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Hypersonic Weapons: The New Challenge for U.S. Deterrence and Grand Strategy

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I. INTRODUCTION

The emergence of hypersonic weapons has introduced new challenges on how the United States should view deterrence and grand strategy. Hypersonic weapons can travel at or above five times the speed of sound (Mach 5). While China and Russia have touted the offensive superiority these capabilities add to operations, the United States must also consider how hypersonics can be utilized for deterrent and coercive purposes. Although concepts of hypersonic technologies have existed for decades, the fielding of these capabilities has only recently been achieved by China and Russia.¹ The United States has yet to field a hypersonic weapon or defensive capabilities to combat these threats.

Publicly, fielding dates for U.S. hypersonic weapon systems are as follows; the Army Long-Range Hypersonic Weapon (LRHW), targeting the end of this year, 2023, and the Navy Conventional Prompt Strike (CPS) program targeting 2025 for fielding on the Zumwalt-class destroyer and 2029 for the Virginia-class submarine.² Meanwhile, the Air Force (AF) has not publicly released a fielding date. However, the organization has recently celebrated the fourth successful flight test of the joint Defense Advanced Research Projects Agency (DARPA) and Air Force Research Laboratory (AFRL) Hypersonic Air-breathing Weapon Concept (HAWC).³ With fielding dates rapidly approaching and pressure increasing daily to match advances by peer adversaries, the United States must be prepared to harness the versatile capabilities that

¹ Most recently, Russia has publicized the deployment of the country's Zircon hypersonic missile on a frigate in the Atlantic as a show of force as tensions continue to escalate in the West over the war in Ukraine. This is the first known fielding of a shipboard hypersonic weapon.

² Saylor, Kelley. "Hypersonic Weapons: Background and Issues for Congress." *Congressional Research Service*, 27 October 2022. PDF.

³ "Final Flight of HAWC Program Screams Through the Sky." Defense Advanced Research Projects Agency, 30 Jan 2023, <https://www.darpa.mil/news-events/2023-01-30>.

hypersonic weapons offer and realize the potential for these technologies to enhance deterrence and strategy.

Although experts disagree on the potential impact of adversary hypersonic capabilities on warfare, the Department of Defense (DoD) and recent administrations have prioritized fielding a U.S. capability as reflected in the nation's annual budgets and National Defense Strategies (NDSs). In 2018, Former Under Secretary of Defense for Research and Engineering (USD[R&E]) Michael Griffin testified to Congress that the United States does not "have systems which can hold [China and Russia] at risk in a corresponding manner, and we don't have defenses against [their] systems."⁴ Furthermore, DoD spending on hypersonic capabilities rose from \$350 million in 2016 to \$3.8 billion in 2020, a ten-fold increase in funding over four years.⁵ The funding increase illustrates the DoD's rush to ensure the U.S. is not inferior to peer adversaries and is a nod to the significance of hypersonic technologies.⁶

The speed, accuracy, and maneuverability of these weapons can substantially change strategic and tactical operations, altering the nature of warfare. Hypersonic capabilities allow the ability to hold numerous targets at risk and directly threaten missile defenses and high-value assets across the globe while increasing the survivability of the user and decreasing the reaction times of those being targeted. Given the current state of hypersonic technologies by adversaries

⁴ Griffin, Michael. "Statement of Michael D. Griffin, Under Secretary of Defense for Research and Engineering before the House Armed Services Subcommittee on Intelligence, FY20 Science and Technology Posture Hearing." 11 March 2020, <https://www.congress.gov/116/meeting/house/110655/witnesses/HHRG-116-AS26-Wstate-GriffinM-20200311.pdf>.

⁵ Tan, Melissa. "Frost & Sullivan Analyzes Hypersonic Technology Development in the United States." Frost & Sullivan; San Antonio, TX, 7 June 2021. <https://www.frost.com/news/press-releases/hypersonic-technology-development-in-the-united-states>.

⁶ Early on the U.S. did not prioritize development of a hypersonic capability as the idea seemed far-off and unattainable in the near-term. Clearly, decades later the U.S. is paying for this mistake.

and their potential impact on warfare, the U.S. must continue prioritizing this capability's development while recognizing its implications on deterrence and strategy.⁷ First, current hypersonic development programs and progress in the U.S. will be analyzed. Then, adversarial systems and capabilities will be outlined, followed by an overview of the emerging threat's impact on the NDS. Finally, an analysis of hypersonic weapons' impact on psychology will be conducted to demonstrate further the numerous challenges and opportunities these weapons introduce to deterrence and grand strategy.

II. HYPERSONIC DEVELOPMENTS IN THE UNITED STATES

Over the past forty years, DoD interest in hypersonic technologies has not been consistent. The concept of deploying a weapon capable of hypersonic speeds has been on the radar of defense communities for decades, though not always a priority.⁸ Although the U.S. was aware of Chinese and Russian research into the subject, significant focus was not placed nationally on developing the capability until the past decade when the DoD increased funding in the field and began substantially leveraging its agencies, warfare centers, national laboratories, and industry for hypersonic research.

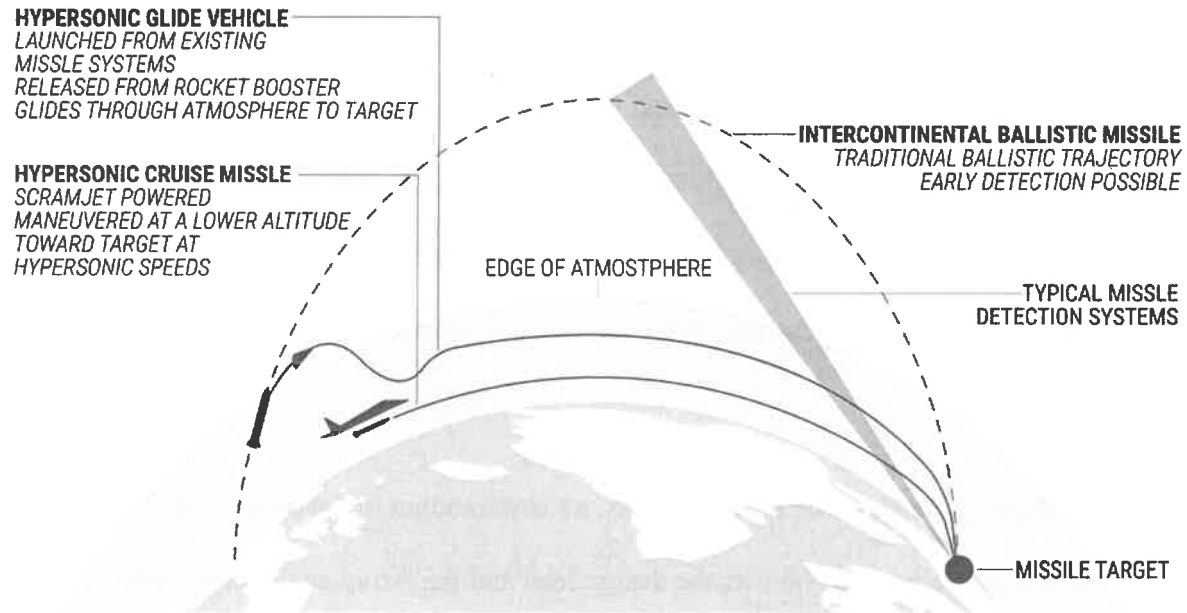
Hypersonic weapons are broken into two categories: glide and cruise missiles. Hypersonic Glide Vehicles (HGVs) are typically rocket-launched with no additional propulsion. Rocket boosters propel the HGV to apogee, then the vehicle glides within the atmosphere to its designated target, utilizing energy-managing maneuvers throughout the flight. Meanwhile, cruise vehicles are powered by high-speed, air-breathing engines, or "scramjets," throughout flight and

⁷ Even though the impact of the capability is disputed, the psychological impact of adversaries outpacing the U.S. cannot be disputed.

⁸ Interest fluctuated over the years the administrations doubted hypersonic weapon feasibility and impact on warfare.

are typically air-launched.⁹ Figure 1 below illustrates the difference between glide and cruise vehicles.

Figure 1. Hypersonic Trajectories¹⁰



Source: "Hypersonics and Modern War," *Geopolitical Futures*, 30 April 2019.

In the U.S., several programs are making significant strides toward fielding a hypersonic weapon. The Hypersonic Air-breathing Weapon Concept (HAWC) is a joint effort by Defense Advanced Research Projects Agency (DARPA) in partnership with the Air Force (AF) and numerous industry partners. The program is developing an air-launched hypersonic cruise missile. After completing four successful flight tests, the original HAWC program concluded in January 2023. It will now transition into the More Opportunities with HAWC (MOHAWC) program by building and flying more vehicles that build upon HAWC's advances.¹¹ Fielding

⁹ Sayler, Kelley. "Defense Primer: Hypersonic Boost-Glide Weapons." Congressional Research Service, 14 November 2022. PDF.

¹⁰ "Hypersonics and Modern War," *Geopolitical Futures*, 30 April 2019.
<https://geopoliticalfutures.com/hypersonics-modern-war/>.

¹¹ "Final Flight of HAWC Program Screams Through the Sky." Defense Advanced Research Projects Agency, 30 Jan 2023, <https://www.darpa.mil/news-events/2023-01-30>.

dates have not been publicly released though the concept has been demonstrated successfully.¹² Another AF program informing hypersonic cruise-missile development is the Air-Launched Rapid Response Weapon (ARRW). This program was developing a hypersonic air-to-ground missile equipped with a rocket motor that propels the vehicle to a target speed and then glides to its target.¹³ In March 2023, the AF announced that the organization would not pursue further program funding after several failed flight tests. Although ARRW is being cut from the U.S. portfolio of hypersonic solutions, learning through failure is inherently beneficial to Research & Development (R&D), and progress from the program will provide data and lessons learned for future programs.¹⁴

In addition to the U.S. Air Force's efforts, a memorandum of agreement (MOA) was signed in 2019 designating the Navy as the design lead and the Army as the manufacturing lead on the Conventional Prompt Strike's (CPS) boost-glide weapon system (W.S.). This joint effort between the Navy and Army under the CPS Program seeks to quickly field a boost-glide hypersonic capability for both services. Each force will utilize a Common-Hypersonic Glide Body (C-HGB) integrated with a service-specific launcher system. For the Army, the C-HGB will be utilized in the Long-Range Hypersonic Weapon (LRHW) with an Army-developed land-based, truck-launched system. Fielding is scheduled for late 2023, and the Army has successfully

¹² "DARPA'S Hypersonic Air-breathing Weapon Concept (HAWC) Achieves Successful Flight." Defense Advanced Research Projects Agency, 27 Sept 2021, <https://www.darpa.mil/news-events/2021-09-27>.

¹³ Suci, Peter. "Meet ARRW: The U.S. Air Force Is Going All In On Hypersonic Weapons" 19-FortyFive, 6 December 2022, <https://www.19fortyfive.com/2022/12/meet-arrw-the-u-s-air-force-is-going-all-in-on-hypersonic-weapons/>.

¹⁴ Losey, Stephen. "US Air Force drops Lockheed hypersonic missile after failed tests." DefenseNews, 30 Mar 2023, <https://www.defensenews.com/air/2023/03/30/us-air-force-drops-lockheed-hypersonic-missile-after-failed-tests/>.

demonstrated weapon system (W.S.) capability.¹⁵ The Navy's boost-glide weapon system utilizes the C-HGB and Navy-developed shipboard and submarine cold-launch launcher systems, with fielding goals of 2025 for the Zumwalt-class destroyer and 2029 for the Virginia-class submarine.¹⁶ All of the U.S. programs listed are pursuing conventional solutions, and the DoD has made it clear that, as of now, it does not plan to field nuclear-capable hypersonic weapons.

Although the U.S. is trailing its adversaries, the scheduled dates for fielding are quickly approaching. Along with ensuring its hypersonic weapons are operationally ready, the U.S. must also focus on grand strategy and how these weapons will be utilized in battle. Hypersonic weapons can threaten high-value, time-sensitive target sets across the sea, sky, and land that current systems cannot reach due to speed, range, and maneuverability constraints. Hypersonic weapons can alter warfare and how battles are fought at tactical, strategic, and operational levels. While a significant amount of focus has been placed on offensive capabilities, understanding the impact on defense and deterrence must be a priority to harness the potential of hypersonic weapons fully.

III. HYPERSONIC DEVELOPMENTS IN RUSSIA & CHINA

Meanwhile, Russia has fielded the Avangard, a nuclear-capable, hypersonic boost-glide vehicle. President Vladimir Putin announced the missile in March 2018, and it has a range of over 6,000 km, weighs approximately 2,000 kg, and can carry a nuclear or conventional

¹⁵ Feickert, Andrew. "The U.S. Army's Long-Range Hypersonic Weapon (LRHW)" Congressional Research Service, 23 May 2022, <https://crsreports.congress.gov/product/pdf/IF/IF11991>.

¹⁶ Eckstein, Megan. "US Navy touts hypersonic missile progress ahead of 2025 fielding" DefenseNews, 1 November 2022, <https://www.defensenews.com/naval/2022/11/02/us-navy-touts-hypersonic-missile-progress-ahead-of-2025-fielding/>.

payload.¹⁷ The Russian Federation has also announced the development of the Tsirkon hypersonic weapon, an anti-ship cruise missile planned to be integrated onto ships and submarines by 2025.¹⁸ The Avangard and Tsirkon missiles are not the only hypersonic capabilities that Russia is fielding; the Kh-47M2 "Kinzhal" ("Dagger" in Russian) is another air-launched, hypersonic cruise missile that Putin has announced. The Kinzhal missile has even seen operational use in the Ukraine war, striking an underground warehouse and storage base.¹⁹

Russia is the only country that has deployed hypersonic weapons in a wartime environment. Although Russia has demonstrated its weapons operationally, the impact of these superior capabilities has yet to be proven. Hypersonic missiles' strategic capabilities have not appeared to change the situation on the ground in Ukraine significantly. In addition to the previously mentioned weapon systems, Russia has also been pursuing other hypersonic solutions. In 2021, Colonel-General Vladimir Zarudnitsky, the head of the Military Academy of the General Staff of the Armed Forces of the Russian Federation, published an article mentioning the Kh-95, a hypersonic anti-aircraft missile.²⁰ Though still in development with few public details released, the weapon is expected to target enemy aircraft and airfield infrastructure, underground warehouses, and similar target sets. Russia is striving to leverage hypersonic

¹⁷ Missile Defense Project, "Avangard," Missile Threat, Center for Strategic and International Studies, January 3, 2019, last modified July 31, 2021, <https://missilethreat.csis.org/missile/avangard/>.

¹⁸ Episkopos, Mark. "Bad News: Russia's Tsirkon Hypersonic Missiles Are Coming 2025" The National Interest, 26 August 2021, <https://nationalinterest.org/blog/buzz/bad-news-russias-tsirkon-hypersonic-missiles-are-coming-2025-192495>.

¹⁹ Sokol, Lia. "Russia's Kinzhal Hypersonic Missile: A Game-Changing Weapon or a Distraction?" Nuclear Threat Initiative, 7 April 2022, <https://www.nti.org/atomic-pulse/russias-kinzhal-hypersonic-missile-a-game-changing-weapon-or-a-distraction/>.

²⁰ Mihayloff, Andrey. "Russia's new Kh-95 hypersonic missile ends the arms race with the United States" Pravda, 11 October 2021, https://english.pravda.ru/science/149597-hypersonic_missile/.

weapons to achieve dominance in aviation, on the ground, and at sea, which disrupts the balance of deterrence. Russia has also made it clear that its hypersonic weapons are both conventional and nuclear-capable.²¹ These new capabilities raise several international security concerns, and the U.S. must be prepared to incorporate these adversary advances into strategy, deterrence, and policy decisions.

The People's Republic of China (PRC) is also pursuing several hypersonic capabilities. As early as 2014, the country demonstrated a number of operational flight tests launched from the ground and aircraft. The DoD has published several reports on Chinese hypersonic interests, outlining their aggressive development and testing of capabilities. According to a recent DoD report on Chinese military capability, in 2020, the country fielded its first operational hypersonic weapons system, the DF-17 HGV, and advanced its scramjet engine development, which has applications in hypersonic cruise missiles.²² The DoD also noted in this report that the PRC plans to leverage hypersonic capabilities for global strike and defeat of missile defense systems and anti-satellite, anti-missile, and anti-unmanned aircraft system capabilities.²³ Beyond the DF-17, few details have been released publicly about the PRC's other hypersonic capabilities. However, the Pentagon has stated that China is developing hypersonic weapons at a "stunning" pace, conducting "hundreds" of tests, significantly outpacing the U.S. in testing.²⁴ In August 2021, the

²¹ Saylor, Kelley. "Hypersonic Weapons: Background and Issues for Congress." Congressional Research Service, 27 October 2022. PDF.

²² Office of the Secretary of Defense. *Military and Security Developments Involving the People's Republic of China*, 2021. Page 144, <https://media.defense.gov/2021/Nov/03/2002885874/-1/-1/0/2021-CMPR-FINAL.PDF>.

²³ Ibid. Page 148.

²⁴ Nakamura, Ryo. "Pentagon sounds alarm on China's 'hundreds' of hypersonic tests" Nikkei Inc., 30 October 2021, <https://asia.nikkei.com/Politics/International-relations/Pentagon-sounds-alarm-on-China-s-hundreds-of-hypersonic-tests>.

PRC successfully tested a nuclear-capable hypersonic weapon that circumnavigated the globe.²⁵ Similar to the test, the implications of its success on missile defense, deterrence, and strategy raised global concerns. The capability to strike promptly anywhere on the globe shifts the strategic advantage to China as missile defense systems could be rendered ineffective and impede the U.S.'s ability to provide threat warning and attack assessments. China has also stated that its hypersonic missiles are conventional and nuclear-capable.

Although the United States has maintained its stance on fielding conventional hypersonic capabilities, Russia and China have nuclear-capable systems. The implications of this difference could lead to a strategic imbalance with the U.S. system, requiring a much higher accuracy than its adversaries' weapons. With the U.S. pursuing only conventional solutions, discussions must occur regarding Russia and China's nuclear capabilities, the likelihood of use, and if an additional nuclear-capable system will affect the traditional understanding of mutually assured destruction (MAD). Historically, the U.S. has maintained a technical advantage over adversaries with a versatile toolbox of capabilities to ensure readiness for any scenario. By choosing not to pursue a nuclear-capable weapon system, the U.S. is broadcasting that it intends to utilize hypersonic weapons differently than its adversaries and avoid initiating another nuclear arms race.²⁶ Although the U.S. is currently behind in fielding a hypersonic system, its pursuit of a

²⁵ Widener, Laura. "US military shocked: China flew hypersonic nuke capable missile around the globe; 'We have no idea how they did this': report" American Military News, 18 October 2021, <https://americanmilitarynews.com/2021/10/us-military-shocked-china-flew-hypersonic-nuke-capable-missile-around-the-globe-we-have-no-idea-how-they-did-this-report/>.

²⁶ The U.S. is sending a clear message that when fielded, the country's hypersonic weapons will be utilized for high-precision, time-sensitive strikes.

higher-accuracy weapon forecasts that the technology could outperform adversaries' capabilities when fielded.²⁷

IV. NATIONAL DEFENSE STRATEGY SHIFTS

Over the past few decades, the National Defense Strategy (NDS) has shifted to address the rise of China and Russia as peers regarding emerging technologies, including hypersonic capabilities, and each country's increased aggression globally. A notable shift in strategy occurred in 2018 when an unclassified summary of the year's NDS was released, the first new, publicly released NDS in ten years. The summary focused on "restoring America's competitive military advantage to deter Russia and China from challenging the United States, its allies or seeking to overturn the international order."²⁸ The NDS acknowledged the increasingly complex and changing international security environment defined by rapid technological change and challenges from adversaries in every operating domain.²⁹ Rapidly developing hypersonic capabilities, as well as other emerging technologies, is specifically called out as a vital focus for the DoD and administration due to the impact these technologies have on changing the character of war.

In contrast, the 2008 NDS places emphasis on al-Qaeda and extremist groups, in line with previously released strategies after the events of 9/11. Rogue states such as North Korea and Iran are also mentioned due to their advances in nuclear capabilities. China and Russia are then

²⁷ Hypersonic weapons can make much more of an impact conventionally; with MAD, introducing additional nuclear-capable weapon systems is not a logical strategy for any country.

²⁸ U.S. Department of Defense. Summary of the 2018 National Defense Strategy of the United States of America. 19 January 2018, Page 2, hsdl.org/c/2018-national-defense-strategy/. Online.

²⁹ Ibid. Page 1.

mentioned, with their military modernization acknowledged, but their status as near-peers in capability is not mentioned.³⁰ The impending threat of technological advances in the two countries was not realized in 2008. The 2018 NDS shifted and prioritized the U.S., matching China and Russia's capabilities and the necessity to adapt to the rapidly advancing technological environment.

In the 2022 NDS, the PRC is noted as the U.S.'s "most consequential strategic competitor for the coming decades" due to its actions internationally and the rapid modernization of its military.³¹ On the other hand, Russia is called out directly for its reckless actions in Ukraine and the significance of allied unity in combatting its aggression. Furthermore, the NDS outlines the administration's plans for deterrence. In this section, three areas are outlined, deterrence by denial, deterrence by resilience, and deterrence by direct and collective cost imposition. In deterrence by denial, emphasis is placed on developing asymmetric capabilities to enhance the denial of adversary capabilities. Hypersonic weapons are specifically called out in this section as the technology provides a kinetic solution for denying adversaries' capabilities, such as missile defense.³²

In deterrence by resilience, the administration calls out the importance of the ability to withstand and recover quickly from disruption.³³ To be resilient, the U.S. must understand adversary hypersonic capabilities and develop plans to endure and react if these weapons are

³⁰ U.S. Department of Defense. 2008 National Security Strategy of the United States of America. June 2008, <https://nssarchive.us/national-defense-strategy/national-defense-strategy-2008/>. Online.

³¹ U.S. Department of Defense. "2022 National Defense Strategy of the United States of America." 27 October 2022, Page 9, media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF. Online.

³² U.S. Department of Defense. "2022 National Defense Strategy of the United States of America," 8.

³³ U.S. Department of Defense. "2022 National Defense Strategy of the United States of America," 8.

utilized against the U.S. or its allies. In the third deterrence area of focus, direct and collective cost imposition, the administration outlines that denial and resilience cannot be the only two forms of deterrence. The U.S. must also impose costs in excess of the perceived benefits of adversary aggression. In this sense, deterrence focuses on modernizing nuclear capabilities while imposing direct costs from conventional long-range fires and irregular warfare.³⁴ While conventional hypersonic weapons fall under the long-range fires mentioned in this section, it is interesting that the NDS calls out the necessity to modernize nuclear capabilities when the administration has repeatedly stated that it will not pursue nuclear-capable hypersonic weapons. The current administration and the DoD have drawn a clear line between nuclear modernization and hypersonic weapons.³⁵ The conventional advantages of hypersonic weapons outweigh the necessity for a nuclear-capable weapon system. Hypersonic weapons can make much more of an impact conventionally; with MAD, introducing additional nuclear-capable weapon systems is not a logical strategy for any country.³⁶

Over the past two decades, there has been a clear progression in each administration's national defense strategy. From focusing on extremist groups and the threat of terrorism to acknowledging China and Russia as peers in terms of emerging technologies, each NDS has reflected the complex international security environment. The U.S. has been outpaced in fielding hypersonic capabilities in today's environment, and addressing this gap has been a national priority. For the U.S. and its allies to maintain a strategic balance against China and Russia, a

³⁴ U.S. Department of Defense. "2022 National Defense Strategy of the United States of America," 9.

³⁵ Given the aggression of China and Russia in recent years, coupled with both countries' advances in nuclear-capable hypersonic weapons, the question must be asked; does the US need to rethink its stance on nuclear warheads in its hypersonic weapons?

³⁶ Nuclear-capable hypersonic weapons in the hands of adversaries must be matched by the US to maintain balance strategically for the nation and its allies.

priority must continue to be placed on developing hypersonic capabilities and incorporating them effectively and efficiently into warfare.³⁷

V. PSYCHOLOGY IN WARFARE

Although the U.S. is behind in fielding a hypersonic system, the country is leading in other fields of emerging technologies, such as quantum computing and artificial intelligence (A.I.).³⁸ Some might argue that the U.S. should focus on expanding advantages in these areas instead of following a reactive strategy and playing catch-up in terms of its prioritization of hypersonic systems development. While the U.S. has prioritized fielding a hypersonic weapon, the current and previous administrations have also prioritized the continual development of emerging technologies. In 2021, the Trump administration invested more than six-billion dollars in AI-related research-and-development projects.³⁹ In addition, the 2022 NDS specifically called out the prioritization of emerging technologies to transform the fleet's capabilities and ensure successful deterrence strategies.⁴⁰ The best path forward is the U.S. strategy to be proactive in continuing R&D in the fields it is dominating while being reactive in the areas it is not.⁴¹ Hypersonic capabilities add a multitude of targeting opportunities, given their high degree of maneuverability and speed. The U.S. must continue prioritizing hypersonic weapon system

³⁷ To ensure confidence of allies, the US must maintain technological capability equal to or surpassing its adversaries' capabilities.

³⁸ Waddel, Kaveh; Pandey, Erica. "China is eroding the U.S. edge in AI and 5G" *Axios*, 25 September 2019, <https://www.axios.com/2019/09/25/china-united-states-ai-quantam-computing-research-5g>.

³⁹ Harper, Jon. "Federal AI Spending to Top \$6 Billion" *National Defense*, 10 February 2021, [https://www.nationaldefensemagazine.org/articles/2021/2/10/federal-ai-spending-to-top-\\$6-billion](https://www.nationaldefensemagazine.org/articles/2021/2/10/federal-ai-spending-to-top-$6-billion).

⁴⁰ U.S. Department of Defense. 2022 National Defense Strategy of the United States of America. Page 19.

⁴¹ The U.S. must continue to be proactive in emerging technology fields. China is quickly advancing AI/machine-learning capabilities, the U.S. cannot afford to fall behind in another technology field.

development along with other emerging technologies to maintain U.S. dominance in battle and psychologically.

Psychology plays a significant role in the international arena, especially in long-term power competition. The world's dominant powers are locked in an era of tremendous technological innovation. Losing the edge in any field is damaging to psyche, especially in the current environment. Even in World War I, the effect of superior capabilities on decision-making was seen with the British decision to set up a distant blockade of the North Sea instead of a close blockade of Germany due to the threat of torpedoes and mines.⁴² Even though both technologies were still in development and did not have a high success rate, the threat of their capability impacted maritime strategy.⁴³ Similarly, China and Russia having a highly maneuverable, high-speed, nuclear-capable weapon system that the U.S. cannot defend against opens the door to additional adversary strategies and target sets while limiting U.S. alternatives and responses. Thus, the U.S. needs to match China and Russia system for system in capability to maintain balance in the realm of psychological warfare and maintain status as a dominant world power.

VI. A CALL TO ACTION

Although the United States has made significant strides in acknowledging the potential of hypersonic capabilities as an emerging technology and its impact on the character of war, continued diligence is vital. The country has already fallen behind China and Russia in fielding

⁴² Havern, Christopher. *Woodrow Wilson, World War I, and Freedom of the Seas*. Naval History and Heritage Command, 30 October 2020, <https://www.history.navy.mil/content/history/nhhc/browse-by-topic/wars-conflicts-and-operations/world-war-i/history/ww1-freedom-of-seas.html>.

⁴³ Navy Department Library. *American Ship Casualties of the World War*. Naval History and Heritage Command, 22 August 2017, <https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/a/american-ship-casualties-world-war.html>.

the capability; the U.S. cannot allow itself to also fall behind in effectively incorporating and integrating these new capabilities tactically, strategically, and operationally. China and Russia may have outpaced the U.S. in deploying the capability, but the U.S. still has the opportunity to show its superiority in integration and strategy development. Demonstrating an operationally ready weapon system does not demonstrate superiority in strategy or tactics. It is a challenge to field a capability, but an entirely different scenario to utilize it effectively and strategically.

Russia has illustrated this challenge in Ukraine. Kinzhal missiles have been deployed targeting underground warehouses and storage bases. Although a few of the missiles successfully hit their targets, strategically, the weapon did not appear to impact Russian progress significantly. Although showing its superior military force through this demonstration, Russia failed to achieve any other notable gains in the region from these strikes.⁴⁴ More recently, Russia again attempted to assert its dominance and signal its willingness to escalate the conflict in the region by sending a frigate armed with the Kinzhal to the Atlantic Ocean.⁴⁵ While the country has not operationally demonstrated the significance of hypersonic capabilities, it is experimenting with strategy and deterrence through these actions. Learning through failure is effective, and Russia is gaining plenty of experience integrating its strategies with its hypersonic capabilities. During this conflict, the U.S. is in a unique position where the country can observe the conflict and learn from Russia's mistakes.

Outside of the conflict in Ukraine, the growing threat posed by China and its assertive posturing in the South China Sea further emphasizes the necessity for the U.S. to develop and

⁴⁴ Sokol, Lia. "Russia's Kinzhal Hypersonic Missile: A Game-Changing Weapon or a Distraction?"

⁴⁵ Reuters. "Russia's Putin deploys frigate with new Zircon hypersonic cruise missiles to Atlantic" South China Morning Post, 4 January 2023, <https://www.scmp.com/news/world/russia-central-asia/article/3205600/russia-sends-unique-new-hypersonic-cruise-missiles-atlantic-and-indian-oceans>.

deploy hypersonic capabilities and strategies rapidly.⁴⁶ Power transition theory asserts that great-power wars typically occur at the intersection of one hegemon's rise and another's decline.⁴⁷ China's current state suggests that its impending decline may cause it to act now instead of waiting for its peak power to decline.⁴⁸ Currently, China has hypersonic capabilities that the U.S. and its allies have not deployed. The country also has enjoyed decades of growth but is now facing demographic, economic, and political challenges. Historically, dominant powers on the decline have acted in line with the power transition theory, acting aggressively before a decline in their country's power. In World War I, the Germans felt cornered and provoked war before their impending decline, believing that acting immediately would result more favorably as the country was at the peak of its power. Similarly, the Japanese decision to attack Pearl Harbor, provoking World War II in the Pacific, was motivated by the country's realization that acting before their power declined was their only hope and option. Power transition theory, China's current status as a declining superpower, as well as the rapidly approaching fielding dates for U.S. hypersonic capabilities, illustrates a volatile international security environment. Due to this environment, the U.S. must remain focused on rapidly deploying a hypersonic capability with a thorough deterrence strategy to maintain global peace.

Although the U.S. is behind in the race to field hypersonic weapons, hope can be placed on the country's record of successfully integrating novel technologies into warfare. The U.S. has enjoyed decades of leading the world in not only technological innovation but, more importantly,

⁴⁶ On the other hand, China has a number of internal issues including political protests and growing demographic and population troubles that it must handle and prioritize before acting aggressively externally.

⁴⁷ Organski, A.F.K. *World Politics*. (Cambridge University Press: New York, 1958) 19.

⁴⁸ Brands, Hal; Beckley, Michael. "China Is a Declining Power—and That's the Problem" *Foreign Policy-com*, 24 September 2021, <https://foreignpolicy-com.usnwc.idm.oclc.org/2021/09/24/china-great-power-united-states/>.

successful strategic integration and deployment of those innovations. The U.S. must continue to prioritize developing hypersonic capabilities while exercising the same amount of diligence in strategy development, integration, and deployment of the capabilities. While hypersonic weapons are viewed as decisive offensive tools, they also have the capacity to influence psychology and adversary decision-makers significantly. Moving forward, the U.S. must be prepared to harness the versatile capabilities that hypersonic weapons offer and realize the potential for these technologies to enhance deterrence and grand strategy.

Bibliography

- Brands, Hal; Beckley, Michael. "China Is a Declining Power—and That's the Problem" Foreign Policy-com, 24 September 2021, <https://foreignpolicy-com.usnwc.idm.oclc.org/2021/09/24/china-great-power-united-states/>.
- DARPA Outreach. "Final Flight of HAWC Program Screams Through the Sky." *DARPA*: 30 Jan 2023, online. <https://www.darpa.mil/news-events/2023-01-30>
- Eckstein, Megan. "U.S. Navy touts hypersonic missile progress ahead of 2025 fielding," DefenseNews, 1 November 2022, <https://www.defensenews.com/naval/2022/11/02/us-navy-touts-hypersonic-missile-progress-ahead-of-2025-fielding/>.
- Episkopos, Mark. "Bad News: Russia's Tsirkon Hypersonic Missiles Are Coming 2025" The National Interest, 26 August 2021, <https://nationalinterest.org/blog/buzz/bad-news-russias-tsirkon-hypersonic-missiles-are-coming-2025-192495>.
- Feickert, Andrew. "The U.S. Army's Long-Range Hypersonic Weapon (LRHW)" Congressional Research Service, 23 May 2022, <https://crsreports.congress.gov/product/pdf/IF/IF11991>.
- Griffin, Michael. "Statement of Michael D. Griffin, Under Secretary of Defense for Research and Engineering before the House Armed Services Subcommittee on Intelligence, FY20 Science and Technology Posture Hearing." 11 March 2020, <https://www.congress.gov/116/meeting/house/110655/witnesses/HHRG-116-AS26-Wstate-GriffinM-20200311.pdf>.
- Harper, Jon. "Federal A.I. Spending to Top \$6 Billion" National Defense, 10 February 2021, [https://www.nationaldefensemagazine.org/articles/2021/2/10/federal-ai-spending-to-top-\\$6-billion](https://www.nationaldefensemagazine.org/articles/2021/2/10/federal-ai-spending-to-top-$6-billion).
- Havern, Christopher. *Woodrow Wilson, World War I, and Freedom of the Seas*. Naval History and Heritage Command, 30 October 2020, <https://www.history.navy.mil/content/history/nhhc/browse-by-topic/wars-conflicts-and-operations/world-war-i/history/ww1-freedom-of-seas.html>.
- Jervis, Robert. 1978. "Cooperation Under the Security Dilemma." *World Politics* 30 (2): 167–214.

- Losey, Stephen. "US Air Force drops Lockheed hypersonic missile after failed tests." *DefenseNews*, 30 Mar 2023, <https://www.defensenews.com/air/2023/03/30/us-air-force-drops-lockheed-hypersonic-missile-after-failed-tests/>.
- Losey, Stephen. "What should be the United States' next move on hypersonic tech?" *DefenseNews*, Washington, D.C., 14 March 2022, [defensenews.com/air/2022/03/14/what-should-be-the-united-states-next-move-on-hypersonic-tech/](https://www.defensenews.com/air/2022/03/14/what-should-be-the-united-states-next-move-on-hypersonic-tech/). Online.
- McKinney, Jared M., and Peter Harris, "Broken Nest: Deterring China from Invading Taiwan," *Parameters*, 51:4 (2021), 23-36.
- Mihayloff, Andrey. "Russia's new Kh-95 hypersonic missile ends the arms race with the United States," *Pravda*, 11 October 2021, https://english.pravda.ru/science/149597-hypersonic_missile/.
- Missile Defense Project, "Avangard," *Missile Threat*, Center for Strategic and International Studies, January 3, 2019, last modified July 31, 2021, <https://missilethreat.csis.org/missile/avangard/>.
- Nakamura, Ryo. "Pentagon sounds alarm on China's 'hundreds' of hypersonic tests," *Nikkei Inc.*, 30 October 2021, <https://asia.nikkei.com/Politics/International-relations/Pentagon-sounds-alarm-on-China-s-hundreds-of-hypersonic-tests>.
- Navy Department Library. *American Ship Casualties of the World War*. Naval History and Heritage Command, 22 August 2017, <https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/a/american-ship-casualties-world-war.html>.
- Office of the Secretary of Defense. *Military and Security Developments Involving the People's Republic of China*, 2021. <https://media.defense.gov/2021/Nov/03/2002885874/-1/-1/0/2021-CMPR-FINAL.PDF>.
- Organski, A.F.K. *World Politics*. (Cambridge University Press: New York, 1958).

Outreach Defense Advanced Research Projects Agency. "DARPA'S Hypersonic Air-breathing Weapon Concept (HAWC) Achieves Successful Flight." *Defense Advanced Research Projects Agency*, 27 September 2021, <https://www.darpa.mil/news-events/2021-09-27>.

Reuters. "Russia's Putin deploys frigate with new Zircon hypersonic cruise missiles to Atlantic," *South China Morning Post*, 4 January 2023, <https://www.scmp.com/news/world/russia-central-asia/article/3205600/russia-sends-unique-new-hypersonic-cruise-missiles-atlantic-and-indian-oceans>.

Sayler, Kelley. "Defense Primer: Hypersonic Boost-Glide Weapons." *Congressional Research Service*, 14 November 2022. PDF.

Sayler, Kelley. "Hypersonic Missile Defense: Issues for Congress." *Congressional Research Service*, 3 October 2022. PDF.

Sayler, Kelley. "Hypersonic Weapons: Background and Issues for Congress." *Congressional Research Service*, 27 October 2022. PDF.

Schelling, Thomas C. 1963. *The Strategy of Conflict*. New York: Oxford University Press, Ch8, 187-203.

Sokol, Lia. "Russia's Kinzhal Hypersonic Missile: A Game-Changing Weapon or a Distraction?" *Nuclear Threat Initiative*, 7 April 2022, <https://www.nti.org/atomic-pulse/russias-kinzhal-hypersonic-missile-a-game-changing-weapon-or-a-distraction/>.

Suciu, Peter. "Meet ARRW: The U.S. Air Force Is Going All In On Hypersonic Weapons" *19FortyFive*, 6 December 2022, <https://www.19fortyfive.com/2022/12/meet-arrw-the-u-s-air-force-is-going-all-in-on-hypersonic-weapons/>.

Tan, Melissa. "Frost & Sullivan Analyzes Hypersonic Technology Development in the United States." Frost & Sullivan; San Antonio, TX, 7 June 2021. <https://www.frost.com/news/press-releases/hypersonic-technology-development-in-the-unitedstates/#:~:text=Since%202016%2C%20spending%20on%20hypersonic%20capability%20by%20the,the%20way%20in%20investments%2C%20followed%20by%20the%20Army>.

U.S. Department of Defense. *2022 National Defense Strategy of the United States of America*. 27 October 2022, media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF. Online.

U.S. Department of Defense. *Summary of the 2018 National Defense Strategy of the United States of America*. 19 January 2018, hsdl.org/c/2018-national-defense-strategy/. Online.

U.S. Department of Defense. *2008 National Security Strategy of the United States of America*. June 2008, <https://nssarchive.us/national-defense-strategy/national-defense-strategy-2008/>. Online.

Waddel, Kaveh; Pandey, Erica. "China is eroding the U.S. edge in A.I. and 5G" *Axios*, 25 September 2019, <https://www.axios.com/2019/09/25/china-united-states-ai-quantam-computing-research-5g>.

White, Mike. "Hypersonic Strike and Defense: A Conversation with Mike White." *Center for Strategic and International Studies*, Superior Transcriptions LLC., 2 June 2021, csis.org/analysis/hypersonic-strike-and-defense-conversation-mike-white. Transcript.

Widener, Laura. "U.S. military shocked: China flew hypersonic nuke capable missile around the globe; 'We have no idea how they did this': report," *American Military News*, 18 October 2021, <https://americanmilitarynews.com/2021/10/us-military-shocked-china-flew-hypersonic-nuke-capable-missile-around-the-globe-we-have-no-idea-how-they-did-this-report/>.