

FEBRUARY 2025



INFOFLASH



**REASSESSING THE EURO-
ATLANTIC NUCLEAR UMBRELLA IN
THE 21ST CENTURY**

WRITTEN BY

VICTORIANO VICENTE
BOTELLA BERENQUER

EDITED BY

MAXWELL GOLDSTEIN

SUPERVISED BY

BENJAMIN ROBITAILLE

Introduction

At eighty-nine seconds to midnight, the 'Doomsday Clock' has reached its closest point to global disaster, accentuating the greater risk of nuclear confrontation and other existential threats (Mecklin, 2025). This alarming assessment coincides with a security environment in which the possibility of a nuclear confrontation involving NATO is higher than it has been since the Cold War (Kroenig, 2016). Decades of relative stability and arms control agreements have given way to a volatile security environment characterised by the return of great power competition, rapid technical innovation, and evolving geopolitical factors that threaten NATO's deterrence framework (Kroenig, 2016). While NATO's post-Cold War shift from nuclear dependence signalled hope for long-term peace, it has exposed the Alliance to new challenges (Anderson, 2016).

Among these threats is Russia's aggressive nuclear policy, characterised by its 'escalate to de-escalate' doctrine and significant modernisation of its nuclear triad. These developments have undermined the Euro-Atlantic security architecture and exposed flaws in NATO's ability to prevent or respond to limited nuclear strikes (Verstraete, 2024). Key arms control frameworks, including the New Strategic Arms Reduction Treaty (START), are due to expire in 2026, exacerbating the situation. This expiry marks the first time in decades that the US and Russia will have no limitations on their nuclear arsenals, increasing the likelihood of a new arms race involving China (Mathews, 2024). Nonetheless, US President Donald Trump has recently indicated a willingness to re-engage in arms control discussions despite earlier reservations (Arms Control Association, 2025). This shift may pave the way for a renewed dialogue aimed at mitigating the dangers posed by unrestricted nuclear competition, which the Kremlin welcomes (Arms Control Association, 2025).

Simultaneously, disruptive technologies like hypersonic missiles and artificial intelligence (AI) are altering the basic calculus of nuclear deterrence. The formers' speed and non-ballistic flight profile greatly shorten the already short decision-making window during crises, heightening the risk of making catastrophic miscalculations in such situations (Cimbala & Lowther, 2022). Meanwhile, the incorporation of AI into military nuclear command, control, and communication (NC3) systems poses additional risks, such as vulnerability to cyberattacks and algorithmic blunders (Saltini, 2023). These improvements compound NATO's concerns about maintaining a credible deterrent posture.

In addition to external threats, the Alliance's internal cohesiveness is a concern. Divergent threat perceptions, political disagreements, and unequal burden-sharing among NATO countries threaten to undermine the Alliance's collective resolve. Such fragmentation jeopardises NATO's credibility as it confronts more complex challenges spanning both

conventional and hybrid domains (Larsen, 2019).

Despite these limitations, NATO has taken measures to strengthen its commitment to collective security. Recent summits in Madrid (2022) and Vilnius (2023) emphasised the relevance of nuclear deterrence, as well as the role of nuclear-sharing agreements and non-nuclear nations in strategic deliberations (Verstraete, 2024). However, these steps are insufficient to manage the rapidly evolving security landscape. Therefore, this paper seeks to investigate the current reliability of nuclear deterrence in the transatlantic setting by firstly, analysing the theoretical foundations of credible deterrence; secondly, examining the transformative consequences of technological breakthroughs; and finally, assessing current geopolitical competitiveness.

1. Theoretical Foundations of Credible Deterrence

The credibility of nuclear deterrence relies on a set of core assumptions, the most fundamental being that decision-makers can rationally assess their options and act accordingly—fundamentally, deterrence is the process of making people cautious by threatening them with harm, in this case, the possibility of using nuclear weapons (Borrie, 2020). As Borrie (2020) explains, this assumption fosters the conviction that the civilisation-ending implications of the usage of nuclear weapons will compel leaders to exercise caution. Historically, the United States and the Soviet Union successfully navigated numerous crises during the Cold War, preventing nuclear tragedy (Borrie, 2020). However, the current geopolitical landscape differs fundamentally from that of the Cold War. The rise of multipolarity in global politics and great power competition, alongside the development of advanced technologies, cast doubt on long-held assumptions regarding nuclear deterrence and strategic equilibrium (Borrie, 2020).

Borrie (2020) observes that even those who staunchly accept the concept of nuclear weapons as a deterrent are beginning to doubt their effectiveness in today's world—recent research challenges traditional notions of utilitarian human reasoning. In this context, the stability-instability paradox exacerbates the problem; while mutually assured destruction (MAD) may prevent large-scale conflicts, it also permits smaller-scale aggressions in 'grey zones' (Olmstead, 2024). Russia and China exploit this ambiguity to undermine NATO while avoiding a full-scale military confrontation (Olmstead, 2024). Consequently, NATO faces a strategic dilemma: how to respond to low-level provocations while maintaining the stability of the post-war world order.

Power transition theory adds to this complexity. As the balance of power shifts, rising and declining nations are more likely to employ aggressive strategies to alter the status quo

(Olmstead, 2024). Russia's use of hybrid warfare techniques and nuclear strategy to challenge NATO's conventional dominance exemplifies this (Olmstead, 2024). These provocations underscore the necessity for NATO to maintain flexible deterrence capabilities beyond traditional frameworks.

A core principle of nuclear deterrence is that it is predicated on the assurance of second-strike capability—the ability to launch an unprecedented counterattack even after a nuclear assault (Ruble, 2020). This assurance is crucial in deterring enemies from launching a first attack. However, developments in cyberwarfare, particularly 'left-of-launch' strategies for crippling missile systems or disrupting communication networks, are compromising this confidence (Ruble, 2020). Such measures create a hazardous dynamic in which leaders, believing that their capacity to react has been harmed, may feel driven to attack first. This risk is genuine; US officials have openly discussed utilising these capabilities against North Korea, raising fears about miscalculation or unauthorised launches (Ruble, 2020). With nations such as China and Russia developing advanced cyberwarfare technologies, the loss of faith in second-strike capabilities undermines global deterrence frameworks and increases the possibility of nuclear escalation (Ruble, 2020). The operationalisation of these technological breakthroughs by rival actors threatens NATO's deterrent posture. To combat this, the Alliance must enhance cyber resilience, safeguard communication networks, and develop secure, redundant NC3 systems that can operate in disputed areas.

2. Technological Disruptions to Deterrence

Rapid advancements in military technology are reshaping past doctrines about nuclear deterrence and introducing new challenges and threats. Hypersonic weapons and AI stand out as particularly deterministic because of their profound implications for nuclear deterrence credibility.

The Strategic Disruption of Hypersonic Weapons

Hypersonic missiles significantly limit the time for countries to assess and respond to potential threats (Cimbala and Lowther, 2022). With their unprecedented speed and manoeuvrability, hypersonic glide vehicles (HGVs) evade traditional missile defences and can strike targets with little or no warning, placing immense stress on NC3 systems (Cimbala and Lowther, 2022). This compression in time weakens established decision-making mechanisms, raising the possibility of error or unintentional escalation, particularly when combined with prospective cyberattacks on command networks.

HGVs also jeopardise the survival of national leadership during a crisis, compelling nations to

adopt destabilising strategic postures like ‘launch on warning’ policies or automating important decision-making procedures (Cimbala and Lowther, 2022). By undermining second-strike capabilities—a cornerstone of Cold War-era strategic stability embodied in accords such as the New START—these advancements heighten the risk of rash, fear-driven decisions (Saltini, 2023). Beyond their speed, hypersonic weapons demand a fundamental re-evaluation of defence strategies, contributing to the erosion of global strategic stability (Saltini, 2023).

In response to these challenges, the US has recently announced ambitious plans to construct sophisticated missile defence systems capable of combating hypersonic threats. In a move reminiscent of Ronald Reagan’s Strategic Defence Initiative (SDI), sometimes known as ‘Star Wars,’ President Trump has proposed the construction of an ‘Iron Dome for America’ (Miller et al., 2025). This next-generation system will use space-based lasers and other sophisticated technologies to intercept and destroy hypersonic missiles before they reach their targets (Miller et al., 2025). However, nuclear experts have cautioned that this move may prompt China and Russia to develop countermeasures, reducing its efficacy and further destabilising the global security situation (Miller et al., 2025). The unveiling of this strategy coincided with the Bulletin of Atomic Scientists moving the ‘Doomsday Clock’ one second closer to midnight, emphasising the increased hazards of nuclear escalation in a time of fast technical advancement (Mecklin, 2025).

Artificial Intelligence and Nuclear Strategy

The integration of AI into military technology creates substantial weaknesses in nuclear NC3 systems, presenting technical and ethical problems. AI systems are often complicated, and their decision-making processes can be opaque, making accountability and verification in high-stakes scenarios complicated (Saltini, 2023). For instance, while AI may give answers that sound rational or sensible, they might be based on defective algorithms or biased datasets. This generates a perilous scenario in which an overconfident AI system misinterprets innocuous signals as immediate dangers, resulting in potentially disastrous judgements in a nuclear setting (Saltini, 2023).

The risk of AI being weaponised through cyberattacks further compounds these dangers. A successful hack might provide unauthorised access to AI-powered decision-making systems, compromising situational awareness and potentially triggering erroneous or unauthorised actions (Chernavskikh, 2024). As nations increasingly rely on automation for critical decision-making, these vulnerabilities become more apparent, emphasising the necessity to protect the integrity of such systems (Chernavskikh, 2024).

While AI has the potential to improve efficiency and decision-making speed inside command hierarchies, its implementation may damage confidence and increase uncertainty in nuclear deterrence. The opaque nature of AI behaviour, combined with its vulnerability to manipulation, makes the trustworthiness of nuclear decision-making frameworks doubtful.

The fast pace of AI growth highlights the need for strong ethical frameworks and stricter control. The complexity of current military AI applications varies, but integrating these technologies with nuclear systems presents a unique set of risks and challenges (Hruby & Miller, 2021). AI not only exacerbates vulnerabilities but raises new issues about the openness and dependability of decision-making processes. This demands extensive consultation to predict the larger ramifications of new technologies in nuclear strategy.

3. Great Power Competition and the Erosion of Strategic Stability

Russia's Nuclear Doctrine

Russia's evolving nuclear policy poses a significant challenge to NATO's deterrence credibility, as it marks a considerable departure from conventional policies. Since the early 2000s, Moscow has progressively integrated nuclear capabilities into its national security policy, indicating a shift away from a deterrence-by-denial approach and towards a more coercive posture (Kroenig, 2016). Central to this shift is the controversial 'escalate to de-escalate' doctrine, which advocates the limited use of nuclear weapons during conflicts (Kroenig, 2016). This doctrine reveals Russia's deliberate intent to leverage its nuclear arsenal not just for deterrence but also as a tool for coercion.

In response to the unfolding situation in Ukraine, President Vladimir Putin has announced plans to reevaluate Russia's nuclear strategy during a Russian Security Council meeting on September 25th, 2024 (Vincent et al., 2024). Although Russia's official 2020 policy permits nuclear weapon deployment only in the case of a nuclear attack or a threat to the nation's survival (Cimbala & Korb, 2024), Putin's recent statements suggest a broader interpretation. He declared that "aggression against Russia by any non-nuclear state, supported by a nuclear power, would be deemed a joint attack on Russia" (Vincent et al., 2024, para. 2). This rhetoric, which appears to be connected to Ukraine's military activities in the Kursk region, signals Moscow's willingness to consider nuclear weapons even in conventional conflict scenarios (Vincent et al., 2024).

Russia's readiness to escalate is reinforced by the continuous upgrading of its nuclear triad, which includes intercontinental ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs), and air-delivered nuclear systems (Kroenig, 2016). Cutting-edge platforms

such as the Avangard HGV and the Poseidon underwater drone demonstrate Moscow's determination to establish technological superiority and ensure the arsenal's survival against advanced missile defence systems (Cimbala & Lowther, 2022; Rublee, 2020). These developments provide a significant challenge to the Euro-Atlantic security architecture, requiring a thorough evaluation of NATO's strategic capabilities to address these growing threats.

Additionally, Russia's growing military presence in the Arctic has intensified NATO's concerns. As climate change accelerates the emergence of faster economic routes and encourages rivalry for important untapped resources, the Arctic has evolved into a critical geopolitical theatre. In response, Russia has strengthened its military infrastructure in the region by creating new facilities, modernising radar systems, and greatly increasing the capabilities of its Northern Fleet (Sergunin & Konyshov, 2017). This development demonstrates Moscow's desire to achieve strategic advantages in the Arctic and raises the stakes for NATO.

Despite the Alliance's efforts to bolster conventional deterrence through initiatives such as the Enhanced Forward Presence and the Readiness Action Plan, its nuclear doctrine remains limited (Durkalec & Kroenig, 2016). NATO's reluctance to engage in nuclear escalation may have emboldened Russia, allowing Moscow to use nuclear brinkmanship to shape the security landscape.

Russia's hostile nuclear rhetoric, notably regarding its tactical nuclear capabilities, has heightened tensions in the Euro-Atlantic security framework. This approach, along with current military activities in Ukraine, demonstrates Moscow's determination to use its nuclear arsenal to counter the West. The deployment of nuclear-capable equipment in Belarus and high-profile military exercises also demonstrate Russia's willingness to employ nuclear threats to discourage perceived NATO encroachment (Mathews, 2024).

Beyond nuclear provocations, Russia employs various grey-zone techniques to destabilise NATO's eastern flank. These include large-scale disinformation operations, economic coercion, and cyberattacks aimed at sowing dissent and undermining member states' coherence (Olmstead, 2024). Such efforts increase the complexity of NATO's strategic environment, as the Alliance must combat both conventional and hybrid threats in a rapidly changing security picture.

These developments blur the line between strategic and tactical nuclear weapons. As the situation progresses, it becomes clear that a comprehensive approach to deterrence is required—one that incorporates conventional, nuclear, and hybrid responses to address the interconnected nature of nuclear and non-nuclear threats (Vergun, 2021). NATO must stay

adaptable, strengthening its nuclear policy while ready to face both conventional and hybrid threats in an increasingly complex international security environment.

The Chinese Factor

The People's Republic of China (PRC)'s ascension to nuclear powerhouse status presents a new challenge. Traditionally, the PRC has had a modest nuclear arsenal, but recent developments reflect an unprecedented expansion of its military capabilities. Notably, China has invested heavily in the development of HGVs (Cimbala & Lowther, 2022). These advancements, when combined with the development of road-mobile ICBMs, SLBMs, and new missile silos, mark a significant move towards a more adaptable and powerful Chinese deterrent posture. These improvements not only increase the PRC's regional dominance but also directly undermine NATO's capacity to maintain deterrent stability in the face of new threats, complicating its strategic calculations and placing an additional burden on nuclear NC3 systems (Mathews, 2024).

China's ambitions extend further, and the possibility that the PRC's deployed nuclear arsenal would match that of the US and Russia by 2035 heightens anxieties. As of 2023, Russia is estimated to possess approximately 5,900 nuclear warheads, while the US has around 5,240, with roughly 1,600 strategically deployed on both sides (Dyvik, 2024). According to estimates, China currently has around 500 operational nuclear warheads and intends to increase its stockpile to 1,500 during the next decade (Mathews, 2024). Within NATO, the UK and France collectively contribute with smaller nuclear arsenals of approximately 225 and 290 warheads, respectively, with the UK only having 120 actively deployed (Dyvik, 2024). Consequently, NATO's nuclear relies on contributions from these three member states. As for delivery systems, Russia possessed around 1,185 ICBMs in 2022, whereas NATO had 800; on the other hand, NATO has more aircraft-delivered warheads and SLBMs (Statista Research Department, 2024). Notably, Russia continues to have a significant lead in the field of tactical (nonstrategic) nuclear weapons, with over 1,912 of these warheads compared to NATO's roughly 230 (Statista Research Department, 2024). This growing parity in nuclear arsenals underscores the Alliance's need to reconsider its policy, especially given its reliance on limited member-state contributions and the persistent imbalance in tactical capabilities.

Already in a detrimental position, such significant Chinese expansion complicates NATO's defence strategies further. A stark example of China's arsenal update is the 2021 test of a hypersonic missile integrated with a space-based fractional orbital bombardment system (FOBS). This development is likely to undermine traditional US and NATO defences, dramatically shortening response times and blurring the line between conventional and nuclear warfare, increasing the risk of miscalculation during crises (Cimbala & Lowther,

2022).

China's military modernisation, coupled with its growing nuclear arsenal, puts NATO at a strategic disadvantage. These factors may spark a new arms race or force NATO members to commit considerably higher military spending to maintain effective deterrence despite internal misunderstandings (Cimbala & Lowther, 2022). Admiral Charles Richard, Commander of US Strategic Command, highlighted the significance of these concerns, stating, "We are witnessing a strategic breakout by China. The explosive growth and modernisation of its nuclear and conventional forces can only be what I describe as breathtaking. And frankly, that word breathtaking may not be enough" (Vergun, 2021, cited in Cimbala & Lowther, 2022, p. 284).

Adding complexity, Beijing's ever-growing relationship with Moscow adds a new degree of difficulty to the security picture. Joint military drills, notably naval operations in the Baltic and Arctic areas (Depledge, 2020), demonstrate a shared goal of resisting Western influence and expanding NATO's operational capabilities on several fronts. Although these drills may look purely symbolic, they reflect a deeper convergence of interests, emphasising a unified front against perceived US-led hegemony. This partnership increases the possibility of concerted geopolitical moves that undermine NATO's security environment even more.

Given these dynamics, NATO must take a diversified strategy to confront the consequences of China's rising. Reinforcing transatlantic cooperation is critical in fighting Beijing's geopolitical and economic influence. At the same time, NATO and its allies must engage China in arms control talks to address the concerns presented by its nuclear modernisation and expanding strategic alliance with Russia (Anderson, 2016). A balanced strategy that combines strong deterrence with proactive diplomacy will be critical for NATO as it navigates an increasingly complicated security environment created by China's ascent and evolving position in global power dynamics.

Concluding Remarks

NATO's nuclear deterrence strategy faces unprecedented challenges in the 21st century, necessitating a comprehensive reassessment of its strategic posture. The evolving geopolitical landscape, marked by Russia's aggressive nuclear policies and China's rapid military modernisation, underscores the inadequacy of traditional deterrence frameworks. The integration of advanced technologies, such as hypersonic weapons and AI, further complicates the security environment, introducing new risks to decision-making processes and the stability of NC3 systems. These developments highlight the need for NATO to adopt a multifaceted approach that combines military preparedness with diplomatic engagement

and alliance cohesion.

To address these challenges, NATO must prioritise the modernisation of its nuclear capabilities while enhancing cyber resilience and securing its NC3 infrastructure. Strengthening transatlantic collaboration and fostering unity among member states will be critical in addressing divergent threat perceptions and burden-sharing disparities. Additionally, NATO should actively engage in arms control negotiations with both Russia and China to mitigate the risks of an unconstrained arms race and promote strategic stability.

In sum, NATO's ability to maintain credible deterrence in the 21st century will depend on its capacity to adapt to a rapidly changing security environment. By integrating conventional, nuclear, and hybrid response strategies, NATO can effectively counter the interconnected threats posed by great power competition and technological disruption. In an era of uncertainty, innovation and cooperation will be essential to preserving the alliance's stability and ensuring its continued relevance in global security.

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