, Pioneer/SS-20, and 15P666/Skorost (abandoned project), all three of which, like the RS-26 and the naval Bulava, were developed (coincidentally ?) by the MIT, the Moscow Institute of Thermal Technology.
The SS-20 and Skorost were themselves hybrids [17] : the Skorost consisted of the 2nd and 3rd stages of the SS-25 Topol (2 stages) with a bus (3 warheads) of the SS-20 mod2 ; the SS-20/Pioneer used the 1st and 2nd stages of the SS-16. As for the Yars RS-24, it is merely a MIRV version of the RS-12M1/SS-27 Mod1 Topol-M on TEL, while the RS-26 uses the 1st and 2nd stages of the RS-24 Yars. Viktor Baranets, a military expert for the newspaper Komsomolskaya Pravda, sees a direct link between the Oreshnik and the SS-20/Pioneer.
Similarly, the Oreshnik/Kedr [18] could share some lineage with the SLBM R-30 Bulava [19], whose bus houses at least six MIRVs (and decoys) (see table 1 above and table 3 below).

	IRBM SS-20 Pioner	ICBM RS-26 Rubezh	SLBM R-30 Bulava
Launch weight	37t. à 41t.	36t.	36,8 t.
Length	16,5m	12m	12m
Stages	2	3 (ICBM) 2 (IRBM)	3
Propellant	Solid	Solid	Solid
Payload	3 MIRV (mod2) de 150 kt	4 MIRV De 150/300 Kt	6 à 10 MIRV de 100 à 150 Kt.
Range	+/- 5000km	2000 à 5800km	>8.000 km
Designer	MIT	MIT	MIT
Manufacturer	Votkinsk plant	Votkinsk plant	Votkinsk plant
Basing	TEL	TEL	SSBN

Table 3 : similarities Pioner-Rubezh and Bulava

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Gloaguen/Diploweb.com

11. Potentially carrying nuclear warheads, the Oreshnik is subject to the logic of deterrence. It is noteworthy in this regard that a second launch, announced as imminent by V. Putin during the Alma-Ata summit at the end of November 2024, has still not taken place. This can likely be attributed to the deployment in Finland, on the same date, of two B-52H bombers of the US Air Force and, possibly, other « demonstrations » of allied nuclear assets (such as the French Strategic Air Forces (FAS), for example) that have not been publicly disclosed.

12. Due to their dual nature, Oreshnik launches are subject to a HCoC notification, to the notification required by the 1988 US-Soviet treaty (SLBM and ICBM launches) [20], and, as a safety measure, they are preceded by the issuance of a NOTAM, sometimes several days before

the launch.
This constraint, therefore, does not make the Oreshnik a tactical weapon, usable "at will" like the SS-26 Iskander, Kh-101, and other Kinzhal are for instance on the Ukrainian theater on a daily basis, even though these missiles also carry tactical nuclear warhead but have lesser range, are slower, fly lower, and cannot be MIRVed.

13. Finally, the Oreshnik is likely subordinated to the RVSN (strategic mission, therefore, not tactical) and not to the Army like the Iskander.

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By reintroducing this type of missile into its strategic arsenal, Russia has opened a door through which other nuclear-weapon States, led by the United States, but also France and Great Britain, might be tempted to enter (SS-20 vs Pershing contest !), risking, while major international strategic agreements are in disarray, reigniting the arms race, particularly on the European theater, more than thirty years after the end of the Cold War.

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P.-S.

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Notes

[1] The academician of IMEMO (Institute of World Economy and International Relations in Moscow), Ilya Kramnik, attributes the Oreshnik a maximum range of approximately 5000 km. (« Что известно об « Орешнике », которым ВС РФ ударили по Украине », Profil').

[2] For example, loaded with a special explosive or simply with metal rods. As a reminder, in the early 2000s, the USA tested the use of denuclearized ICBMs (Conventional Prompt Strike program) whose single charge consisted of tungsten or inert bars, aimed at penetrating deeply buried targets (Iranian nuclear infrastructure ?). This project was abandoned due to the inherent ambiguity of an ICBM launch, whether in its nuclear or conventional version.

[3] President who, as we remember, withdrew the United States from the INF Treaty in 2019.

[4] Interview with General Budanov, head of the Ukrainian military intelligence :https://united24media.com/latest-news/oreshnik-or-kedr-ukrainian-intel-chief-e

xplains-confusion-over-the-name-of-russias-new-ballistic-missile-3934

[5] « What Is Russia's Oreshnik Ballistic Missile ? » - The New York Times.

[6] See :
https://sevastopol.su/news/chto-izvestno-ob-oreshnike-kotoroy-vs-rf-udarili-po-ukraine

[7] « *Le HCoC face à la dissémination des missiles balistiques conventionnels* » (in French), January 2020, Stéphane Delory.

[8] Is it a coincidence that some Russian experts emphasize what their country has learned from China in the field of short- and medium-range missiles ? (Example among others :
« Чему России стоит поучиться у Китая в сфере ракет средней и меньшей дальности »)

[9] Except maybe in politics !

[10] For a technical analysis of the effect of such a missile, see Theodore Postol, professor at the Massachusetts Institute of Technology :
https://www.youtube.com/watch?v=kKS7OYZoVdE

[11] TASS dispatch, March 1, 2021.

[12] The American expert T. Postol (see note above) estimates the weight of each munition to be "100 to 150 pounds" (50 to 70 kg).

[13] According to open sources, the CEP (Circular Error Probable) of the RS-26 Rubezh warheads is estimated to be between 90 and 250 meters.

[14] « The kernels of the "Hazel Tree », December 2nd, 2024.

[15] Hypersonic drone Anchar-RV : this 1.3-billion-ruble program was launched in August 2018 during the Moscow Armiya forum, and an agreement was signed between the MINDEF and the Moscow Institute of Thermal Technology (MIT).

[16] The Avangard is already deployed on some SS-19/UR-100NUTTH Mod4 of the 13th RVSN division of Yasnyy/Dombarovskiy.

[17] Svetlana Shcherbak (« What Missile Hides Under the Name Kedr, and Could It Be Both Oreshnik and Rubezh ? »)

[18] The missile names could also indicate a link between them : the Oreshnik/Kedr (hazel/cedar) would thus be linked to the Topol (poplar), with Yars being just the acronym for "nuclear deterrence missile" (ядерная ракета сдерживания), Rubezh means "border" and Bulava means "mace." Some also see a connection with the supersonic drone Anchar (Antiaris toxicaria, a type of flowering plant native to Asia), which is also being developed at the MIT.

[19] It should be noted that besides having the same manufacturer/designer (Votkinsk and MIT), some of the technologies of the Topol-M, and thus by extension the RS-24 and RS-26, were used in the design of the R-30 Bulava.

[20] May 1988 Ballistic Missile Launch Notification Agreement. The text concerns ICBMs (including in the form of space launchers) and SLBMs. The notification states the date of the launch, the launch area, and the impact/return area, along with more technical data (telemetry, etc.). Article 16 of the SALT II treaty (never ratified) also required the parties to notify any ICBM test "going beyond national territory."