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Hypersonic Myths and Strategic Realities[1]

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Introduction

After decades of deterrence preventing nuclear war, hypersonic weapons appear poised to undermine strategic stability and have thus received vigorous academic attention. With speeds at 6,000 kilometres per hour (or Mach five), unpredictable flight paths, and a potential ability to defeat ballistic missile defences,[2] Canadian assessments emphasize the negative implications of hypersonic glide vehicles (HGVs) and hypersonic cruise missiles (HCMs)[3] on the international security environment, suggesting they can undermine the strategic nuclear balance. This reflects American perspectives, which argue that they render land-based forces and command-and-control (C^2) vulnerable. However, this discourse overemphasizes their technological characteristics, with less attention paid to their technical and strategic constraints, resulting in exaggerated threat assessments that assert they can potentially disrupt nuclear deterrence, without acknowledging the risk of retaliation.

Colin S. Gray, *Another Bloody Century: Future Warfare* (London: Weidenfeld & Nicolson, 2005): pp. 39, 85.

[2] Andrea Charron and James Fergusson, *NORAD: In Perpetuity and Beyond* (Montreal: McGill-Queen's University Press, 2022), p. 120.

[3] Hypersonic glide vehicles, which are launched by rockets and glide towards their target, are one type of hypersonic weapon. Hypersonic cruise missiles, which are powered by a scramjet or ramjet engine, are another type. Charron and Fergusson, *NORAD*, p. 120.

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With the return of great power politics and emerging weapons that appear threatening enough to destabilize the international system on their own,[4] it is crucial to emphasize their limitations. This paper therefore counters the literature's claims by addressing two research questions: What are the longstanding strategic constraints that discourage a counterforce strike; and how do they apply to hypersonic weapons? By drawing from Thomas Schelling's emphasis on mutual vulnerability and Kenneth Waltz's insights about counterforce[5] limitations, this approach informs two core arguments. The first is that hypersonics cannot undermine strategic stability because they are subject to the same constraints that discourage the use of current nuclear weapons. The second is that attacking C^2 is a more dangerous option than a counterforce strike since it does not attempt to physically neutralize an adversary's second-strike capability.

To demonstrate how Waltz's insights are relevant to current geopolitical rivalries between the United States, Russia and China, this paper's argument is structured into four sections. The first illustrates the nuclear triad's continued significance by showcasing Washington and Moscow's hesitancy to escalate the war in Ukraine, and how their strategic forces are being maintained and modernized. This section also includes Beijing's modernization programs. The second highlights the importance of military intelligence by exploring current and future challenges in locating an adversary's nuclear arsenal. The third addresses the required quantity of warheads, which considers the cost-effectiveness of mass-producing hypersonics. Finally, the fourth emphasizes why targeting C^2 is riskier than attacking an adversary's nuclear force by focusing on the blurred distinction between counterforce and countervalue strikes[6] and missile defence innovations. This demonstrates that since retaliation is ensured, strategic stability will be maintained despite the development and deployment of hypersonic weapons.

Countering a Technological Approach in the Literature

[4] See Andrew F. Krepinevich, Jr., *The Origins of Victory: How Disruptive Military Innovation Determines the Fates of Great Powers* (New Haven: Yale University Press, 2023), p. 86.

[5] A counterforce, or disarming, strike targets nuclear weapons, and a countervalue strike targets cities. Kenneth N. Waltz, "Nuclear Myths and Political Realities," *The American Political Science Review* 84, no. 3 (September 1990): pp. 735-736, https://www.jstor.org/stable/1962764.

[6] Waltz, "Nuclear Myths," p. 735.

The Canadian defence literature largely uses a technical lens when examining the implications of hypersonics on the international security environment. Andrea Charron and James Fergusson, for instance, assert they are one of many emerging technologies that render North America just as, if not more, vulnerable than during the Cold War, especially considering Russia and China's emergence as peer competitors.[7] Because they can manoeuvre inside and outside the atmosphere, they argue that hypersonics signal the merging of air and space into a single aerospace domain, providing challenges for current surveillance systems and missile defences.[8] Ugurhan Berkok and Oana Secrieru draw similar conclusions, pointing to hypersonic weapons as an emerging threat that renders the binational command vulnerable.[9] By highlighting the North Warning System's (NWS) inability to track them, they claim that the threat of a barrage can *hold North America, hostage*, by targeting critical infrastructures and slowing down deployment in case of conflict overseas."[10] Furthermore, Marc Kieley portrays the development of hypersonic weapons as Russia's response to the American reconnaissance-strike complex (RSC).[11] While he briefly highlights the importance of doctrine in Moscow's attempt to replicate the RSC, more attention is given to hypersonic technology, emphasizing their manoeuvrability, unpredictability, range, and ability to carry conventional or nuclear warheads. Based on these characteristics, he suggests they would permit Moscow or Beijing to rapidly attack Western forces, preventing them from deploying their

[7] Charron and Fergusson, *NORAD*, p. 3.

[8] Charron and Fergusson explain that the US ballistic missile defence (BMD) system can only intercept ballistic missiles in space, whereas air defences can only target threats in the atmosphere, which is problematic since hypersonics can travel within either domain. Furthermore, while the US Theatre High Altitude Area Defence (THAAD) system and high-altitude air defences can potentially intercept hypersonics, their defensive coverage is limited. Ibid., pp. 121, 115.

[9] Ugurhan G. Berkok and Oana Secrieru, "NORAD Modernization: Private Benefits to Canada," *Defence and Peace Economics* (August 2023): pp. 16, 2, https://doi.org/10.1080/10242694.2023.2228565.

[10] Ugurhan and Secrieru, "NORAD Modernization," p. 2.

[11] The reconnaissance strike complex, as was labelled by the Soviets, is the result of late Cold War-era technological and doctrinal developments by the United States to offset the Soviet Union's conventional superiority. It was designed to strike targets deep within enemy territory and was first used during the 1991 Gulf War. Marc Kieley, "No Umbrella for the Rain: Canadian Implications Following the Global Revolution in Reconnaissance-Strike Technologies," *International Journal* 76, no. 2 (July 2021): pp. 223-226, https://doi.org/10.1177/00207020211019301.

conventional systems against Russian or Chinese militaries, strategic interests, or territory.[12]

This approach is also present in considerations about hypersonics and nuclear deterrence. Nancy Teeple argues that, because "the deployment [of] offensive weapons and postures contributes to strategic instability, provokes states into arms races, and reduces incentives for cooperation on arms control," the "deployment of next-generation offensive weapons creates unique challenges for current and future arms control."[13] Additionally, she classifies hypersonic weapons as an offensive system, designed to disarm an adversary's forces and leadership, because their speed and manoeuvrability allow them to evade current surveillance systems and missile defences.[14] Consequently, deploying hypersonics would incentivize first use and risk escalation.[15] Conversely, Dominika Kunertova is skeptical about their disruptive potential but believes their political hype can be destabilizing.[16] Contrary to expectations that they can evade strategic defences, create confusion about intended targets, and shorten the defender's reaction time, she argues that HGVs and HCMs will not be fully operational until the 2030s and 2040s, respectively, because of engineering challenges. Thus, their strategic advantage is likely minimal.[17] However, maintaining the belief that hypersonics are invincible fuels great power rivalries, since they signal great power status, creating instability amid deteriorating arms control norms.[18] In another article, she contends that the current arms race between the United States, Russia, and China is inherently destabilizing because it pollutes the international security environment with more mistrust and uncertainty, potentially leading to unintentional military confrontation.[19]

[12] Kieley, "No Umbrella for the Rain," pp. 227, 225-26.
[13] Nancy Teeple, "Offensive Weapons and the Future of Nuclear Arms Control," *Canadian Journal of European and Russian Studies* 14, no. 1 (April 2021): p. 80, https://doi.org/10.22215/cjers.v14i1.2695.
[14] Teeple, "Offensive Weapons," pp. 83-84.
[15] Ibid., p. 84.
[16] Dominika Kunertova, "New Hypersonic Weapons: Same but Different," *Network for Strategic Analysis Policy Report* 20 (December 2022): pp 3,. 6-7, https://ras-nsa.ca/new-hypersonic-weapons/.
[17] Kunertova, "New Hypersonic Weapons," pp.3, 4.
[18] Ibid., 6-7.
[19] Dominika Kunertova, "Weaponized and Overhyped: Hypersonic Technology," *CSS Analyses in Security Policy*, no. 285 (June 2021): pp. 2, 4, https://css.ethz.ch/content/dam/ethz/special-interest/gess/cis/center-for-securities-studies/pdfs/CSSAnalyse285-EN.pdf.

These assessments are similar to many American perspectives about hypersonic weapons, which largely agree that they are a potential disruptor. A RAND report contends they lower the threshold for aggression because they increase expectations of a disarming strike.[20] By emphasizing their long-range, speed, and evasiveness, it claims they could target a nuclear power's C^2, strategic forces, and storage sites.[21] Christopher Bidwell and Bruce MacDonald, however, are not convinced they can seriously disrupt strategic stability before 2040 and believe it is possible to incorporate them into arms control agreements.[22] Nonetheless, they also argue that if their speed is combined with conventional, high-accuracy warheads, it "becomes possible to envision a disarming first strike against adversary missile silos and other hard targets with very little warning that does not cross the nuclear threshold."[23] Stephen Cimbala and Adam Lowther also suggest they could increase the allure of a first strike, arguing that deploying these missiles en masse can threaten a second-strike capability. They additionally claim that conventionally armed warheads could target nuclear weapon storage sites and command centres, which can incentivize the defender to "escalate to de-escalate" by launching its nuclear weapons first.[24] Finally, James Johnson asserts that technologically advanced hypersonics could target mobile missile launchers, and, in a conflict between the United States and Russia, or China, their capabilities would encourage both sides to pre-emptively target C^2 systems.[25]

When these arguments are taken at face value, hypersonic weapons appear to be what Thomas Schelling would call a "strike-first weapon," which is designed to find and destroy an adversary's second-strike capability.[26] However, they reflect a tendency of

[20] Richard H. Speier, George Nacouzi, Carrie Lee, and Richard M. Moore, *Hypersonic Missile Nonproliferation: Hindering the Spread of a New Class of Weapons* (Santa Monica, CA: RAND Corporation, 2017), p. 19, https://www.rand.org/pubs/research_reports/RR2137.html.

[21] Speier et al, *Hypersonic Missile Nonproliferation*, pp. 10-11, 12-13, 17.

[22] Christopher A. Bidwell and Bruce W. MacDonald, "Emerging Disruptive Technologies and Their Potential Threat to Strategic Stability and National Security," *Federation of American Scientists* (September 2018): pp. 22-23, https://uploads.fas.org/media/FAS-Emerging-Technologies-Report.pdf.

[23] Bidwell and MacDonald, "Emerging Disruptive Threats," p. 21.

[24] Stephen J. Cimbala and Adam Lowther, "Hypersonic Weapons and Nuclear Deterrence," *Comparative Strategy* 41, no. 3 (April 2022): pp. 291-292, https://doi.org/10.1080/01495933.2022.2057736.

[25] James S. Johnson, "Artificial Intelligence: A Threat to Strategic Stability," *Strategic Studies Quarterly* 14, no. 1 (Spring 2020): pp. 25-26, https://www.jstor.org/stable/26891882.

[26] Thomas C. Schelling, *The Strategy of Conflict*, 2nd ed (Cambridge, MA: Harvard University Press, 1980), p. 240.

Cold War-era deterrence critics like Paul Nitze to highlight the inhibitions of an attacked nuclear power facing a counterforce strike, while downplaying the risks of attempting a disarming attack, as was identified by Waltz.[27] The literature only explores possibilities for how hypersonics could disrupt strategic stability and gives less consideration to the consequences of trying to disarm an adversary. When examined through their technological capabilities, they could indeed target a competitor's nuclear force and command structure, but this approach ignores the risk of sparking a nuclear exchange.

The suggestion that hypersonic weapons can tempt a first strike also assumes their presence is powerful enough for a state to discard long-standing deterrence postures that prevented nuclear war for decades, regardless of the high probability of retaliation. In other words, this approach frames hypersonic technology as the chief influencer in what Schelling calls the "inherent propensity toward peace or war."[28] Weapons are indeed not neutral factors in determining the likelihood of international conflict, since they "affect the outlook for war and peace," but they are not *decisive*.[29] To suggest otherwise overemphasizes technology, considering that a state's decision to go to war is influenced by a combination of "weapons, organization, plans, geography, communications, warning systems, intelligence, and even beliefs about the conduct of war."[30] Therefore, what the literature suggests is not characteristic of strategic stability being undermined, but a result of deterrence failing, which requires drawing from international relations theories of wars and their causes.

Consequently, the analysis should incorporate strategic constraints that discourage a first strike. It is possible to highlight them by emphasizing technological challenges, but it is limited. Andrew Futter argues that HGVs offer little advantages over existing ballistic missiles, which already travel at hypersonic speeds. Some are even manoeuvrable and can already overwhelm most missile defences.[31] He also explains that HGVs would likely travel much slower than ballistic missiles upon reaching their target,

[27] Waltz, "Nuclear Myths," p. 736.
[28] Thomas C. Schelling, *Arms and Influence*, 3rd ed. (New Haven; London: Yale University Press, 2020), p. 234.
[29] Schelling, *Arms and Influence*, p. 234.
[30] Ibid., p. 234.
[31] Andrew Futter, "Disruptive Technologies and Nuclear Risks: What's New and What Matters," *Survival* 64, no. 1 (February 2022): p. 104, https://doi.org/10.1080/00396338.2022.2032979.

making them more vulnerable to missile defences. Additionally, the heat HGVs and HCMs emit in flight risk making "them easier to track…than normal ballistic or cruise missiles."[32] Illustrating their technical limitations is a step in the right direction, but incorporating strategic constraints is equally crucial to avoid overblown assessments. As demonstrated earlier, Kunertova also emphasizes technological challenges but still concludes that hypersonic weapons are destabilizing[33] without considering the consequences of retaliation.

Nathan Terry and Paige Price Cone provide a more nuanced assessment, portraying them as merely an evolution in nuclear weaponry. While they compare the technological characteristics of hypersonics with current nuclear weapons, concluding that the former offers few advantages in speed, range, and accuracy, and will likely be countered by missile defences,[34] equal attention is given to deterrence theory. Terry and Cone demonstrate how despite developments in nuclear delivery systems like more accurate intercontinental ballistic missiles (ICBMs), the United States' nuclear posture maintained its purpose of deterring nuclear war.[35] This is because even though the advent of nuclear weapons changed how nations viewed armed conflict, the development of subsequent delivery systems was evolutionary. Consequently, they did not radically change deterrence thinking and resulted in only brief instability due to their inability to undermine strategic parity.[36]

Even though Terry and Cone acknowledge that a hypersonic strike will not prevent retaliation,[37] further studies are needed to explore counterforce limitations that

[32] Futter, "Disruptive Technologies," 104-105.

[33] Kunertova, "New Hypersonic Weapons," pp. 3, 4, 6-7; Dominika Kunertova, "Weaponized and Overhyped,"pp. 2, 4.

[34] Nathan B. Terry and Paige Price Cone, "Hypersonic Technology: An Evolution in Nuclear Weapons?" *Strategic Studies Quarterly* 14, no. 2 (Summer 2020): pp. 84-85, 86, 89. 92, https://www.jstor.org/stable/26915278.

[35] Terry and Cone, "Hypersonic Technology," 76-80. Their purpose of deterring nuclear attacks, large-scale and limited, is still maintained in the 2022 Nuclear Posture Review. US Department of Defense, "2022 Nuclear Posture Review," in *2022 National Defense Strategy of the United States of America: Including the 2022 Nuclear Posture Review and the 2022 Missile Defense Review* (Washington, DC: The Office of the Secretary of Defense, 2022), p. 7, https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF.

[36] Terry and Cone, "Hypersonic Technology," pp. 79, 78.

[37] Ibid., pp. 89-90.

ensure strategic stability will not be undermined easily. While technological considerations are incorporated into this paper's analysis, since it is impossible to discuss the relationship between technology and deterrence without acknowledging the former, equal emphasis is placed on strategic constraints to demonstrate how the disruptive potential of hypersonic weapons is seriously limited. Therefore, this approach demonstrates how assessments about emerging threats should not be conducted in isolation from nonmaterial factors that are just as crucial since it prevents exaggerated conclusions.

Theoretical Basis: Prioritizing Mutual Vulnerability and Strategic Constraints

This paper's core argument is that hypersonic weapons cannot undermine strategic stability because they are subject to the same constraints that discourage the use of existing nuclear weapons. Since retaliation is ensured despite their technological characteristics, the strategic nuclear balance will be maintained. To demonstrate how and why this is the case, this paper draws from Schelling's concept of crisis stability, and Waltz's insights about counterforce limitations, as its theoretical basis.

The most common definition of strategic stability is a combination of arms race stability and crisis stability. The former depends on "the absence of perceived or actual incentives to augment a nuclear force – qualitatively or quantitatively – out of fear that in a crisis an opponent would gain a meaningful advantage by using nuclear weapons first."[38] The latter is maintained "if neither side has or perceives an incentive to use nuclear weapons out of the fear that the other side is about to do so."[39] Despite James Acton's assertion that they are two parts of one phenomenon,[40] this paper uses crisis stability because of its emphasis on mutual vulnerability,[41] as explained by Schelling:

[38] James M. Acton, "Reclaiming Strategic Stability," in *Strategic Stability: Contending Interpretations*, ed. Elbridge A. Colby and Michael S. Gerson (Carlisle, Penn.: Strategic Studies Institute, US Army War College, 2013), pp. 123, 121, https://carnegieendowment.org/files/Reclaiming_Strategic_Stability.pdf.

[39] Acton, "Reclaiming Strategic Stability," p. 121.

[40] Ibid., 124.

[41] In a paper submitted to the US Naval War College, Thomas Tauer also draws from mutual vulnerability to illustrate the limited destabilizing potential of hypersonic weapons on nuclear deterrence, arguing that offensive capabilities enhance strategic stability. Thomas M. Tauer, "Don't Believe the 'Hype': Nuclear

> There is a difference between a balance of terror in which *either* [emphasis in original] side can obliterate the other and one in which *both* sides can do it no matter who strikes first. It is not the "balance" – the sheer equality or symmetry in the situation – that constitutes mutual deterrence; it is the *stability* of the balance. The balance is stable only when neither, in striking first, can destroy the other's ability to strike back.[42]

This understanding of crisis stability is a crucial platform for understanding the limitations of a disarming attack, illustrating that as long as a nuclear force is survivable, an aggressor has no hope of launching a successful first strike. This logic is strengthened by Waltz's insights about counterforce limitations, which hypersonic weapons cannot overcome, rendering attempts to undermine the strategic nuclear balance unfeasible and undesirable, even with new technologies.

Waltz asserted that no nuclear power can benefit from a first strike since retaliation is guaranteed.[43] In countering Nitze's claims about the Soviet Union's ability to hold the United States hostage by striking first, he identified several constraints that would have discouraged a Russian disarming attack.[44] Waltz first noted that a first strike needs to be well-timed, with intelligence agencies having accurately revealed nearly "all of their intended targets."[45] He also argued that Nitze's distinction between counterforce and countervalue strikes was pointless since the distinction between the two is blurred when hundreds of missiles are launched. Despite the Soviet's intention to attack American nuclear weapons, the United States would not know what the intended targets were. Furthermore, he identifies that a successful counterforce strike "would require that thousands, not hundreds, of warheads be fired," noting that only several hundred nuclear warheads could obliterate the United States and the Soviet Union.[46]

He also emphasized the triad's importance, arguing against applying conventional military thinking to nuclear strategy. In asserting that smaller nuclear forces are enough

Hypersonic Weapons are not Destabilizing," *US Naval War College* (May 2023): p. 7, https://apps.dtic.mil/sti/citations/trecms/AD1208456.

[42] Schelling, *The Strategy of Conflict*, p. 232.

[43] Waltz, "Nuclear Myths," p. 733.

[44] Paul H. Nitze, "Deterring our Deterrent," *Foreign Policy*, no. 25 (Winter 1976-1977): pp. 196, 204-6, 208, https://www.jstor.org/stable/1148029; Waltz, "Nuclear Myths," pp. 735-736.

[45] Waltz, "Nuclear Myths," p. 735.

[46] Ibid., 735.

to deter, so long as they are survivable, he highlights that identifying the vulnerability of land-based missiles dwells on "one class of weapon."[47] Rather than one component, focus must be placed on the entire strategic force, since "destroying a portion…means little if sufficient weapons for deterrence survive."[48] Conventional strategy works differently, where the vulnerability of non-nuclear forces can pose a problem. For example, protecting sea lanes of communication is justified because if they were destroyed, the United States could not transport and support troops overseas.[49]

To demonstrate how Waltz's arguments are relevant to current geopolitical rivalries between the United States, Russia and China,[50] this paper's argument is structured into four sections. The first demonstrates the continued relevance of the nuclear triad by highlighting the hesitancy of Washington and Moscow from escalating the war in Ukraine into a great power conflict, and showcasing how their strategic forces are not only being maintained but also modernized. Beijing's modernization programs have likewise been included. The second explores contemporary and future surveillance limitations to illustrate the difficulty of locating an adversary's nuclear force, even with new sensor technology. The third addresses the required quantity of warheads by displaying a lack of consensus about the cost-effectiveness of mass-producing hypersonic weapons. Finally, the fourth section focuses on the blurred distinction between counterforce and counter value strikes by emphasizing why targeting C^2 is riskier than attacking an adversary's nuclear arsenal. It also discusses missile defence innovations that an anti-C^2 strike will have to account for. Compared to the first three sections, which consider the possibility of the United States attempting a disarming strike on Russia or China, and vice versa, the fourth only explores the potential for Moscow or Beijing to use hypersonic weapons to attack Washington's C^2, because the latter is the only known power that is developing anti-hypersonic interceptors.

The Raison d'être of the Nuclear Triad

[47] Ibid., p. 736.
[48] Ibid., p. 736.
[49] Ibid., p. 736.
[50] To maintain a narrow scope, this paper focuses only on the three nuclear powers and refrains from considerations about extended deterrence.

A necessary prerequisite for a successful counterforce strike is the ability to disarm all three legs of the nuclear triad, which is comprised of land-, sea-, and air-based forces, such as ICBM launchers, ballistic missile submarines (SSBNs), and bomber jets, respectively.[51] Otherwise, enough weapons would remain for a nuclear power to retaliate. In line with Waltz's thinking, importance must thus be placed on the whole strategic force, instead of one component.[52] Bernard Brodie expressed similar views, stating that Soviet planners in the Cold War would have been foolish not to account for two to three hundred American ICBMs surviving a well-coordinated strike, much less the seven to eight thousand warheads from the remaining two legs of the triad. Consequently, it would make no sense to try and destroy one branch, without attempting the same for the remaining forces, because the triad is designed to ensure each leg reinforces, and is reinforced by, the other two.[53]

Thus, considerations about the ability of hypersonic weapons to disrupt strategic stability must account for the whole triad. However, since the literature mostly pays attention to land-based forces – and C^2, which is addressed in the last section – it repeats Nitze's mistakes of assuming that nuclear forces are vulnerable by prioritizing only one portion. As identified by Waltz, this approach reflects conventional military thinking. Alongside concerns about protecting sea lanes of communication, contemporary anxieties about geopolitical rivals attacking satellites are equally justified, since disrupting a space-based C^2 network, which allows conventional militaries to travel more efficiently, impedes power projection capabilities.[54] In the nuclear realm, however, destroying one branch of the triad accomplishes little, because the remaining two legs that have the same purpose will still allow a nuclear power to retaliate.[55]

Another important distinction is that the results of conventional war are harder to predict than those of nuclear war, rendering assumptions that hypersonic weapons can disrupt nuclear deterrence more problematic. In the conventional realm, it is easy to

[51] US Department of Defense, "2022 Nuclear Posture Review," p. 21.
[52] Waltz, "Nuclear Myths," p. 736.
[53] Bernard Brodie, "The Development of Nuclear Strategy," *International Security* 2, no. 4 (Spring 1978): pp. 70-71, https://www.jstor.org/stable/2538458.
[54] Waltz, "Nuclear Myths," 736; Joshua Rovner, "Strategy and Grand Strategy in New Domains," in *The New Makers of Modern Strategy: From the Ancient World to the Digital Age*, ed. Hal Brands (Princeton; Oxford: Princeton University Press, 2023), pp. 1085-1086.
[55] Waltz, "Nuclear Myths," p. 736.

miscalculate the relative strength of one's military forces to that of its adversary and entertain delusions of victory at an acceptable cost.[56] This was clearly the case when Russia directly invaded Ukraine in 2022, which was "premised on the assumption that a long war could be avoided if its forces executed a *coup de main*."[57] During the war's initial phase, Russian forces attempted to decapitate the Ukrainian leadership, isolate its forces, and quickly occupy its territory, but they failed to anticipate an organized, sustained defence on several fronts.[58] Additionally, compared to Moscow's rigid command and control structures, Kyiv's forces were more flexible and made good use of Western weapons like anti-tank guided missiles, and concentrated artillery fire, which helped thwart Russian advances.[59]

Conversely, the outcome of a war involving nuclear weapons – regardless of whether it is purely a nuclear exchange, or a conventional conflict with the risk of escalating to nuclear strikes – is much clearer. States would not be concerned about winning or losing, but the likelihood of annihilation, forcing them to be cautious because the high risk of catastrophe is easier to contemplate.[60] This was also exemplified during Russia's 2022 war on Ukraine. Since the invasion began, neither Washington nor Moscow appeared willing "to escalate against the other," having roughly identified "each other's red lines early on."[61] While the United States provided Ukraine with weapon systems like Patriot missiles, advanced armour vehicles, and high-mobility artillery, it was unwilling to implement further measures like a no-fly-zone, which then-White House press secretary Jen Psaki asserted would potentially require shooting down Russian planes and

[56] Kenneth N. Waltz, "More May be Better," in *The Spread of Nuclear Weapons: An Enduring Debate*, 3rd ed., eds. Scott D. Sagan and Kenneth N. Waltz (New York; London: W.W. Norton, 2013), p. 8; Waltz, "Nuclear Myths," p. 734.

[57] A *coup de main* is a surprise attack. Michael Kofman, "The Russia-Ukraine War: Military Operations and Battlefield Dynamics," in *War in Ukraine: Conflict, Strategy, and the Return of a Fractured World*, ed. Hal Brands (Baltimore: Johns Hopkins University Press, 2024), p. 105, https://muse.jhu.edu/pub/1/oa_edited_volume/chapter/3881920/pdf.

[58] Kofman, "The Russia-Ukraine War," pp. 101, 105.

[59] Ibid., pp. 106-107.

[60] Waltz, "More May be Better," p. 9; Waltz, "Nuclear Myths," p. 734.

[61] Francis J. Gavin, "Nuclear Lessons and Dilemmas from the War in Ukraine," in *War in Ukraine: Conflict, Strategy, and the Return of a Fractured World*, ed. Hal Brands (Baltimore: Johns Hopkins University Press, 2024), 180, https://muse.jhu.edu/pub/1/oa_edited_volume/chapter/3881924/pdf.

risk World War Three.[62] Additionally, Russian nuclear threats to the West did not provide the desired coercive effects, since the Biden administration continued supporting Ukraine. Despite Moscow's sabre-rattling, the White House saw no indication that it was preparing for nuclear use.[63] This is because, as Francis Gavin notes, while nuclear threats should be evaluated seriously, they are most likely bluffs.[64] Reuter's recent interviews with Russian officials also confirm the Kremlin's caution, as two out of the five sources explained that Moscow was concerned about the danger of nuclear escalation with NATO over Ukraine.[65]

The hesitancy to risk nuclear exchange is further solidified by the guarantee of retaliation ensured by the triad. If nuclear powers are hesitant to take such a risk, then it follows that the presence of hypersonic weapons will not be powerful enough to tempt the United States, and Russia or China, into attempting a disarming attack. Even if conventional warheads are used, the likelihood of exchanges escalating to nuclear war is too high to entertain miscalculated assumptions about a successful counterforce strike.

This is especially important since maintaining and modernizing the triad is still official United States policy, which is intended to ensure survivability. The 2022 Nuclear Posture Review (NPR) places immense value on its ability to ensure Washington "can withstand and respond to any strategic attack."[66] This explains why, despite placing renewed focus on arms control and non-proliferation, the NPR lists modernization programs for land-, sea-, and air-based nuclear forces, ensuring the triad's continued role in deterring large-scale strikes on American territory.[67] They include replacing the Minuteman III ICBM with the Sentinel, which has a longer range and can potentially

[62] Gavin, "Nuclear Lessons," p. 180; Aaron Blake, "Why Biden and the White House keep talking about World War III," *Washington Post*, 17 March 2022, https://www.washingtonpost.com/politics/2022/03/17/why-biden-white-house-keep-talking-about-world-war-iii/.

[63] Gavin, "Nuclear Lessons," 183, 179, 180-181; Guy Faulconbridge and Lidia Kelly, "Putin wars the West: Russia is ready for Nuclear war," *Reuters*, 14 March 2024, https://www.reuters.com/world/europe/putin-says-russia-ready-nuclear-war-not-everything-rushing-it-2024-03-13/.

[64] Gavin, "Nuclear Lessons," p.181.

[65] Guy Faulconbridge and Andrew Osborn, "Exclusive: Putin wants Ukraine ceasefire on current frontlines," *Reuters*, 24 May 2024, https://www.reuters.com/world/europe/putin-wants-ukraine-ceasefire-current-frontlines-sources-say-2024-05-24/.

[66] US Department of Defense, "2022 Nuclear Posture Review," p. 20.

[67] US Department of Defense, "2022 Nuclear Posture Review," pp. 16-19, 20-21, 11.

carry two warheads.[68] Additionally, plans are underway to replace the Ohio-class SSBN with the Columbia-class submarine, which is "2,000 tons heavier," and "expected to be significantly quieter."[69] Finally, the United States is developing the B-21 Raider bomber to replace the B-2A Spirit, which can deliver both B61-12 guided nuclear gravity bombs and the upcoming AGM-181 air-launched cruise missile.[70]

Russia also maintains a nuclear triad, most of which it is currently modernizing.[71] Significant motivators are its ambition to maintain strategic parity with Washington, and the Russian leadership's belief that the US BMD system can undermine its retaliatory capability.[72] This is exemplified by President Vladimir Putin's speech to the Russian Federal Assembly in March 2018, where he claimed that American anti-ballistic missile systems would completely devalue "Russia's nuclear potential," since their missiles "could simply be intercepted."[73] Alongside the RS-28 Sarmat ICBM – which has a potentially longer range than other ballistic missiles, is due to replace the RS-20V Voevoda, and will possibly carry some Avangard HGVs – Moscow is developing the Osina-RV and Kedr to replace its Yars ballistic missiles. Russia also appears to be developing additional HGVs, but these programs are highly secretive.[74] For its submarine force, the Kremlin launched its newest Borei-class SSBN in December 2022, which will potentially be replaced by a new generation of submarines, called Arktur or Arcturus, after approximately 2037. Moscow is also developing the intercontinental-range and nuclear-armed Poseidon torpedo, which is expected to be equipped on the Belgorod submarines.[75] Additionally, Russia is modernizing its Tu-160 bomber force by

[68] Hans M. Kristensen and Matt Korda, "United States Nuclear Weapons, 2023," *Bulletin of the Atomic Scientists* 79, no. 1 (January 2023): pp. 35-36, https://doi.org/10.1080/00963402.2022.2156686.

[69] Kristensen and Korda, "United States Nuclear Weapons, 2023," pp. 39, 40.

[70] Kristensen and Korda, "United States Nuclear Weapons, 2023," pp. 42-43; US Department of Defense, "2022 Nuclear Posture Review," p. 21.

[71] Mary Beth D. Nikitin, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, CRS Report No. R45811 (Washington, DC: Congressional Research Service, 2022), pp. 16-17, https://crsreports.congress.gov/product/pdf/R/R45861/16.

[72] Hans M. Kristensen, Matt Korda, Eliana Johns, and Mackenzie Knight, "Russian Nuclear Weapons, 2024," *Bulletin of the Atomic Scientists* 80, no. 2 (March 2024): 118, https://doi.org/10.1080/00963402.2024.2314437.

[73] "Presidential Address to the Federal Assembly," President of Russia, March 1, 2018, http://www.en.kremlin.ru/events/president/transcripts/messages/56957.

[74] Kristensen et al. "Russian Nuclear Weapons, 2024," pp. 127-129.

[75] Ibid., 131.

incorporating a new engine to increase its range by around 1,000 kilometres. It also includes a new autopilot system, a new radar and cockpit, along with communications and avionics equipment. Another program is the next-generation PAK-DA bomber, which is expected to carry cruise and hypersonic missiles.[76]

Even though China has a significantly smaller nuclear force compared to the United States and Russia, it also understands the necessity of a survivable arsenal and continues to develop and maintain one. Chinese military thinking has emphasized the need for deterrence to convince its adversaries that "any aggression and interference against China will receive due retaliation," which requires a reliable strategic nuclear force.[77] Beijing also possesses a triad and continues to expand its arsenal.[78] According to the Pentagon's estimates, it will increase to around 1,000 warheads in 2030, with the potential to increase further to 1,500.[79] Currently, China is constructing 320 new silos for its land-based forces in the Yumen silo field in Gansu Province, the Hami field in Eastern Xinjiang, and the Yulin field near Hanging Banner. Furthermore, it "is upgrading and expanding the number of silos for the liquid-fuelled DF-5 ICBM and increasing the number of silos per brigade."[80] For its submarine force, Beijing is constructing Jin-class SSBNs, despite their noisy design, and will potentially begin developing the Type 096 submarine, which is expected to be quieter, larger, and heavier.[81] For its air-based force, China first tested a nuclear air-launched ballistic missile in December 2016 and conducted

[76] Ibid., 133, 134.

[77] Xiao Tianliang, Lou Yaoliang, Kang Wuchao, and Cai Renzhao, eds., *Science of Military Strategy (Revised in 2020)*, ed. The China Aerospace Studies Institute, trans. The China Aerospace Studies Institute (Beijing, National Defense University Press, 2020), p. 134, https://www.airuniversity.af.edu/Portals/10/CASI/documents/Translations/2022-01-26%202020%20Science%20of%20Military%20Strategy.pdf/.

[78] Hans M. Kristensen, Matt Korda, Eliana Johns, and Mackenzie Knight, "Chinese Nuclear Weapons, 2024," *Bulletin of the Atomic Scientists* 80, no. 1 (January 2024): p. 50, https://doi.org/10.1080/00963402.2023.2295206.

[79] Kristensen et al, "Chinese Nuclear Weapons, 2024," p. 49; US Department of Defense, *Military and Security Developments Involving the People's Republic of China, 2023* (Washington, DC: Office of the Secretary of Defense, 2023), 111, https://media.defense.gov/2023/Oct/19/2003323409/-1/-1/1/2023-MILITARY-AND-SECURITY-Developments-Involving-The-Peoples-Republic-Of-China.Pdf; US Department of Defense, *Military and Security Developments Involving the People's Republic of China, 2022* (Washington, DC: Office of the Secretary of Defense, 2022), p. 98, https://media.defense.gov/2022/Nov/29/2003122279/-1/-1/1/2022-military-and-security-developments-involving-the-peoples-republic-of-china.pdf.

[80] Kristensen et al, "Chinese Nuclear Weapons, 2024,"pp. 57-59, 61, 62.

[81] Ibid., p. 66.

a further five by April 2018. Also, to replace the H-6 bomber, China is developing the stealth-capable H-20, which will have a range longer than 10,000 kilometres, a dual conventional and nuclear capability, and a potential intercontinental range.[82]

These developments demonstrate that the triad's importance is not diminishing anytime soon. Since it is designed to mutually reinforce the entire arsenal, any disarming strike, even with hypersonic weapons, will need to account for all three legs. Consequently, highlighting the vulnerability of one portion of the nuclear force is problematic because it applies conventional military thinking to the nuclear realm. It is also dangerous because focusing on one leg of the triad ignores the reality that a nuclear power under attack will maintain its ability to retaliate, defeating the purpose of a counterforce strike.

Contemporary and future Surveillance Challenges

To incapacitate the entire triad, however, uncovering the locations of a nuclear power's arsenal with surveillance is crucial. Without this knowledge, the would-be attacker would be strategically incapable of inflicting a disarming attack with any level of success. This logic especially applies to hypersonic weapons, whose speed and manoeuvrability will amount to nothing if such a strike was attempted without this information because there would be no target. It is also important to note that incomplete information, even if it uncovered most nuclear forces, is not enough for a successful counterforce strike, because the remainder can still retaliate.

It is possible to spot strategic forces with sensors. During the late 1950s and early 1960s, while ICBMs shortened the delivery time of thermonuclear weapons, the development and use of satellites "allowed a state to better see an adversary's capabilities and potentially recognize a mobilization or preparation for an attack, reducing the danger of surprise attack."[83] Other means of obtaining strategic intelligence during the Cold War

[82] Ibid., pp. 67-68.

[83] Francis J. Gavin, "The Elusive Nature of Nuclear Strategy," in *The New Makers of Modern Strategy: From the Ancient World to the Digital Age*, ed. Hal Brands (Princeton; Oxford: Princeton University Press, 2023), p. 701.

included utilizing piloted aircraft, submarines, photoreconnaissance, the collection of adversary communications, and underwater acoustics.[84]

Currently, innovations in remote sensing have caused some to question the survivability of submarines and mobile missiles.[85] For instance, Kier Lieber and Daryl Press believe they are making the oceans more transparent, diminishing the concealment of submarines. They also believe that even though satellites with synthetic aperture radar – which can locate moving objects – do not resolve the issue of finding mobile targets, considering Russian and Chinese anti-satellite capabilities, they can still pose problems. Even if adversaries place missiles "and conduct deterrent patrols in locations that are difficult to observe," they force themselves into narrow zones, which can be spotted by stealthy penetrating drones.[86] Johnson makes similar claims, suggesting that drones augmented by artificial intelligence (AI) could be another way to locate an adversary's strategic force. These drones could also suppress air defences, paving the way for conventional or nuclear hypersonic strikes.[87]

There are three problems with assuming that new sensory technologies increase the vulnerability of a nuclear force. The first is Lieber and Press' assumption that remote sensing innovations are eroding concealment,[88] which does not sufficiently account for the use of decoys to confuse surveillance data. Their argument suggests they – alongside deploying anti-satellite weapons and radar jammers, as well as adapting mobile missile doctrines – will leave a defender's nuclear force more vulnerable because powerful states with more resources and "are leaders in sensing technology have an advantage in the race to build (and thwart) countermeasures."[89] Lieber and Press, however, place too much importance on technological superiority, underestimating the value of decoys as a deceptive strategy.

[84] Keir A. Lieber and Daryl G. Press, "The New Era of Counterforce: Technological Change and the Future of Nuclear Deterrence," *International Security* 41, no. 4 (Spring 2017): p. 33, https://doi.org/10.1162/ISEC_a_00273.
[85] Lieber and Press, "The New Era of Counterforce," pp. 32-35.
[86] Ibid., pp. 38, 41.
[87] Johnson, "Artificial Intelligence," p. 25.
[88] Lieber and Press, "The New Era of Counterforce," p. 10.
[89] Ibid., pp. 46-47.

The use of decoys creates uncertainty over a state's ability to destroy an adversary's land-based nuclear force.[90] Considering the high risk of disaster that a failed disarming strike will bring,[91] the possibility of even a portion of located launchers being decoys is enough to dissuade a nuclear power from attacking first. Even if a state's satellites become capable of decreasing interval times to twenty-four minutes, and enough of them are placed in different orbits to maintain persistent surveillance,[92] these systems will still need to distinguish the actual nuclear launchers from their decoys. Otherwise, any disarming strike, even with hypersonic weapons, will still leave the attacked nuclear power with sufficient warheads to retaliate.

Second, even if new sensors can discern decoys from real nuclear launchers, they would still have to account for more mobile forces like submarines. The assumption that transparent oceans make them more vulnerable overlooks crucial strategic issues that are present even with full visibility. It is theoretically true that if an adversary's strategic submarines can be efficiently and simultaneously located with wide-scale space-based sensors, a barrage of nuclear weapons could sink or disable them.[93] Combined with enough hypersonic weapons in the American, Russian, or Chinese arsenals, this would give each nuclear power the potential capability to wipe out SSBNs, considering their manoeuvrability and alleged accuracy, provided they are confident that such a large-scale and unrehearsed disarming attack would not backfire.[94] However, increased submarine visibility does not lead to vulnerability, since emerging space-based sensors cannot distinguish a state's own sea-based force from those of its adversary or a neutral party, much less a nuclear attack submarine from its nuclear strategic counterpart. This issue delivers a risk of unintentionally destroying the wrong targets in a disarming strike,

[90] Historically, decoys were successfully utilized to complicate intelligence gathering attempts by an adversary, as demonstrated by Operation Fortitude before the D-Day invasion in 1944, which constructed fake landing craft, airfields, and army camps in southeastern England and contributed to the Germans concluding that the Allies intended to target Calais instead of Normandy. Mary Kathryn Barbier, "Deception and the Planning of D-Day," in *The Normandy Campaign, 1944: Sixty Years On*, ed. John Buckley (London; New York: Routledge, 2006), pp. 172-174, 176.

[91] Norman Friedman, *Strategic Submarines and Strategic Stability: Looking Towards the 2030s* (Canberra: Australian National University, September 2019), p. 10, https://nsc.crawford.anu.edu.au/sites/default/files/publication/nsc_crawford_anu_edu_au/2019-09/publish_nsc_publication_strategic_submarines_2019_1.pdf.

[92] Lieber and Press, "The New Era of Counterforce," 40; Futter, "Disruptive Technologies," p. 101.

[93] Friedman, *Strategic Submarines*, p. 10.

[94] Waltz, "Nuclear Myths," p. 735; Friedman, *Strategic Submarines*, 10.

which would only "warn the real targets and might trigger an attack before they could be destroyed."[95] The use of underwater sensors also runs into challenges, since submarines can simply attack them and then move into bastions beyond their reach.[96]

The last is overestimating the ability of drones to observe an adversary's nuclear force. While they can be a supplementary capability for satellites to make up for their periodic coverage, they would have to move closer to the target, flying through or loitering in enemy airspace, which will render them more "vulnerable than satellites."[97] It also does not consider the reality that states do not take kindly to their airspace being violated. A recent example is the 2023 Chinese surveillance balloon incident when a suspected spy balloon crossed into American and Canadian airspace. Believing that Beijing was using it to survey the United States' strategic sites, Washington, with Ottawa's help in tracking it, shot it down.[98]

It also assumes this capability will be largely one-sided in favour of the attacker, with little consideration given to existing countermeasures by the defender.[99] Not only is the United States aware of the drone threat, as showcased by the 2022 Missile Defense Review,[100] but Washington also owns the VAMPIRE Counter-Unmanned Aerial System. While it was primarily designed to attack ground targets, it can also shoot down drones with small missiles.[101] Additionally, plans for modernizing the North American Aerospace Defence Command's (NORAD) infrastructure include procuring advanced

[95] Friedman, *Strategic Submarines*, pp. 13, 14.
[96] Futter, "Disruptive Technologies," pp. 101-102
[97] Futter, "Disruptive Technologies," p. 101.
[98] Thomson Reuters, "U.S. military shoots down suspected Chinese spy balloon off Carolina coast," *CBC News*, February 4, 2023, https://www.cbc.ca/news/world/us-response-china-spy-balloon-1.6737412.
[99] Johnson has acknowledged that manned F-35 fighters will eventually be capable of leveraging AI to control and counter drone swarm attacks. Johnson, "Artificial Intelligence," p. 21.
[100] US Department of Defense, "2022 Missile Defense Review," in *2022 National Defense Strategy of the United States of America: Including the 2022 Nuclear Posture Review and the 2022 Missile Defense Review* (Washington, DC: The Office of the Secretary of Defense, 2022), 8, https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-national-defense-strategy-npr-mdr.pdf.
[101] Emma Helfrich and Tyler Rogoway, "What The VAMPIRE Weapon System The U.S. Is Sending To Ukraine Can Actually Do," *The Warzone*, August 26, 2022, https://www.thedrive.com/the-war-zone/what-the-vampire-weapon-system-the-u-s-is-sending-to-ukraine-can-actually-do.

short-range air-to-air missiles that can target drones.[102] Russia also recently unveiled a new counter-drone system, the SERP-VS6, which is designed to track and jam various drones, and disrupt their navigation systems, forcing them to either land or crash. It can also operate autonomously.[103] Furthermore, China is focused on improving tactical air defences against drones with "hybrid self-propelled air defence artillery systems (SPADA), gun air defense artillery, small focused electronic warfare systems, and Man-Portable Air Defense Systems (MANPADS)."[104] Since they will not enjoy an uncontested environment, drones will be insufficient to find enough of a nuclear power's strategic arsenal. Therefore, because of inadequate surveillance capabilities, a hypersonic disarming strike is simply unfeasible.

The required quantity of Warheads

Even if future advances in surveillance allow the United States, Russia and China, to locate each others' nuclear arsenals, it is unclear whether any of them would have enough hypersonic weapons to launch a counterforce strike. As Waltz identifies, a successful disarming attack requires a high quantity of warheads numbering in the thousands.[105] Schelling held similar views, making two observations in favour of large nuclear forces. Firstly, when both sides possess a large strategic arsenal, a greater number of missiles is expected to remain for retaliation, increasing the value of deterrence in preventing a first strike. Secondly, a big arsenal held by all sides means that a disarming attack requires a "proportionate increase in missiles…in order to be capable of assuring, with any specified probability, that the other's left-over missiles would be less than some specified number after being attacked."[106] Even with the emergence of hypersonics, a counterforce strike will need to at least match, if not exceed, an adversary's nuclear force.

[102] "Advanced Short Range Missile," *Department of National Defence*, Government of Canada, modified December 1, 2022, http://dgpaapp.forces.gc.ca/en/defence-capabilities-blueprint/project-details.asp?id=1310.

[103] "All-new Russian counter-UAV system debut at the World Defense Show," *Military Africa*, 7 February 2024, https://www.military.africa/2024/02/new-russian-drone-protection-system-is-presented-for-the-first-time-at-the-world-defense-show-2024/.

[104] US Department of Defense, *People's Republic of China, 2023*, pp. 49-50.

[105] Waltz, "Nuclear Myths," p. 735.

[106] Schelling, *The Strategy of Conflict*, p. 236.

In a hypothetical first strike by the United States on Russia or China, or vice versa, decisionmakers would need to account for not only the number of nuclear weapons deployed, but also the amount held in storage. Theoretically, for Washington and Moscow to threaten each other's second-strike capability, each would need thousands of hypersonic weapons. The US has a stockpile of around 3,708 warheads, with 1,419 strategic weapons deployed and approximately 1,938 in storage in case of geopolitical or technical surprises.[107] Additionally, the Kremlin possesses around 4,380 warheads, with approximately 1,719 strategic weapons deployed and 2,670 strategic and non-strategic weapons in storage.[108] This matter of numbers initially appears to be different regarding China, because its warhead stockpile is significantly fewer, being approximately 440 – although the Pentagon estimates there are over 500 – with most of its warheads located in storage facilities. However, as mentioned earlier, the size of its force will likely change by 2030, with Chinese nuclear weapons increasing to 1,000 by 2030 and potentially 1,500 by 2035.[109] Furthermore, in a hypothetical strike against the United States, China would need to account for the size of its nuclear forces and storage sites. This still necessitates that all three nuclear powers have a hypersonic arsenal numbering in the thousands.

The possibility of this being realized, however, depends on a country's ability to produce them. Unfortunately, there are contradicting assessments about production potential, which is linked to cost-effectiveness. According to Tong Zhao, some Chinese experts believe conventional hypersonic weapons are less expensive to develop and deploy than conventionally armed long-range ballistic missiles and are more efficient than short-range tactical missiles, which need to be positioned on forward bases, increasing their overall cost.[110] Their reasoning is that a hypersonic cruise missile's scramjet engine is cheaper to produce than a traditional jet engine. This contrasts with American assessments, which suggest that, because of their high cost, only a few missiles

[107] Kristensen and Korda, "United States Nuclear Weapons, 2023," p. 28; "New START Treaty Aggregate Numbers of Strategic Offensive Arms," *U.S. Department of State*, United States Government, 12 May 2023, https://www.state.gov/new-start-treaty-aggregate-numbers-of-strategic-offensive-arms-5/.

[108] Kristensen et al, "Russian Nuclear Weapons, 2024," p. 118.

[109] Kristensen et al, "Chinese Nuclear Weapons, 2024," pp. 49, 56.

[110] Tong Zhao, "Conventional Challenges to Strategic Stability: Chinese Perceptions of Hypersonic Technology and the Security Dilemma," in *The End of Strategic Stability? Nuclear Weapons and the Challenge of Regional Rivalries*, ed. Lawrence Rubin and Adam N. Stulberg (Washington, DC: Georgetown University Press, 2018), p. 182.

would be ready for use.[111] Dean Wilkening shares this view. While he asserts that tactical missiles will likely be deployed in large numbers, strategic weapons will be less available because of their high expense.[112] Additionally, even though the US Department of Defense wants to procure many hypersonic weapons, Frank Kendall, Secretary of the Air Force, commented that only small inventories will be likely because they will not be cheap.[113]

Without a clear estimate, it is difficult to reliably determine whether the United States, or Russia and China, would have enough hypersonics to attempt to disarm each other. Simultaneously, it is important to understand that a high quantity of advanced missiles is not enough to threaten strategic stability, even with sufficient intelligence gathered by surveillance systems. This is because firing enough missiles at once will likely backfire horribly, regardless of their intended targets. The same is true for attacking C^2 infrastructure, which is riskier than attempting a counterforce strike.

The redundancy of Command Vulnerability

Since the literature also expresses concerns about anti-C^2 strikes, it is necessary to highlight that attacking command-and-control is a more dangerous option than a counterforce strike, since it does not attempt to physically neutralize an adversary's second-strike capability. The risk of nuclear retaliation remains, rendering a strike on command centres with hypersonic weapons more unfeasible and undesirable. Suggesting that they can target C^2 infrastructure[114] also lacks recognition of current American innovations in missile defences. These obstacles would require Russia and China to fire a high number of missiles at once to circumvent them, yet such a barrage would alarm the United States to the extent it treats the attack as a nuclear strike intended to obliterate the country.

[111] Zhao, "Conventional Challenges," p. 182.
[112] Wilkening, "Hypersonic Weapons," pp. 140-141.
[113] Kelley M. Sayler, *Hypersonic Weapons: Background and Issues for Congress*, CRS Report No. R45811 (Washington, DC: Congressional Research Service, 2024), p. 22, https://crsreports.congress.gov/product/pdf/R/R45811/38.
[114] Speier et al, *Hypersonic Missile Nonproliferation*, p. 17; Cimbala and Lowther, "Hypersonic Weapons," pp. 292; Johnson, "Artificial Intelligence," p. 25.

Anxieties about anti-C^2 strikes are not new. In the late 1970s, John Steinbruner, who was critical of discourse about strategic stability ignoring command channels, argued they were more vulnerable than nuclear forces. He also asserted that because only the president of the United States had formal authority to initiate a nuclear launch, a carefully planned strike on Washington could cripple its ability to retaliate. Furthermore, damage to communications systems could disable considerable segments of C^2 infrastructure.[115] It should be recognized, however, that Washington currently has an order of succession in place among the president's cabinet, which ensures a member will be ready to assume command. Additionally, one senior cabinet member called a designated survivor, is always kept absent from special events, like the State of the Union address, in case American leadership is attacked. Therefore, striking the US government will unlikely decapitate its ability to respond.[116]

While Waltz does not heavily focus on command vulnerability,[117] he clarifies that firing only a few hundred warheads is needed to blur the line between counterforce and countervalue attacks, since a state facing a missile barrage would not know the aggressor's intended targets.[118] Warhead ambiguity also worsens this problem. Even though the United States is only pursuing conventionally armed hypersonic weapons, the same cannot be stated about Russia or China. Despite advanced sensors being developed to track them, it is difficult to classify incoming warheads as conventional or nuclear.[119] Moreover, this identification cannot be made until a missile reaches its target, forcing leaders to assume that the attack is a nuclear strike.[120]

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[115] John D. Steinbruner, "National Security and the Concept of Strategic Stability," *The Journal of Conflict Resolution* 22, no. 3 (September 1978): pp. 417-420, https://www.jstor.org/stable/173725.

[116] Jeffrey G. Lewis and Bruno Tertrais, "The Finger on the Button: The Authority to Use Nuclear Weapons in Nuclear-Armed States," *CNS Occasional Paper*, no. 45 (February 2019): pp. 8-9, https://nonproliferation.org/op-45-the-finger-on-the-button/.

[117] He does, however, argue that defending command, control, and communications is redundant because deterrence is sufficient to prevent an attack. Waltz, "Nuclear Myths," p. 743.

[118] Waltz, "Nuclear Myths," p. 735.

[119] Charron and Fergusson, *NORAD*, pp. 120, 121, 190n19; Wilkening, "Hypersonic Weapons," pp. 139, 138; "NORAD modernization project timelines," *Department of National Defence*, Government of Canada, modified24 March 2023, https://www.canada.ca/en/department-national-defence/services/operations/allies-partners/norad/norad-modernization-project-timelines.html.

[120] James M. Acton, *Silver Bullet? Asking the Right Questions About Conventional Prompt Global Strike* (Washington, DC: Carnegie Endowment for International Peace, 2013), p. 114, https://carnegieendowment.org/files/cpgs.pdf; Carrie A. Lee, "Asking the Right Questions: Hypersonic

Furthermore, hypersonic missile interceptors will likely be part of future missile defences, which an anti-C^2 strike by Russia or China must account for. As of March 2023, the US Missile Defense Agency announced they will shortly begin developing hardware for the Glide Phase Interceptor program.[121] Therefore, Moscow and Beijing would need a substantial number of missiles to bypass these defences. Because of warhead ambiguity, however, a massive barrage threatening the American C^2 system will likely alarm Washington to the extent it treats the assault as a strategic nuclear strike, forcing it to launch-under-attack, a posture it does not currently adhere to.[122] Exacerbating this bad situation is the fact that only several hundred nuclear missiles are enough to obliterate the United States,[123] further stoking fears that an incoming barrage will doom the country to certain destruction. Consequently, considering the large number of incoming warheads, it would not matter to Washington whether Moscow or Beijing intended to target its nuclear arsenal or C^2 infrastructure. In other words, Russia and China risk instigating a nuclear exchange that devastates all sides. The possibility of an assault backfiring in this manner illustrates that the idea of targeting command makes a counterforce strike appear feasible because at least the latter seeks to eliminate a retaliatory capability.

Conclusion

Counterforce limitations still apply to hypersonic weapons, making it highly unlikely they will undermine strategic stability. Challenges posed by the nuclear triad, military intelligence, the required number of warheads, and the high risk of attacking C^2 infrastructure demonstrate why exploring their implications on the international security environment, especially nuclear deterrence, through a technological lens delivers exaggerated threat assessments. This is not a complete dismissal of hypersonics, but

Missiles, Strategic Stability, and the Future of Deterrence," in *Recalibrating NATO Nuclear Policy*, ed. Andrea Gilli (Rome: NATO Defense College, June 2020), pp. 37-38, https://www.jstor.org/stable/resrep25147.9.

[121] Theresa Hitchens, "Glide Phase Interceptor for hypersonic defense about to enter 'hardware phase': MDA Director," *Breaking Defense*, 24 March 2023, https://breakingdefense.com/2023/03/glide-phase-interceptor-for-hypersonic-defense-about-to-enter-hardware-phase-mda-director/.

[122] US Department of Defense, "2022 Nuclear Posture Review," p. 13.

[123] Waltz, "Nuclear Myths," 735.

rather a suggestion that future studies should acknowledge the consequences of using them in a counterforce strike. Analysis should not be limited to technical constraints either, since it still leads to ill-informed conclusions. Instead, strategic realities that prevented nuclear war since 1945 should be incorporated with equal importance.

It would also be prudent to explore the likelihood of geopolitical competition escalating to nuclear war, with a focus on military doctrine to determine how hypersonic weapons would be used. Questions about how nuclear powers would react to their core interests being threatened, and whether they would overwrite the need to maintain nuclear deterrence, should likewise be considered. Weapon technology must also be relegated to a supporting role since they are not the decisive factor in a state's decision to go to war.[124] Priority should instead be given to political, social, and cultural contexts since armed conflict is a human undertaking, not a technological endeavour.[125] Additionally, since deterrence theory alone cannot fully explain the incentives for states to engage in conflict, international relations theories of wars and how they start should be incorporated. This approach will demonstrate that even with the use of hypersonic weapons in the equation, it will not be the poster child of strategic instability, but a consequence of deterrence failing.

[124] Schelling, *Arms and Influence*, p. 234.

[125] Colin S. Gray, *Another Bloody Century: Future Warfare* (London: Weidenfeld & Nicolson, 2005), pp. 39, 85.

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