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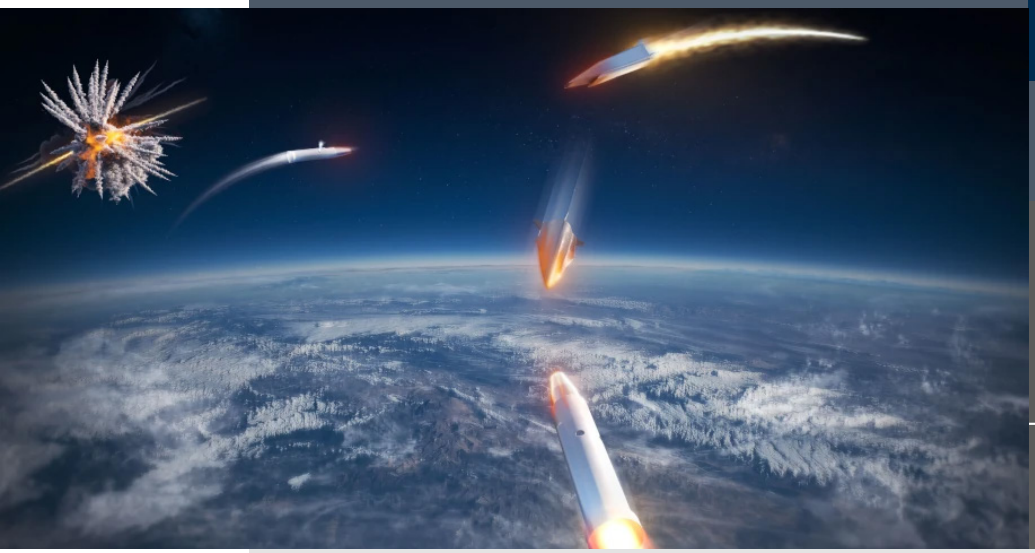


Confronting Russia's High-Velocity Arsenal: European Challenges and Solutions

Fabian HOFFMANN

Key Takeaways

- A hypersonic missile is not defined only by a terminal speed over Mach 5, or 6 000km/h, but also by its ability to keep significant maneuvering capability until impact, making it a lot harder to intercept than other more predictable missiles.
- Therefore, intercepting hypersonic missiles is a challenging task, requiring more sophisticated and costly sensors and interceptors, significantly rising the cost of an efficient defense system.
- While Russia keeps accelerating its production of hypersonic missiles, protecting the whole European territory from this threat may prove extremely costly, thus advocating for common development and financing at a European level.
- A credible European counter-strike capability could also play a major role in deterring Russia from striking or targeting launching systems, a capability that should be linked with a common and coherent doctrine.

Introduction

Since February 2022, Russian missile and long-range drone strikes against Ukraine have served as near-daily reminders of what European states could face in a war with Russia. The same weapon systems battering Ukrainian infrastructure and population centers would be directed against European military and civilian targets in any confrontation between Russia and NATO. Between February 2022 and March 2026, Russia is estimated to have launched over 83,000 long-range drones, over 4,600 cruise missiles, and close to 1,000 short- and medium-range ballistic missiles against Ukraine.[1] As Russian missile production expands and its arsenal diversifies, Europe must confront an uncomfortable question: how to deter and, if push comes to shove, fight Russia's long-range strike arsenal?

Russia's long-range strike arsenal includes different types of missile systems, ranging from long-range one-way attack drones like the Geran series to cruise missiles like the Kh-101 and *Kalibr*, to ballistic missiles like the Kh-47 *Kinzhal* or the 9M723 used on the *Iskander* system. While each missile type presents its own challenges, this memo focuses specifically on Russia's high-velocity missile arsenal, that is, its ballistic and hypersonic missiles. In many ways, these systems have proved most difficult for Ukraine to deal with, and European states could be expected to face similar challenges.[2]

Ballistic missiles are rocket-boosted systems whose flight, after the boost phase, is determined primarily by ballistic physics: they arc toward their targets along largely predictable trajectories, even if greater maneuverability has become an increasingly important feature of modern ballistic missiles. Several types of ballistic missiles reach hypersonic velocity (at or above Mach 5) during descent, especially those that leave and subsequently re-enter the atmosphere. The German V-2, the world's first operational ballistic missile, reached hypersonic velocity in 1944, as have a large number of ballistic missiles developed since.[3] A hypersonic missile is therefore not defined by hypersonic speed alone, but by its ability to combine sustained hypersonic speed with significant maneuverability during the midcourse and terminal phase of flight. In this regard, maneuverability *governs* the missile's trajectory rather than merely modulating it. Three missile system types meet this standard: hypersonic boost-glide vehicles (HGVs), hypersonic cruise missiles, and some types of longer-range aeroballistic missiles. Unlike ballistic missiles on a traditional parabolic trajectory driven by gravity, aeroballistic missiles follow a depressed flight path that keeps them within the atmosphere for most or

1. "The Russia-Ukraine War Report Card", Harvard Kennedy School, Belfer Center for International Affairs, March 11, 2026, available at: russiamatters.org.
2. F. R. Hoffmann, "Ukraine's Missile Defense Crisis: Causes, Consequences, and Solutions", Substack newsletter Missile Matters — with Fabian Hoffmann, August 8, 2026.
3. M. J. Neufeld, *The Rocket and the Reich: Peenemunde and the Coming of the Ballistic Missile Era*, Washington: Smithsonian Books, 2013.

all of their flight. Sustained atmospheric flight provides aerodynamic control authority during the midcourse and terminal stages, enabling better course correction ability throughout flight and evasive maneuvers in the endgame.

This memo considers what European states' response to the high-velocity missile threat can and should look like, particularly as it emerges from Russia. China fields a comparable and in parts more advanced high-velocity missile arsenal. However, because the Russian threat remains the most immediate for European defense planning, this memo focuses on missile systems on the European continent. The argument centers on two points. First, missile defense remains indispensable, and efforts to deploy a sovereign and cost-efficient ballistic and hypersonic missile defense capability should remain a top European priority. Second, interceptor scarcity, cost asymmetries, and difficulties with establishing comprehensive territorial coverage mean that a posture built on defense alone will fail against an adversary able to generate mass in the high-velocity missile domain. Europe therefore requires a complementary conventional counterstrike capability that credibly threatens calibrated retaliation.

Russia's high-velocity missile expansion

Since February 2022, Russia has substantially expanded its missile arsenal across the board. This also applies to its high-velocity missiles, which it manufactures and launches against Ukraine at unprecedented and ever-increasing rates. Before the war, production of the 9M723 short-range ballistic missile stood at an estimated 72 missiles annually, complemented by a small number of Kh-47M2 *Kinzhal* aeroballistic missiles.[4] By mid-2026, Russia may have scaled combined production to as much as 700 to 800 units per year—if not more—, alongside thousands of cruise missiles and tens of thousands of long-range drones, while also fielding new and more exotic missile systems, notably the *Oreshnik* intermediate-range ballistic missile.[5] Despite Ukraine's efforts to undermine Russian missile production by targeting component manufacturing, Russian missile production capacity has continued to grow.

Russia's missile arsenal comes with a distinct hypersonic layer. Russia fields one unambiguously hypersonic missile, the *Avangard* HGV. That system, however, presently fulfills only a strategic nuclear function and is apparently not considered a tool for conventional warfighting.[6] The *Kinzhal* reaches hypersonic speeds during parts of its flight while retaining significant maneuverability. The same appears to apply to the 3M22 *Zircon*, which, according to more recent analysis—and confirmed by Ukrainian intelligence—, constitutes another type of high-velocity aeroballistic missile rather than a

4. K. Post, "Exclusive: Russia's Ballistic Missile Production up at Least 66% over Past Year, According to Ukrainian Intel Figures", *The Kyiv Independent*, June 3, 2025.
5. F. Hoffmann, "How Many Ballistic Missiles Is Russia Producing?", Substack newsletter Missile Matters — with Fabian Hoffmann, May 31, 2026, available at: substack.com.
6. H. M. Kristensen *et al.*, "Russian Nuclear Weapons, 2025", *Bulletin of the Atomic Scientists*, May 13, 2025.

hypersonic cruise missile as initially claimed.[7] The *Oreshnik*, often called a hypersonic missile in public commentary, is likewise a high-velocity missile, though it lacks the maneuverability to qualify as a proper hypersonic system under the definition above.

Even if this arsenal has not always lived up to the technical hype and prominence implied by much of the pre-war Western literature, it constitutes a serious threat. In particular for Russia's aeroballistic missiles, intercept rate statistics from Ukraine indicate that they are among the most difficult missiles to defend against.[8] In addition, even though Russia does not currently deploy a conventional HGV, the existence of the *Avangard*, fielded continuously since at least 2020, indicates that Russia has access to advanced HGV technology that could theoretically be repurposed for conventional missions. Deployment of a conventionally armed HGV therefore cannot be excluded, especially in a scenario where the Russo-Ukrainian War has ended and capacity for new weapons development has been freed up. Similarly, even if the *Oreshnik* at present constitutes a rather crude capability lacking the sophistication to pose a formidable threat, its potential as a dual-capable system means it must be factored into European and NATO defense planning.[9]

Taken together, Russia's high-velocity missile arsenal is large, growing, and difficult to intercept. Russia is increasingly diversifying these systems across platforms, domains, and missions: the *Zircon* is fielded from the *Bastion* coastal defense system, surface ships, and submarines, while the 9M723 is launched from ground-based *Iskander* platforms, and the Kh-47M2 *Kinzhal* is employed from aircraft. This cross-platform design enhances survivability and versatility, allowing the different high-velocity missile systems to be launched from whichever platform is best positioned or least exposed. Russia has further demonstrated both the ability and the intent to employ these systems as part of salvos incorporating dozens of high-velocity missiles alongside hundreds of other projectiles, notably long-range drones and cruise missiles, rather than as standalone strike weapons. Russia is also continuously diversifying the arsenal, both in the projectiles used and in the ground-, surface-, and air-based platforms from which these capabilities are employed. Left unanswered, it hands Moscow an instrument of coercion in peacetime and confronts Europe, in war, with the same challenges Ukraine faces daily.

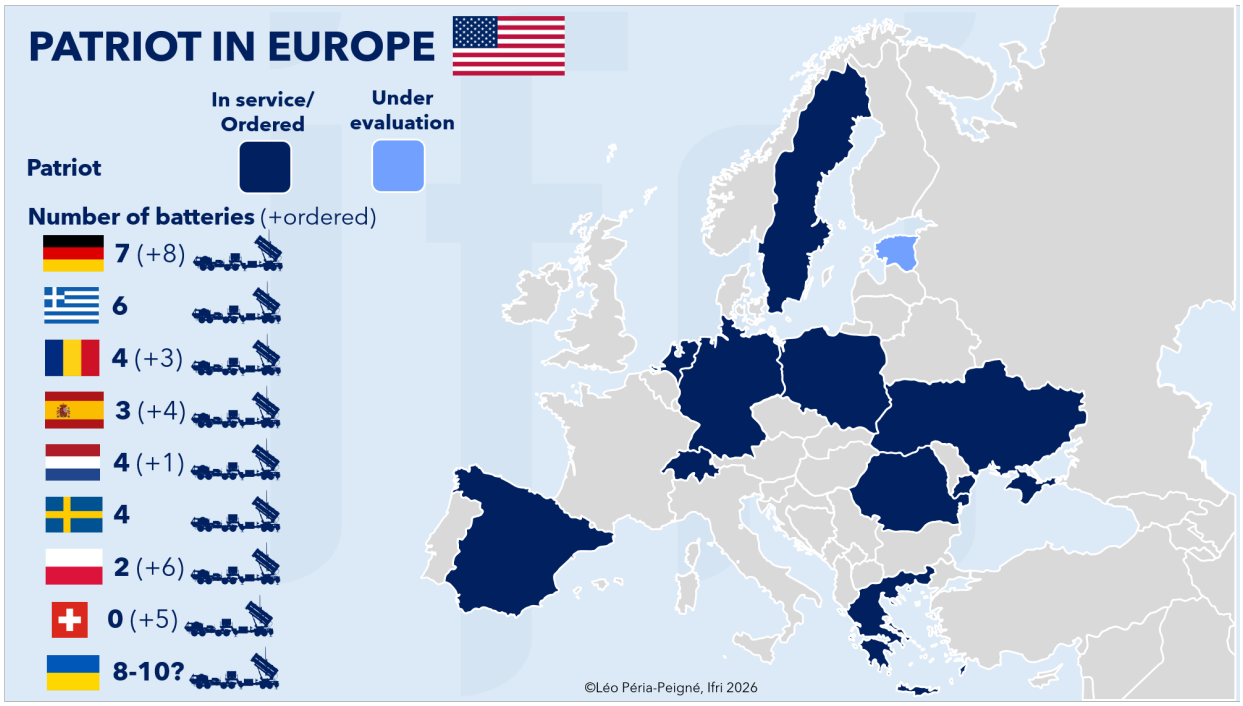
The case for, and limits of, missile defense

Defending against Russia's high-velocity missile arsenal is not optional. Interception remains the only way to deny an adversary the physical effects of a missile strike once

7. F. Hinz, "Not Quite a Diamond", Substack newsletter, LUFTLAGE, June 17, 2026, available at: substack.com; J. Rushton, "Ukraine's Military Intelligence Reveals Capabilities of Russian Zircon Missiles", *The Kyiv Independent*, August 31, 2026.
8. F. Hoffmann, "What Happened to Ukraine's Ballistic Missile Defense? Explaining the Reported Drop in Patriot's Effectiveness," Substack newsletter Missile Matters — with Fabian Hoffmann, October 7, 2025, available at: substack.com.
9. F. Hoffmann, "The Oreshnik Problem for Europe," Substack newsletter Missile Matters — with Fabian Hoffmann, January 11, 2026, available at: substack.com.

launch has occurred. When defending high-value sites, effective point defense can meaningfully raise the cost of attack and limit damage even against a determined adversary. Defense also underwrites Europe's own strike capabilities. Offensive deep-strike capabilities without a corresponding defense would open a vulnerability of Europe's own, as adversaries fielding similar systems could potentially hold European strike assets and enabling infrastructure at risk, potentially disproportionately so. Whatever offensive capabilities Europe acquires will thus need to be complemented by defensive systems. For Europe, developing and deploying a credible and sovereign ballistic and hypersonic missile defense capability should therefore remain a top procurement priority.

Map 1-I – *Patriot* in Europe



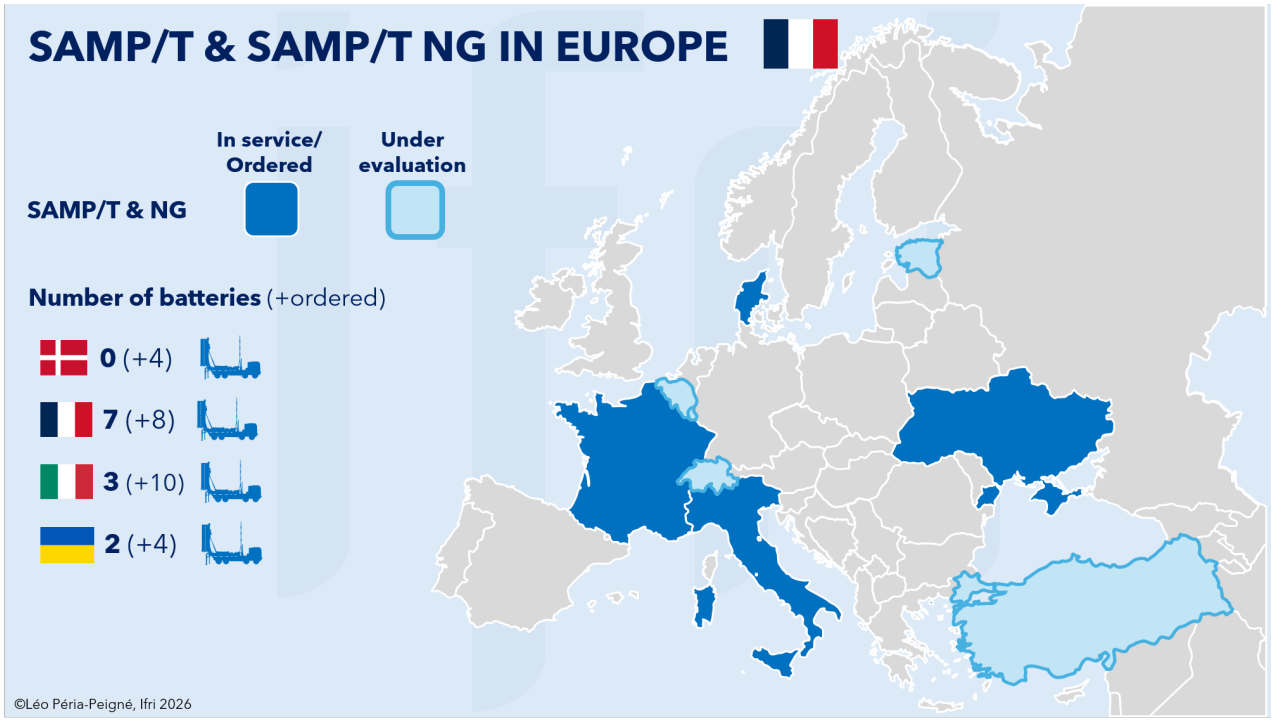
Sources: Military Balance, Interviews.

At the same time, three features of ballistic and hypersonic missile defense mean that interception cannot constitute Europe's primary answer to the Russian threat. The first is interceptor scarcity relative to attacker mass. Modern ballistic and hypersonic missile defense typically requires more than one interceptor per incoming missile to achieve a high probability of successful engagement, as confirmed by Ukraine's experience with the *Patriot* and *SAMP/T*.[10] Against Russia's currently estimated production of 700 to 800 short- and medium-range ballistic missiles annually, sustaining even a moderate intercept rate would require an extraordinary interceptor inventory, replenished continuously and available in sufficient depth across every point of the continent Russia might plausibly target. Even if we assume not every ballistic missile is intended for European targets, or that every projectile would have to be engaged, this still leaves a very

10. T. Newdick, "Ukraine Tests New Missile in Hopes of Leading to Low Cost Patriot Alternative", *The War Zone*, June 4, 2026.

significant number of ballistic missiles to deal with annually. No European state, and arguably no combination of European states, is currently positioned to build and sustain an inventory of this size within a relevant timeframe.

Map 2-I – *SAMP/T and SAMP/T NG* in Europe



Sources: Military Balance, Interviews.

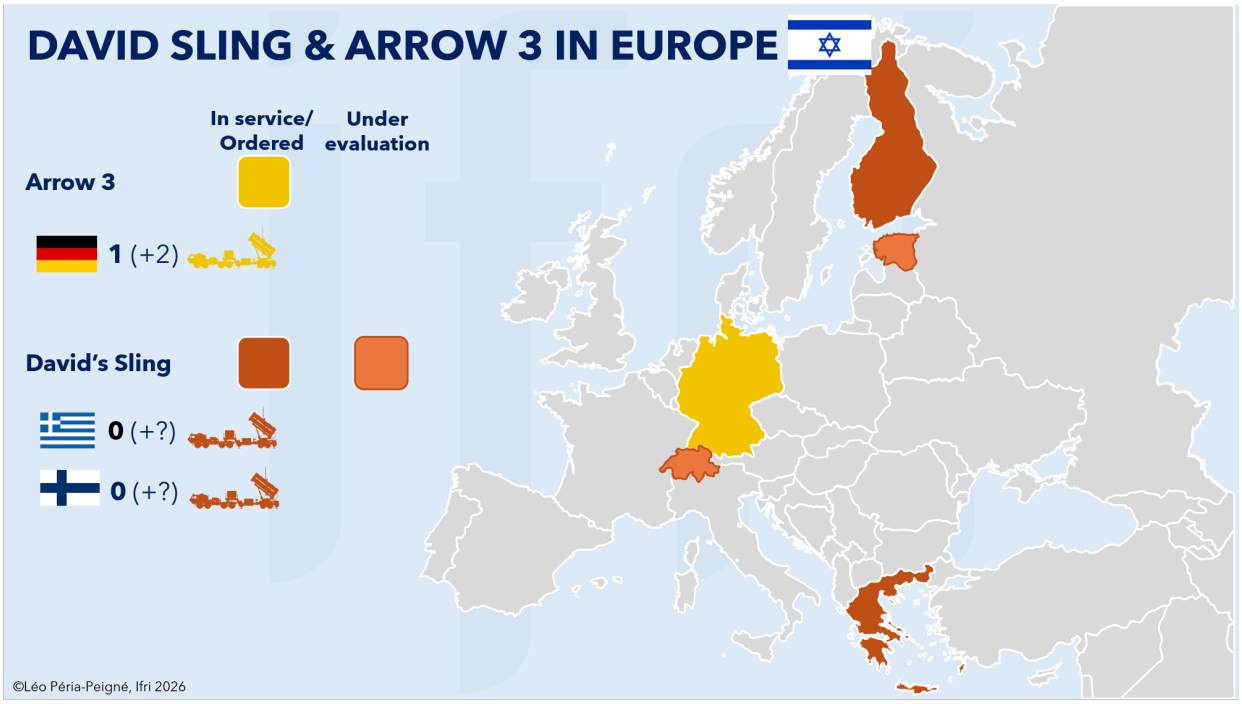
The second is cost asymmetry. A single PAC-3 MSE interceptor costs around 7 million USD on the export market, several times what Russia pays for most of its high-velocity missiles, particularly the 9M723.[11] Because the defender must typically allocate two or more interceptors per incoming missile to achieve acceptable intercept probabilities, the effective cost of each engagement is a multiple of the interceptor's unit price, and the cumulative disadvantage grows with every missile Russia launches. Highly maneuverable hypersonic missiles would further exacerbate this dynamic. A conventionally armed HGV that maneuvers aggressively in midcourse denies the defender a reliable prediction of its terminal approach, forcing engagement from multiple axes, and potentially committing several fire units and additional interceptors against a single incoming missile.[12] The exchange ratio thus deteriorates as the threat becomes more sophisticated. New endo-atmospheric interceptors currently under development in Europe are intended to engage maneuvering hypersonic threats during their atmospheric glide phase rather than outside the atmosphere.[13] No performance or cost data yet exist

11. "Germany Orders 120 PAC-3 MSE Interceptors for Patriot Air and Missile Defence System", *Defence Industry Europe*, March 13, 2025.
12. C.L. Tracy and D. Wright, "Modeling the Performance of Hypersonic Boost-Glide Missiles", *Science & Global Security*, Vol. 28, No. 3, 2020.
13. "AQUILA", MBDA, accessed August 30, 2026.

against which to assess their capability and cost-effectiveness, though overturning the structural disadvantage the defender currently holds in the high-velocity missile domain will be very challenging.[14]

The third is the practical impossibility of comprehensive territorial coverage, at least for terminal phase missile defense capabilities like *Patriot* or *SAMP-T*, which have limited engagement envelopes. Even a well-funded, technologically mature integrated air and missile defense reliant on these types of systems can only protect a limited set of high-value sites rather than an entire country or alliance territory. Given the number of critical military and civilian sites across Europe, and Russia's demonstrated ability to concentrate large numbers of missiles against a small number of targets within a short window, defenders will always face difficult choices about what to protect and what to leave exposed. Higher-altitude missile defense systems, like glide-phase interceptors for hypersonic missile defense, offer, in principle, better area coverage, but similarly suffer from binding inventory constraints and only address a relatively narrow class of threats.

Map 3-I – *DAVID Sling and Arrow 3* in Europe



Sources: Military Balance, Interviews.

Taken together, these three constraints mean that missile defense, however necessary, cannot on its own deter or defeat an adversary capable of generating sustained mass in the high-velocity missile domain. While this is not an argument against investing in missile defense per se, it demonstrates that a posture built exclusively around denial will, over time, be worn down by an adversary who can produce more missiles than the

14. A. Gorremans, "Économie des échanges de salves : vers la fin de la polyvalence des munitions ?", *Notes de l'Ifri*, Ifri, May 2025.

defender can afford to intercept. Europe's response to the Russian high-velocity missile threat therefore requires a second pillar beyond defense, one capable of imposing costs on Russia's own missile forces and infrastructure rather than relying solely on intercepting what Russia chooses to launch.

A calibrated counterstrike posture

The second pillar of Europe's response should take the form of a calibrated counter-strike posture. Its logic is straightforward: rather than resting deterrence entirely on the promise that Russian missile strikes would fail, Europe would signal that coercive or large-scale missile employment against European targets would trigger proportional retaliation in kind, imposing costs that outweigh whatever benefits Moscow expects from its strikes.

Calibration is central to this approach. While the posture would seek to match the pace of Russian action in the missile domain, a European counterstrike posture would not replicate Russia's targeting strategy one-to-one. Population centers and critical civilian infrastructure such as hospitals would remain off limits, even if Russia struck them first. The objective is to threaten Russian value, not Russian lives. The relevant target set is Russia's war-sustaining base, including defense-industrial facilities and the sectors that fund the Russian state, particularly oil and gas infrastructure. Russia's strategic nuclear forces and their associated command and control must equally remain exempt, and target planning must ensure they cannot be struck accidentally, to contain the risk of inadvertent escalation.[15] Such a posture would also not be designed for maximum punishment. One of Europe's primary objectives in a war with Russia would be to keep that war non-nuclear. This means avoiding overly escalatory targeting strategies that could push Russian officials toward rash or hasty decision-making or make it easier for them to justify nuclear use, even if only to themselves.

Of course, implementing this type of posture is not without challenges. Two primary obstacles currently stand in the way of embracing such a posture.

First, Europe's missile arsenals do not appear adequately sized to support a counterstrike posture, since it would require substantial reserve arsenals deployable sequentially as a war with Russia escalates. Maintaining sufficient reserves across the different and consecutive rungs of the escalation ladder is beyond what is currently possible for the vast majority of European states, if not all of them. The one possible exception is Poland, which has placed substantial orders for long-range strike systems in recent years and is expected to expand its arsenal further, including through large numbers of low-cost cruise missiles.[16] That said, a credible counterstrike posture would require substantial missile arsenals in more than one European state. This implies a broad

15. J. M. Acton, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War", *International Security*, Vol. 43, No. 1, 2018.
16. P. Florkiewicz and A. Charlish, "Poland Signs $735 Mln Missile Contract with U.S.," Reuters, May 28, 2024.

European missile ramp-up, from long-range drones to cruise missiles to short- and medium-range ballistic missiles, potentially combined with Europe's own HGV systems (should they judge that such a weapon is needed). It would also require a missile industrial base able to support a wartime ramp-up and resupply dwindling arsenals. Given that this base remains under-mobilized, such a ramp-up is feasible in principle, but it would demand concerted effort and political will.

The second obstacle is doctrinal and institutional. A counterstrike posture deters only effectively if Moscow understands what would trigger retaliation, believes the response would actually come, and knows it would be controlled rather than improvised. None of this can be taken for granted in a Europe of national arsenals. If each state retains sole authority over its long-range strike planning with limited to no coordination across capitals, Russia faces not one counterstrike posture but a patchwork of postures with different thresholds, target sets, and risk tolerances, inviting Moscow to probe the seams and test whether any single state would respond alone. European NATO states therefore need agreed answers to uncomfortable questions before a crisis arrives: who decides that Russian missile employment has crossed the retaliatory threshold, who selects and deconflicts targets, and who controls escalation sequencing as a conflict develops. Developing such procedures is far from impossible, but it would require a level of European coordination in the missile domain that remains, yet, unprecedented. NATO could provide a suitable and centralized coordinating mechanism. Outside NATO, new European coordinating bodies and mechanisms would first have to be devised.

Recommendations

Three recommendations follow from the preceding analysis.

- European states should continue to prioritize missile defense but define the ambition honestly: credible point and limited-area defense of prioritized sites, not comprehensive territorial coverage. Enabling capabilities, notably space-based early warning as well as persistent sensing and tracking capabilities, would also need to be acquired. Within that ambition, the priorities are multi-year contracts that give industry demand certainty. To keep this ambition affordable, European states may draw on common European financing instruments, cooperate at the continental level rather than fragmenting funding across parallel national projects, and mobilize existing expertise within the European defense-technological and industrial base, including actors engaged on both the offensive and defensive side of hypersonic technology.
- Europe should accelerate building a credible counterstrike arsenal now, on the understanding that the requirement is measured in thousands of weapons rather than hundreds. The sensible force mix pairs limited numbers of high-end systems—sophisticated land-attack cruise missiles, conventional ballistic missiles, and possibly HGVs—with large quantities of lower-cost missile

systems, including low-cost cruise missiles and long-range drones. To implement this ambition, manufacturers need multi-year contracts, and investment must extend to hardened storage sites and the logistics needed to maintain survivable reserves across the escalation ladder.

- Investment in enhanced material capabilities must be paired with doctrine. European political and military decision-makers need to agree on thresholds, target selection, and escalation control. This needs to be combined with consistent signaling about when European missile systems would be used, particularly that Europe is not planning to strike first but is willing and prepared to strike back.

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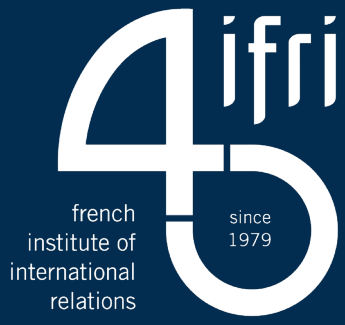

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