

FEBRUARY 2021

On the Horizon

A Collection of Papers from the Next Generation

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Reja Younis

AUTHORS
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A Report of the
CSIS PROJECT ON NUCLEAR ISSUES

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

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About the Project on Nuclear Issues

The Project on Nuclear Issues (PONI) was founded in 2003 to develop the next generation of policy, technical, and operational nuclear professionals by fostering, sustaining, and convening a networked community of emerging experts. PONI identifies and cultivates emerging thought leaders by building relationships, deepening understanding, and sharing perspectives across the full range of nuclear issues and communities. PONI's programs provide inclusive, diverse, and creative opportunities for emerging experts to learn about policy, technical, and operational aspects of the nuclear enterprise, develop and present new concepts and ideas, engage in thoughtful and informed debates, and tour and visit sites across the nuclear enterprise.

PONI works to achieve this mission through several objectives:

- Identifying emerging thought leaders and providing them with the opportunity to develop and present new concepts and ideas.
- Sponsoring new cutting-edge research.
- Encouraging thoughtful and informed debate.
- Engaging a broad and diverse community across the country and internationally.
- Providing a networked platform for information-sharing and collaboration across the broad nuclear community.
- Cultivating young professionals through opportunities to build relationships, deepen understanding, and share perspectives across the full range of nuclear issues and communities.

PONI sponsors numerous opportunities for young professionals to engage in thoughtful and informed debate on the nuclear community's most pressing challenges.

PONI strives to expand its outreach to address all career and academic levels, connect young professionals in collaborative research projects, broaden the topics it covers across the full spectrum of nuclear issues, and ensure robust inclusion of expertise from all critical domains – academic, military, scientific, and technical.

1. Inclusivity – Welcome all ideas and perspectives across political, ideological and policy spectrum.
2. Diversity – Actively seek interdisciplinary perspectives (technical, operational, corporate, government, academic) and embrace participation across all demographics.

3. Creativity – Promote collaborative, innovative research and dynamic, engaging programming.

Amongst the various programming opportunities available through PONI, the authors in this publication were members of PONI's 2020 Nuclear Scholars Class. The PONI Nuclear Scholars Initiative is a group of select graduate students and young professionals. The Nuclear Scholars Initiative aims to provide top graduate students and young professionals from around the country with a unique venue to interact and dialogue with senior experts on nuclear weapons issues. Those accepted into the program are hosted once per month at CSIS in Washington, DC, where they participate in daylong workshops with senior government officials, policy experts, and technical experts. Over the course of the six-month program, Scholars are required to prepare a research product. PONI has several alumni from this initiative, many of which continue to work in the nuclear field and are likely to play key roles in nuclear policy development, technical innovations, and operations.

Acknowledgments

PONI owes many thanks to the authors for their dedication and outstanding work. We appreciate senior experts and Mid-Career Cadre members who reviewed and edited; provided mentorship and guidance; and came to speak with the Nuclear Scholars during their workshops. PONI could not function without their generosity and support.

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Introduction

The role that nuclear weapons play in international security has changed since the end of the Cold War, but the need to maintain and replenish the human infrastructure for supporting nuclear capabilities and dealing with the multitude of nuclear challenges remains essential. For a number of reasons, including the diminished emphasis on nuclear weapons post-Cold War, expertise on nuclear issues—particularly within younger generations—declined following the end of the Cold War. Cultivating the expertise that is critical to meeting the nuclear challenges of the future remains difficult despite efforts to rebuild and restore this essential cadre of talent and expertise.

Meeting the security challenges of the future will require a sustained effort over the long-term by a multidisciplinary cadre of nuclear experts who are equipped with critical knowledge and skills, as well as a robust professional network. It will also require new and creative thinking on how to approach various political, military, legal, and technical challenges in the United States and around the world.

Recognizing this challenge, the Center for Strategic and International Studies (CSIS) launched the Project on Nuclear Issues (PONI) in 2003 to develop the next generation of policy, technical, and operational nuclear professionals by fostering, sustaining, and convening a networked community of emerging experts to meet the nuclear challenges of the future. PONI seeks to revitalize and strengthen the community of nuclear experts whose training and background increasingly emphasize multidisciplinary expertise, especially among young generations.

PONI runs two signature programs—the Nuclear Scholars Initiative and the Annual Conference Series—to engage emerging nuclear experts in thoughtful and informed debate over how to best address the nuclear community's most pressing problems. The papers included in this volume comprise research from participants in the 2020 Nuclear Scholars Initiative. PONI sponsors this research to provide a forum for facilitating new and innovative thinking and to provide a platform for emerging thought leaders across the nuclear enterprise. The papers in this volume span a wide range of technical and policy issues, further discussion in their respective areas, and provide innovative recommendations for pressing challenges. To that end, these papers explore such topics as the impacts of emerging technologies and capabilities, exploring nuclear strategy and national policies, proposing paths forward for addressing proliferation challenges, and enhancing arms control in contentious environments.

Military Micro Nuclear Reactors

Proliferation Problem or Energy Solution?

Alex Bednarek[1]

ABSTRACT

The design and development of micro nuclear reactors (referred to throughout this paper as "microreactors") for a variety of purposes have recently become a topic of significant discussion. One such novel application for these future reactor types includes the potential use in forward operating bases or other remote facilities/installations operated by the U.S. military. Responding to an August 2016 Defense Science Board report on Energy Systems for Forward Remote Operating Bases, the U.S. Office of the Undersecretary of Defense for Research and Engineering (OUSD (R&E)) identified microreactors as a potential solution to electric power needs in rapid response scenarios. OUSD (R&E) argued that these microreactors make more energy available while "drastically simplifying the complex fuel logistical lines which currently support existing power generators operating mostly on diesel fuel."[2] These reactors could also enable a more rapid response during humanitarian aid and disaster relief operations.

However, due to size constraints, most microreactor designs require fuel of a higher enrichment level than that which is used in most existing nuclear power reactors. This more highly enriched fuel carries its own security, safety, and nonproliferation issues, which are only multiplied when located at higher-risk facilities such as military bases or installations. In its Request for Solution document, the Department of Defense (DOD) laid out a high bar of safety and security requirements for potential military-use microreactors. However, questions remain regarding the safety and security of these reactors, and non-

1. Alex Bednarek is a program officer on the International Fuel Cycle Strategies team at the Nuclear Threat Initiative (NTI) in Washington, DC. The views expressed in this paper are those of the author and do not necessarily reflect the views of NTI officers, staff, or the NTI Board of Directors, or the institutions with which they are associated.
2. "Request for Solutions Pele," Department of Defense, June 3, 2019, https://govtribe.com/opportunity/federal-contract-opportunity/request-for-solutions-pele-requestforsolutionspele.

specific requirements for the minimization of proliferation risk must be addressed for this project to be a demonstrable success.

BACKGROUND

WHAT IS A MICROREACTOR?

According to the Idaho National Laboratory, a microreactor is "a small nuclear reactor that can operate as part of the electric grid, independently from the electric grid, or as part of a microgrid to generate approximately 1 to 20 megawatts of electricity (MWe) and provide heat for industrial applications."[3] Many microreactor designs also ensure operability for up to 10 years without needing to be refueled.

The U.S. Department of Energy (DOE) further defines microreactors not by their fuel form or coolant of choice but by three main features:[4]

1. **Factory Fabricated:** These microreactors would be fully assembled in a factory before being shipped out to a specific location, thereby eliminating large-scale construction challenges and reducing initial construction costs.
2. **Transportable:** Effective microreactors would be small enough, by design, to be easily transportable by rail, truck, aircraft, or shipping vessel.
3. **Self-Adjusting:** The simplicity of microreactor designs would allow microreactors to self-adjust, meaning that they would not require a large number of specially trained staff or operators, and would utilize effective passive safety systems to prevent issues such as overheating or reactor meltdown.

As they offer reliability, transportability, and flexibility in operations not found in larger-scale nuclear power reactors, significant interest has been shown in microreactors as of late to address power generation challenges in places such as isolated villages and laboratories, locations undergoing natural disaster recovery, and forward-deployed or remote military installations.

ENRICHMENT

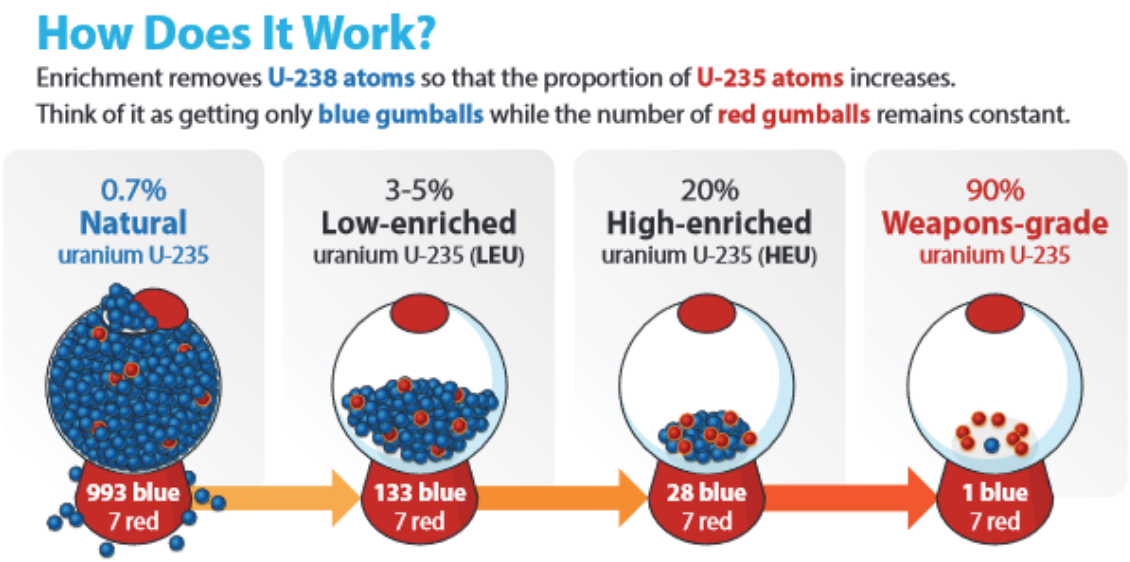
Due to the inherent size constraints in making a microreactor easily transportable, while still generating power outputs of up to 10 MWe, the fuel used for most microreactor designs will have to be enriched to a level higher than that of the majority of standard operating nuclear power reactors. Most nuclear reactors around the world use uranium as fuel. Uranium ore deposits, which are found in abundance in many places around the world, are composed primarily of two isotopes in the following proportions: 99.3% non-fissile uranium-238 (U-238) and 0.7 percent fissile uranium-235 (U-235).[5]

In most nuclear reactors, the uranium used as fuel needs to undergo an enrichment process which increases the proportion of the fissile U-235 in order to effectively operate. Most reactors operate with fuel that is enriched to between 3 and 5 percent U-235, and all uranium that is enriched to below 20 percent U-235 is considered low-enriched uranium (LEU). If fuel is enriched to above 20 percent U-235, it is referred to as highly enriched uranium (HEU), and if it is enriched to above 90 percent U-235, it is considered weapons-grade (See Figure 1). DOD has requested that proposed

3. "Microreactors," Idaho National Laboratory, https://inl.gov/trending-topic/microreactors/.
4. Department of Nuclear Energy, "What is a Nuclear Microreactor?," Department of Energy (DOE), October 23, 2018, https://www.energy.gov/ne/articles/what-nuclear-microreactor.
5. Natural uranium also contains negligible trace amounts of the isotope uranium-234.

microreactors use what is known as high-assay LEU fuel (HALEU), which is fuel enriched to above 5 percent but below the HEU threshold of 20 percent.

Figure 1: Uranium Enrichment Scale



Source: "A Little Enrichment Goes a Long Way," Center for Nonproliferation Studies (CNS)/Nuclear Threats Initiative (NTI), December 2019, https://media.nti.org/documents/enrichment_infographic.pdf.

Due to the nature of the enrichment process, most of the work of increasing the proportion of fissile U-235 is done at the lower enrichment levels. Therefore, the higher the fuel enrichment level, the higher the proliferation sensitivity, as the work required to continue enriching decreases exponentially at higher percentages (See Figure 2).

Figure 2: Effort to Attain Enrichment Levels



Source: "A Little Enrichment Goes a Long Way," Center for Nonproliferation Studies (CNS)/Nuclear Threats Initiative (NTI), December 2019, https://media.nti.org/documents/enrichment_infographic.pdf.

HALEU has been recognized as of higher proliferation and security sensitivity than the 3 to 5 percent enriched LEU used in standard nuclear power reactors. The International Atomic Energy Agency (IAEA), for example, classifies 10 or more kilograms of U-235 found in LEU enriched to between 10 and 20 percent as Category II, above where it puts 10 kilograms or more of LEU enriched to less than 10 percent, indicating that it requires stronger physical protection and security.[6] These potential proliferation risks will be discussed in more detail in a following section.

PROJECT PELE

BACKGROUND

In August 2016, the Defense Science Board concluded that energy delivery and management continue to be a critical defensive risk. Of particular concern were the inherent dangers, logistical complexities, and overwhelming costs of sustaining forward operating bases' power demands using diesel generators. Future military platforms and capabilities are likely to require more, not less, energy, further complicating the issue of supplying electricity to forward and remote operating bases.

To address these risks, DOD launched Project Pele, which is tasked with developing a safe, mobile nuclear microreactor to support a variety of DOD missions.[7] Project Pele's Request for Solutions document called for microreactor designs with a very specific set of characteristics:[8]

- Reactors should generate threshold power (1 to 10 MWe) for longer than 3 years without refueling and must fit in a standard 20- or 40-foot storage container.
- Reactors should be able to reach full electric power operations without offsite power within 72 hours of arrival on site and take no longer than 7 days to shut down, cool down, disconnect, and be prepared for safe transport.
- Reactors should operate semi-autonomously without attended control to ensure safe operation and require minimal overall monitoring and preventative maintenance.
- Core designs should be subcritical and must use HALEU advanced gas reactor (AGR) tri-structural isotropic (TRISO) fuel enriched to less than 19.8 percent.
- Finally, the technology, engineering, and operations must demonstrate minimization of added proliferation risk.

To put this mission in context, according to a 2010 Noblis report, *Sustainable Forward Operating Bases*, estimates of energy demand at forward operating bases depend on size, location, and the mission of those bases but can require 5 MW or more of continuous power. To meet these requirements, larger bases may have a power supply that far exceeds the demand—the example provided in the report of Camp Leatherneck had 19 MW capacity supplied by "196 generators running at 30% capacity and

6. International Atomic Energy Agency (IAEA), *National Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities*, IAEA Nuclear Security Series No. 13 (Vienna: 2011), https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1481_web.pdf.
7. While it is not the primary focus of this paper, it is worth noting that Project Pele is not the only DOD project aimed at introducing small nuclear reactors to military facilities. While Project Pele is primarily focused on prototyping a new design with an eye toward forward-based operations, DOD is also engaged in a project through its Office of the Undersecretary of Acquisition and Sustainment (OUSD (A&S)) focused on introducing an NRC-licensed small modular reactor (SMR) built off commercial technology to domestic military facilities by 2027. OUSD (A&S) is looking to develop this technology to minimize the military's reliance on domestic power grids, which are considered to be vulnerable to physical and cyberattacks.
8. Strategic Capabilities Office, "Request for Solutions (Amendment No. 1); Pele Program Phase I," April 29, 2019, https://govtribe.com/opportunity/federal-contract-opportunity/request-for-solutions-pele-requestforsolutionspele#updates-table.

consuming 15,431 gallons of fuel per day."[9] These 196 generators could hypothetically be replaced by as few as two 9 to 10 MW microreactors developed for Project Pele and remove the need for a fossil fuel supply chain, greatly simplifying the power supply mission of such bases.

While Project Pele is led by DOD, it is not alone. The U.S. Nuclear Regulatory Commission (NRC), DOE, and DOD Strategic Capabilities Office (SCO) signed a memorandum of understanding (MOU) on microreactor research development and demonstration on May 10, 2019, outlining cooperation and coordination between the three agencies on Project Pele. The MOU "specifically lists DOE and its national laboratory infrastructure for providing technical, National Environmental Protection Act (NEPA), siting, and safety basis documentation support."[10]

In March 2020, the DOD awarded $39.7 million in contracts to three companies to start design work on a mobile microreactor that would fulfill these requirements. The contracts were awarded to BWX Technologies, Inc. ($13.5 million), Westinghouse Government Services ($11.9 million), and X-Energy, LLC ($14.3 million). According to a DOD spokesperson, after a two-year design-maturation period, DOD may select one of the three companies to build and demonstrate a prototype.[11]

Project Pele is not the first attempt by the U.S. military to develop small-scale nuclear power plants for military use. In 1954, the Department of the Army and the Atomic Energy Commission established the Army Nuclear Power Program (ANPP), which sought to develop "small, rugged, and transportable nuclear plants that could provide both heat and electricity at remote military installations."[12] Throughout the life of the ANPP, nine reactors were designed, constructed, operated, and decommissioned—two gas-cooled reactors, six pressurized water reactors, and one boiling water reactor. Seven of these reactors were located on U.S. territory, while two of the six pressurized water reactors were located internationally at Camp Century, Greenland and McMurdo Sound, Antarctica. Due to changing military requirements and limitations in funding, ANPP ceased operations in 1977.[13]

SAFETY CONCERNS

Critics of Project Pele point to what they view as potentially unrealistic safety requirements—that it is impossible to develop an inherently safe design that ensures a meltdown is physically impossible in certain complete failure scenarios, including adversary attacks. Critics such as Edwin Lyman, senior scientist and director of the Nuclear Safety Project at the Union of Concerned Scientists, are concerned that a nuclear reactor meant to operate within a war zone is at heightened risk to experience beyond-design-basis events, making it impossible to design a completely safe system. Lyman argues that a severe enough accident or sabotage could "induce more extreme conditions than the reactor is designed to withstand."[14]

9. Strategic Environmental Research and Development Program (SERDP), *Sustainable Forward Operating Bases* (Reston, VA: Noblis, May 2010), 34, https://www.serdp-estcp.org/content/download/8524/104509/file/FOB_Report_Public.pdf.
10. "DOE-ID NEPA CX Certification," Idaho National Laboratory, September 11, 2019, https://www.id.energy.gov/NEPA/DOE-ID-INL-19-057.pdf.
11. Aaron Mehta, "Pentagon awards contracts to design mobile nuclear reactor," Defense News, March 9, 2020, https://www.defensenews.com/smr/nuclear-arsenal/2020/03/09/pentagon-to-award-mobile-nuclear-reactor-contracts-this-week/.
12. "Army Nuclear Power Program, 1954-1976," U.S. Army Corps of Engineers, https://www.usace.army.mil/About/History/Exhibits/Nuclear-Power-Program/.
13. National Nuclear Security Administration, *Highly Enriched Uranium: Striking a Balance* (Washington, DC: DOE, 2004), Appendix D, https://fas.org/sgp/othergov/doe/heu/appd.pdf.
14. Edwin Lyman, "The Pentagon wants to boldly go where no nuclear reactor has gone before. It won't work.," *Bulletin of the Atomic Scientists*, February 22, 2019, https://thebulletin.org/2019/02/the-pentagon-wants-to-boldly-go-where-no-nuclear-reactor-has-gone-before-it-wont-work/.

Lyman also argues that, should the core of these reactors be breached by an attack, it is difficult to imagine there not being some dispersal of radioactive contamination:

> An operating nuclear reactor is essentially a can filled with concentrated radioactive material, including some highly volatile radionuclides, under conditions of high pressure and/or temperature. Even a reactor as small as 1 megawatt-electric would contain a large quantity of highly radioactive, long-lived isotopes such as cesium-137—a potential dirty bomb far bigger than the medical radiation sources that have caused much concern among security experts.[15]

In an attempt to address some of these concerns, the program manager of Project Pele, Jeff Waksman, gave an interview in April 2020 to Breaking Defense in which he stated that the DOD does not envision these reactors being placed in a tactical zone, at least in the short term. However, recognizing that it would be possible to hit a reactor such as this with something large or explosive enough to breach the core, Waksman argues that the TRISO fuel type required by the Request for Solutions document is key to addressing this concern. In Waksman's words:

> The premise of the TRISO is that all those [radioactive] gases are divvied up among a million little pellets. If you only breach one pellet, only one millionth of the gas gets out. We believe that the area that would be impacted by radiation should be comparable to the area that would be destroyed by the explosive.[16]

DOE's definition of TRISO fuel lends credibility to Waksman's argument. According to DOE, TRISO fuel is a particle-type fuel composed of particles or pellets made from a uranium, carbon, and oxygen fuel kernel encapsulated with several layers of carbon- and ceramic-based materials that prevent the release of radioactive fission products. The DOE states that TRISO fuels are "structurally more resistant to neutron irradiation, corrosion, oxidation and high temperatures . . . than traditional fuels" and that TRISO particles "cannot melt in a reactor and can withstand extreme temperatures that are well beyond the threshold of current nuclear fuels."[17]

However, while Waksman's statement that the area of radiation contamination should be comparable to that which would be destroyed by the conventional explosive indicates the forethought of containing radiation release, even area denial of the blast radius caused by such a release of radiation could still be very challenging to address, especially in remote areas without direct access to specialized cleanup equipment.

ENVIRONMENTAL IMPACT

As part of the project development process, the National Environmental Policy Act (NEPA) of 1969 requires federal agencies to evaluate the potential environmental effects of proposed major federal actions through an environmental impact statement (EIS). An EIS describes positive and negative impacts of such a proposed action and usually provides one or more alternative actions that could be undertaken; at the least, a "no action alternative" is required, which identifies the expected environmental impacts if existing conditions remain with no action taken by the lead agency.

15. Ibid.
16. Sydney J. Freedberg, Jr., "New TRISO Nuclear Mini-Reactors Will Be Safe: Program Manager," Breaking Defense, April 8, 2020, https://breakingdefense.com/2020/04/new-triso-nuclear-mini-reactors-will-be-safe-program-manager/.
17. Office of Nuclear Energy, "TRISO Particles: The Most Robust Nuclear Fuel on Earth," U.S. Department of Energy, July 9, 2019, https://www.energy.gov/ne/articles/triso-particles-most-robust-nuclear-fuel-earth.

Project Pele is currently undergoing the EIS process and recently invited public comment on the scope of the EIS from the period March 2, 2020 to April 30, 2020. After an initial public webcast that gave an overview of the program, the scope of the project, and initial next steps, the public was invited to submit comment by email or mail directly to the DOD SCO offices.[18] It does not appear that DOD SCO has made the comments from the public available for viewing, but the next step is for DOD SCO to prepare a draft EIS that will be released alongside a public meeting and a 45-day comment period. DOD SCO will then take those comments and reviews and draft the final EIS. There is no indication of when the EIS will be completed. However, the Council on Environmental Quality found that EISs from 2010 to 2018 took around 4.5 years on average to complete.[19]

SPENT FUEL MANAGEMENT

DOD SCO has also not been clear on their plans for the safe and secure management of spent nuclear fuel from these reactors. Speaking on the public scoping webcast for the EIS, Waksman acknowledged the need for a plan to effectively manage the waste and spent nuclear fuel, though no detailed plans have been provided. The Nuclear Energy Institute's (NEI) Director of New Reactors Marc Nichol believes that the mobile reactors will be brought back whole to the United States to refuel, which could prove to be an advantage of the microreactors size.[20]

However, any decisions to keep spent fuel on site would raise a number of questions. Should the spent fuel be immediately transportable, any fuel shipment back to a secure centralized facility within the United States would almost certainly require specialized canisters and handling equipment. If it is not immediately transportable, safety and security considerations must be taken into account for the additional challenges of on-site pool or dry cask storage facilities. Finally, due to significant political challenges, it is highly unlikely that a permanent disposal option will be available on site or immediately off site for reactors located on or off U.S. territory.

From historical example, it appears that most of the spent fuel from the reactors developed under ANPP was successfully transported to either the Savannah River Site in South Carolina or the Idaho National Engineering and Environmental Laboratory, now Idaho National Laboratory. This might lend credibility to an assumption that spent fuel from reactors developed under Project Pele would also be transported back to a secure centralized facility within the United States, likely a U.S. national nuclear laboratory. However, a concrete plan for management of this spent fuel and other waste in the early stages of Project Pele is critical for future success.

SECURITY AND PROLIFERATION CONCERNS

There are also unique proliferation concerns that come with basing a mobile nuclear reactor on forward and remote operating bases in foreign territory. The design requirements listed above do address some of these concerns, but it does not appear that the DOD has conducted a publicly available in-depth analysis of the proliferation dangers of extraterritorial-based microreactors.

The United States has largely accepted IAEA security classifications when it comes to HALEU, as evidenced by a 1979 Nuclear Regulatory Commission (NRC) ruling that:

18. "Project Pele Public Webcast," YouTube video, posted by KW, March 17, 2020, 30:59, https://www.youtube.com/watch?v=RHUyRumPODs.
19. "Environmental Impact Statement Timelines (2010-2018)," Council on Environmental Quality, June 12, 2020, https://ceq.doe.gov/docs/nepa-practice/CEQ_EIS_Timeline_Report_2020-6-12.pdf.
20. Mehta, "Pentagon awards contracts to design mobile nuclear reactor."

> . . . clandestine enrichment to higher levels may go beyond the capability of subnational terrorists, but it does not go beyond the capability of other governments. Unless properly safeguarded, low enriched uranium could be stolen on behalf of foreign governments and enriched to explosive useable levels after it is smuggled out of the U.S.[21]

In addition, a 1998 Oak Ridge National Laboratory (ORNL) report found that:

> Uranium-235 with enrichments between 10 and 20 wt % are not weapons-usable, but could be converted to weapons-usable materials with a relatively small uranium-enrichment plant. The complexity of these enrichment plants is such that this could not be accomplished by a subnational group, but it could be accomplished by many countries.[22]

The security and proliferation risks of higher enrichment fuels are, therefore, admittedly lower when these materials are located within U.S. territory, but they still exist and are only heightened as enrichment levels increase. Even HALEU, which is not weapons-usable, carries certain proliferation and security risks, which are exacerbated when exported outside the United States. It is worth noting that further enrichment of this fuel is a risk only in countries with current enrichment capability, all of whom are either current nuclear weapons states or have their enrichment facilities under IAEA safeguards. However, while unlikely, the possibility of a country covertly developing an enrichment capability cannot be discounted.

In addition, physical security and protection of these facilities remains a challenge to be addressed by DOD. The risk of nuclear material from these reactors, or even the unlikely scenario of the entire reactor falling into the hands of terrorist groups or other maligned actors, must be accounted for by proper security and protection protocols. The threat of these reactors being captured and potentially moved, studied, or in any way back-engineered could reveal potentially sensitive information that could endanger the further use of these reactors in military applications. This concern, of course, is relative to the extraterritorial location of the reactor—deployment of reactors to Antarctica or Greenland, as was done during the ANPP, carries a very different set of risks as compared to reactors deployed to places such has Afghanistan, Syria, or Iraq.

Utilizing these reactors at military installations outside the United States carries implicit risks that must be addressed. As previously mentioned, the Request for Solutions document specifically required that the "technology, engineering, and operations must demonstrate minimization of added proliferation risk."[23] However, the document did not specifically define this goal, and it is unclear at this point in the development process what the three chosen vendors have promised in their designs that would fulfill this nebulous requirement.

Should these reactors be placed in the territory of states without nuclear weapons, this would raise the question of whether these reactors would have to be placed under IAEA safeguards. The United States is not required to accept safeguards on its nuclear activities unless sites are volunteered. It is unclear whether the United States would volunteer these military microreactors for IAEA safeguards, especially as the Project Pele Request for Solutions document makes no mention of either placing these reactors under international nuclear safeguards or of requiring potential reactor designs to

21. Edwin S. Lyman, "Advanced Reactors: Proliferation and Terrorism Concerns," October 2018 Newsletter, American Physical Society, https://engage.aps.org/fps/resources/newsletters/october-2018.
22. C.W. Forsberg et al., "Definition of Weapon-Usable Uranium-233," ORNL/TM-13517, Oak Ridge National Laboratory, March 1998, https://thoriumenergyalliance.com/wp-content/uploads/2020/02/weapons-usable-u-233-ORNL-TM-13517.pdf.
23. Strategic Capabilities Office "Request for Solutions (Amendment No. 1); Pele Program Phase I."

incorporate safeguards-by-design practices.[24] Effective safeguards-by-design measures, especially in a microreactor design which will likely have many sealed parts and systems unlike those in large-scale power reactors, would almost certainly require design verification inspections at the manufacturing facilities. Submitting their reactors for these design verification inspections should be a requirement of the final contract between DOD SCO and the chosen reactor designer.

In late June 2020, the Senate Armed Services Committee (SASC) released their National Defense Authorization Act (NDAA) bill, which includes a section titled "Report on Micro Nuclear Reactor Programs." This section of the bill requires the secretary of defense to submit a report on DOD micro nuclear reactor programs that includes the following: potential operational uses on U.S. and non-U.S. territory; cost and schedule estimates for each new or ongoing program to reach initial operational capacity; an assessment of physical security requirements; an assessment of any agreements or changes to agreements required for use of such reactors on non-U.S. territory; *applicability of foreign regulations or IAEA safeguards for use on non-U.S. territory*; other policy implications of such systems on non-U.S. territory; summary of requirements pursuant to NEPA; assessment of issues relating to indemnification for operation; determination of whether development, production, and deployment of such systems would require unobligated enriched uranium fuel; and any other considerations deemed relevant by the secretary of defense. The classification of this report is not specified, nor is it clear when this report is due to the appropriate congressional committees.[25]

POLITICAL CONSIDERATION

Consideration must also be given to the political impact of deploying these reactors on foreign territory, with or without "permission" of the host government, especially as it pertains to safety, security, and legacy radioactive waste management. For example, the PM-2 portable reactor installed under ANPP in Camp Century, Greenland played a mostly indirect but substantial role in some political disputes between the United States and Denmark during the program in the 1960s.

Project Iceworm, a program that sought to deploy ballistic missiles under the Greenland ice, necessitated the building of Camp Century—an underground research facility composed of thousands of meters of tunnels. The United States built this facility in partial secret under the auspices of a 1951 Defense Agreement, but this facility extended beyond the territory approved under that agreement, prompting pushback from senior Danish government officials, who were concerned about not only the lack of notice from the United States but also the plans to host nuclear weapons on their territory. The PM-2 reactor was also installed allegedly without permission from or notice to the Danish government, prompting Danish minister of foreign affairs Jens Krag to carefully question U.S. Ambassador to Denmark Val Peterson about the size and purpose of the reactor. While the director of the Danish Foreign Ministry admitted there were no significant "technical issues with a reactor at that location," there was significant concern among senior Danish government leaders about domestic political impact should the camp, mission, and reactor installation become public knowledge.[26]

24. According to the IAEA, Safeguards by Design is "an approach whereby early consideration of international safeguards is included in the design process of a nuclear facility, allowing informed design choices that are the optimum confluence of economic, operational, safety and security factors, in addition to international safeguards." See "Safeguards by design guidance," IAEA, https://www.iaea.org/topics/assistance-for-states/safeguards-by-design-guidance.
25. This version does not yet include the accepted mark-up removing the language regarding limitation of funds: U.S. Congress, Senate, *National Defense Authorization Act For Fiscal Year 2021*, S. 4049, 116th Cong., 2nd sess., June 23, 2020, https://www.congress.gov/116/bills/s4049/BILLS-116s4049rs.pdf.
26. Kristian Hvidtfelt Nielsen and Henry Nielsen, "How the US built a mysterious military camp under the Greendland ice sheet," Science Nordic, December 19, 2017, https://sciencenordic.com/denmark-forskerzonen-history/how-the-us-built-a-mysterious-military-camp-under-the-greenland-ice-sheet/1451993.

While the reactor and spent fuel were returned to the United States when Camp Century closed in 1966, tens of thousands of gallons of radioactive waste from the reactor remain buried under the ice still today.[27] Indeed, as climate change and ice melting has accelerated, concern about the legacy of this nuclear waste has re-entered high-level discussion, as evidenced by an international research group predicting that exposure of this radioactive and other waste "will be irreversible" by 2090, if not sooner.[28] This failure to clean up the legacy waste from Camp Century, including that from the nuclear reactor, in part led to an official complaint being submitted to the United Nations by a member of Greenland's indigenous government body against the Danish government in 2016.[29] It is exactly these complex and sometimes long-term political consequences that must be taken into consideration prior to installation and operation of new microreactors on foreign territories.

RECOMMENDATIONS

While DOD SCO and Project Pele have clearly considered many of the safety and security implications of basing military microreactors outside of the United States, more questions remain. In addition, non-specific requirements addressing the proliferation resistance of these reactors must be further clarified. To assuage continued public concern and strengthen programmatic understanding of these issues, the following recommendations are provided for consideration:

1. **DOD SCO should make all comments submitted as part of the EIS public scoping period available for viewing while a draft EIS is being prepared.**

   Releasing the public comments received during the initial scoping period would help increase transparency and allow the interested public to review what was considered once the draft EIS has been completed. This will allow for a more productive and fruitful public review period following the release of the draft EIS.

2. **DOD SCO must clearly address what will happen with irradiated spent fuel and other radioactive wastes that result from the operation of these reactors.**

   DOD SCO has acknowledged the need for management of waste and spent fuel but has not provided any detailed plans. While the transportability of the reactor itself lends credibility to an assumption that spent fuel will be transported to a secure centralized location within the United States—likely one of the U.S. national nuclear laboratories—the lack of a clear and public plan at this point in the process is concerning. Spent fuel contains highly radiotoxic fission products that require specialized containers for transportation. Should this spent fuel not immediately be moved, maintaining on-site wet or dry cooling and storage facilities invites increased safety challenges that must be addressed. In addition, due to substantial political challenges, it is highly unlikely that permanent disposal options will be available on site or immediately off site. Developing a plan for back-end spent fuel management in the early stages of a new nuclear power project is critical to the success of such a venture. Such a strong waste management plan must also be flexible for the needs of each reactor placed in foreign territory to mitigate longer-term political consequences.

27. "Camp Century," Atomic Heritage Foundation, July 19, 2018, https://www.atomicheritage.org/history/camp-century.
28. John Henley, "Greenland's receding icecap to expose top-secret US nuclear project," *The Guardian*, September 27, 2016, https://www.theguardian.com/world/2016/sep/27/receding-icecap-top-secret-us-nuclear-project-greenland-camp-century-project-iceworm.
29. Martin Breum, "Grønland klager over Danmark til FN," Informatíon, May 17, 2017, https://www.information.dk/udland/2017/05/groenland-klager-danmark-fn.

3. **DOD SCO should conduct or release a publicly available in-depth analysis of the proliferation challenges of extraterritorial nuclear microreactors on military facilities.**

   It is imperative that DOD SCO understands the full proliferation-related challenges of basing nuclear microreactors with HALEU fuel on military installations outside of U.S. territory. An in-depth study dedicated solely to this purpose, with a publicly available version, would do much to assuage concern from the public. This document should include a much more detailed explanation of the non-specific requirement found in the Project Pele Request for Solutions document that the technology, engineering, and operations must demonstrate minimization of added proliferation risk.

4. **DOD SCO should encourage the potential reactor designers to incorporate safeguards-by-design and should strongly consider placing any extraterritorial reactors under voluntary IAEA safeguards.**

   Incorporating safeguards-by-design would go a long way toward alleviating concerns that these facilities could potentially be used as a source of weapons material for nefarious actors. These safeguards-by-design best practices should include design verification inspections at the manufacturing facilities of the chosen reactor designer. Also, in accordance with the requirement within the SASC NDAA to assess the applicability of IAEA safeguards for use on non-U.S. territory, DOD SCO should strongly consider placing any future extraterritorial reactors under voluntary IAEA safeguards.

CONCLUSION

Project Pele, DOD's latest attempt to introduce nuclear energy infrastructure to remote military installations and other forward operating bases, is a potentially worthwhile program capitalizing on the coupling of past successes with new and innovative technologies. It is clear from the high bar set in the Request for Solutions document that DOD SCO is placing significant importance on the safety and security of these developing microreactors. However, remaining questions regarding the safety and security of these reactors, along with non-specific requirements for the minimization of proliferation risk, must be addressed for this project to be a demonstrable success. Addressing these issues will also go a long way in helping to prevent new and potentially long-term political challenges and consequences as a result of installing and operating these microreactors on foreign territory. Continuing to encourage public input, as well as clearer plans for spent fuel management, understanding of proliferation risks, and safeguards authority over extraterritorial reactors, will be key for ensuring that Project Pele reaches a successful conclusion.

Alternatives to Highly Enriched Uranium in Naval Nuclear Reactors

Brian M. Benedicks[1]

ABSTRACT

The end of World War II brought the reality of the nuclear age and, with it, an entire infrastructure centered around weapons development and an enhanced means of naval propulsion. Over the next few decades, major world powers would compete to develop the infrastructure to mine, enrich, utilize, or store the fissile material on which nuclear power and weaponry initially relied—uranium-235 (U-235). The dismantling of tens of thousands of warheads at the conclusion of the Cold War has left these nuclear states with stockpiles of excess fissile material—a precarious vulnerability, given the rise of state and non-state nuclear ambitions.[2]

Efforts have been directed toward reducing the amount of highly enriched uranium (HEU) to prevent its production for weapons use. More specifically, the United States has previously sought to curb such enrichment at home, despite being viewed as burdensome, to encourage similar practices abroad. HEU is uranium enriched to at least 20 percent U-235. Weapons-grade uranium, enriched up to 90 percent, is prominent among the world superpowers. A few nations have made efforts to reduce their HEU stockpiles through blending (mixing low-enriched uranium, or LEU, with HEU) or storing it in a repository in remote locations. Otherwise, these stockpiles are currently on standby for weapons development or use in civilian and naval nuclear reactors.

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2. Harold A. Feiveson, Alexander Glaser, Zia Mian, and Frank Von Hippel, *Unmaking the Bomb: A Fissile Material Approach to Nuclear Disarmament and Nonproliferation* (Cambridge, MA: MIT Press, 2016).

The current paradigm and infrastructure encourage the use of an HEU stockpile for weapons development; a large HEU stockpile works against any nonproliferation initiative. This paper aims to demonstrate that uses of LEU are feasible and that current efforts to explore alternatives are insufficient. The Navy can do its part by pursuing advanced LEU reactor designs in the short term and exploring thorium seed and blanket designs in the long term.

A BRIEF HISTORY

To make a transition away from HEU, it is imperative to understand how U-235 and modern reactor designs came to be. What drove the creation of the light-water reactor design and its integration into both the civilian and military sector? Answering this question will provide perspective on how difficult changing fuel sources may be and elucidate the resistance to any such efforts in the past.

The concept of nuclear power as a means for electric power generation had its inception during the 1930s. Interest in the technology rapidly escalated with the fear that Germany was seeking to harness nuclear technology's vast potential for an atomic weapon.[3] With new impetus, the motivation behind development of nuclear technology shifted to breeding weapons-grade plutonium; quick amounts of weaponizable material obviated the need for breeder-reactor technology.[4] Breeder reactors are designed to create more fissile material over the course of their lives. For example, in some fast-breeder reactors, U-238 functions as the fertile material. When exposed to a neutron flux, it becomes, through radioactive decay, Plutonium-239 (P-239)—the fissile material. U-235, however, became the primary means by which nuclear weapons were made due to its abundance in nature, which led to the development of an entire infrastructure to mine, enrich, and store such material. The selection of U-235 at the core of the nuclear industry would have far-reaching consequences on any effort to restructure it in the future.

The conclusion of World War II established the United States as the major world player in the nuclear industry. Aside from its implications for war, leaders wanted to explore other applications for this newfound power. This question was answered by the founder of the Naval Nuclear Propulsion Program, Admiral Hyman Rickover. With an expert team of engineers, he set the groundwork of what would become the greatest tactical advantage of maritime warfare—the utilization of nuclear technology for propulsion of submarines and aircraft carriers. Submarines would necessitate the need for small, compact reactors to accommodate the technical specifications of a warship that can readily submerge and maintain superiority. The design constraints narrowed the scope of power plant designs that could meet the needs of the Navy.[5]

Two designs were explored and pursued as the answer to the naval nuclear power question. The first, sodium-cooled reactors, afforded the advantage of not having to be pressurized due to the extremely high boiling point of liquid sodium. This provided a greater margin of safety that was not inherent in other designs being explored. In such a design, liquid sodium functioned as the coolant and afforded a high range of temperatures that could be used to increase efficiency. Another advantage was that sodium-cooled reactors were also breeder reactors; due to utilizing a fast neutron flux (neutrons need not be slowed down by a moderator), U-238 would be transmuted into various fissionable

3. George M. Moore, Cervando A. Banuelos, and Thomas T. Gray, *Replacing Highly Enriched Uranium in Naval Reactors* (Washington, DC: Nuclear Threat Initiative, 2016), 19–37, www.jstor.org/stable/resrep14271.10.
4. Charles D. Ferguson, *Moving Advanced Nuclear Energy Systems to Global Deployment* (Washington, DC: Federation of American Scientists, 2015), 9–16, www.jstor.org/stable/resrep18925.5.
5. Moore, Banuelos, and Gray. *Replacing Highly Enriched Uranium in Naval Reactors*.

materials, and therefore the process produced more fissile materials than it consumed. The pursuit of this technology gave rise to the S1G and S2G plants, the latter of which made its debut on the USS *Seawolf*, commissioned in 1957. As time went on, however, the unfortunate reality of maintenance stemmed the growth of this new design due to the highly reactive nature of sodium. When exposed to water, it would react to form sodium hydroxide and hydrogen; any subsequent reaction with air would result in an explosive interaction with hydrogen. Prone to long shutdowns and time-consuming repairs, Rickover made the decision to abandon the design.[6]

In parallel to the S2G sodium-cooled reactor design, naval reactor engineers were pursuing light-water reactor (LWR) technology. In an LWR, "light" water, or water containing hydrogen with one proton and one electron, is used as both the moderator and the coolant. In contrast, heavy water contains deuterium, a hydrogen isotope containing a neutron in the nucleus. More specifically, pressurized water reactors (PWRs) were selected to be designed and installed on the Navy's first nuclear-powered submarine, the USS *Nautilus*. Initially fueled with 20 percent enriched uranium, the Navy became increasingly aware of how increasing enrichment was inversely proportional to the amount of refueling, shipyard time, and, ultimately, cost.

This led to an incremental increase in reactor fueling throughout the life of the ship and set the precedent for the 90 percent HEU used in reactor cores today; this is paramount to understanding the trajectory of the industry.

Despite a 33 percent efficiency (the measure of how much heat is converted to electrical energy), there were multiple factors that made the PWR design the most feasible and more apt to quickly integrate into the fleet. Having a reactor operating out at sea afforded the unique availability of an infinite "heat sink." This minimized the effect of a low-efficient design by allowing for higher operating temperatures. PWRs were also most able to be retrofitted to a Navy that had already been accustomed to the steam boiler design of most ships. The only difference was that the PWR design would make use of saturated steam instead of the superheated steam employed at that time. Most importantly, the design made use of the HEU stockpile left over from the development of the first nuclear weapons. These factors cemented the LWR design for decades to come in both the military and civilian sector.[7] But among the factors that influenced naval nuclear power, what other factors prompted abandonment of other reactor designs, inhibited pursuit of alternative sources, and placed the entire nuclear industry into technological lock-in?

First, the selection of LWR by the Navy provided a path forward and an infrastructure that would be comparatively less expensive to develop. Unable to garner the starting capital to be competitive with the fossil fuel industry, government subsidies were initially heavily relied upon. Subsidies were often granted on designs that were proven safe and reliable, two factors already demonstrated by Rickover's nuclear model. Another factor was the potential influence the Soviets could wield over satellite nations by exporting advances in nuclear technology.[8] To stem the growth of Soviet influence, the United States, although behind in some advances in nuclear technology, turned to the already established LWR technology as its primary export under the "Atoms for Peace" initiative in the 1960s. Doing so ensured that the majority of the international

6. Thomas B. Cochran, Harold A. Feiveson, and Frank Von Hippel, "Fast Reactor Development in the United States," *Science & Global Security* 17, no. 2-3 (2009): 109–31. doi:10.1080/08929880903445514.
7. Feiveson, *Unmaking the Bomb*.
8. Robin Cowan, "Nuclear Power Reactors: A Study in Technological Lock-in," *Journal of Economic History* 50, no. 3 (1990): 541–567, www.jstor.org/stable/2122817.

market would be light-water technology developed by only two major players: Westinghouse and General Electric.

The nascent nuclear industry, out of political and economic expediency, adopted LWR technology that in retrospect may have not been the most cost-effective design. This also caused the industry that supported the construction of Navy warships to become fixated on PWR and the HEU core. Due to the ongoing growth of LWR technology, the "learning by doing" model, and growing safety margin, any potential breakout technology was snuffed out long before it had a chance to demonstrate its superiority.[9] Coupled with the continuing construction of nuclear-powered warships, there were, and continue to be, a paucity of incentives to upend an infrastructure that has long been in place; the United States is, in a sense, addicted to HEU, with no disruptive technology in sight. Succinctly put, utilizing any alternative means of nuclear power means running against the last five decades of industry development, operating procedures, training of nuclear trained officers, and safety analysis. A total paradigm shift would have to take place that would entirely rewrite the way the United States conducts business. The military, such as at the inception of nuclear power, would have to be the driving force behind breaking the lock-in—an unlikely event.

LEU REVISITED

Although the choice for HEU proved to be expedient, challenges to its use surfaced further away from the Cold War as nonproliferation efforts took center stage after the fall of the Soviet Union. Although efforts have been made to thwart the enrichment of uranium to high percentages, major world powers have long enjoyed loopholes in the nonproliferation treaty that exempt nations from enrichment restrictions.[10] More specifically, major world powers are allowed to enrich uranium for military purposes. As national security risks become more of a concern, the need for the Navy to give LEU a more serious look increases in importance. Currently, the United States uses 90 percent enriched HEU for its nuclear reactors and will continue to do so for the foreseeable future.[11] The current naval response to calls to use LEU has been insufficient at best, and the Navy needs a more in-depth look at reactor designs. Despite the engineering challenges that may be presented with shifting to an LEU core, the Navy can leverage its political power to procure funding toward research and development.

The Navy has formally considered the use of LEU on two occasions, once in 1995 and again in 2014. In 1995, Congress received an official report looking into how an LEU reactor would affect warfighting readiness on a multitude of technical, environmental, economic, and proliferation criteria. It concluded that the Navy would need $800 million over the course of 10 to 15 years to even conceive of an advanced fuel system that could meet its technical needs.[12] Among these needs are compactness, endurance, public safety, and reliability. Given these criteria, the report concluded that the use of LEU would diminish the standard already maintained using HEU and would have failing results regarding economic impact, exposure, and proliferation. The economic impact is argued to be substantial. Maintenance cost would rise by an estimated $1.8 billion, along with shipyard and

9. W. Brian Arthur, "Competing Technologies, Increasing Returns, and Lock-In by Historical Events," *Economic Journal* 99, no. 394 (1989): 116–131, doi:10.2307/2234208.
10. Thomas E. Shea, *The Nonproliferation and Disarmament Challenges of Naval Nuclear Propulsion: A Quid Pro Quo for Nuclear-Armed States and NPT Non-Nuclear Weapon States* (Washington, DC: Federation of American Scientists, 2017), 4–6, www.jstor.org/stable/resrep18940.4.
11. U.S. Department of Energy, *Highly Enriched Uranium: Striking a Balance* (Washington, DC: 2006), https://fas.org/sgp/other-gov/doe/heu/striking.pdf.
12. Director of Naval Nuclear Propulsion, *Report on Low Enriched Uranium in Naval Nuclear Propulsion* (Naval Nuclear Propulsion Program, June 1995), http://large.stanford.edu/courses/2015/ph241/hernandez1/docs/onnp95.pdf.

baseline costs to maintain the same naval presence throughout the world. LEU would also increase radiation exposure to shipyard workers and to the environment due to the more frequent movement of nuclear wastes that the LEU fuel cycle would generate.

Regarding proliferation, the report postulated that a larger security apparatus may be required due to the larger facilities needed to handle materials and meet storage requirements. It also argued that the LEU is more of a proliferation concern due to the larger amounts of weapons-usable plutonium generated during its fuel cycle. The executive summary cast its verdict clearly: "The use of LEU for cores in U.S. nuclear powered warships offers no technical advantage to the Navy, provides no significant non-proliferation advantage, and is detrimental from environmental and cost perspectives." The Navy was once again commissioned to reevaluate the use of LEU in 2014, with practically identical results. The major delta between the two findings was a more receptive tone toward LEU if funding were continued toward this effort in the coming years.[13]

Other issues with LEU that were not discussed in both reports have more to do with other reactor design alterations that would have to take place to accommodate such as drastic change. First, in order to accomplish the same core life with LEU, the core would have to be at least 4.5 times the size of current reactors, assuming a 19.75 percent enrichment.[14] This would cause an engineering ripple effect that would necessitate the need for other reactor compartment redesigns, some which may not be revealed until implementation is well underway. Second, but none the more important, changes in reactor dynamics and core behavior need to be considered. In LWR technology, the density of water due to temperature deviations has a direct effect on the rate at which fissions occur. With a LEU reactor, this affect is compounded by increased temperatures of the fuel, also known as the doppler broadening of resonances. This causes more absorptions of neutrons by non-fissile material that would have normally induced fission in an HEU reactor. Another important consideration often overlooked by those outside of the nuclear community is the delayed neutron fraction. In reactor dynamics, the delayed neutron fraction is the fraction of neutrons that are born from fission products and their nuclide daughters. The importance of these neutrons is that they provide the operator time to react to dynamic changes in reactor power. The normal delayed neutron fraction in an HEU core is roughly 0.0065 percent.[15] Due to the increased plutonium in an LEU reactor, the fraction would be reduced. The way to combat the effects of doppler broadening and changes in reactor dynamics would be control rod movements and operator actions. Both would require changes to reactor plant designs and an evaluation of current operating procedures. These factors cause much consternation to a nuclear propulsion program that has had great success with its current design for the last 70 years.

The responses to the Navy's findings and pushback have been overwhelmingly skeptical, and rightfully so. Despite the detailed examination in 1995, it is worth questioning the assumptions that were made in determining the feasibility of LEU. The report seemed to gloss over of the dangers posed by HEU, instead arguing that there were greater inherent risks associated with the LEU fuel cycle. The report also seemed to suggest that using HEU in its reactors was a movement toward nonproliferation despite accusations that its continued use rails against the intent of the non-proliferation treaty.[16]

13. Ibid.
14. JASON, *Low-Enriched Uranium for Potential Naval Nuclear Propulsion Applications* (Washington, DC: DOD, November 2016), https://fas.org/irp/agency/dod/jason/leu-naval.pdf.
15. Ibid., 39.
16. George M. Moore, "Could Low-Enriched Uranium Be Used in Naval Reactors? Don't Ask the Navy," *Bulletin of the Atomic Scientists* 71, no. 3 (2015): 67–75, doi:10.1177/0096340215581361.

Despite the opposition to such a transition, the request for funding in a 2016 report seemed to open the door to some advanced reactor designs that could perhaps accomplish an LEU-loaded reactor. To investigate such possibilities, Congress commissioned JASON in 2016, a group of scientists with varying levels of security clearances, to investigate any movement in this field and provide recommendations. One such discovery was the potential for the use of an enhanced-lifetime-element LEU (ELE-LEU). The design would allow for increased loading of LEU, therefore allowing for less refueling times and prevention of increased core volume and subsequent design modifications. If the Navy were to pursue such an option given favorable test results, it would not be integrated in the near future unless reactor design changes were made to upcoming Virginia-class fast-attack submarines replacements in the 2030s.[17] Otherwise, ELE-LEU would not be useful until the Ford-class aircraft carriers are due for refueling in the 2060s. The report concludes that among the various options that the Navy has, its most viable would be to pursue the ELE-LEU in aircraft carriers first and some variations of core designs that would reduce enrichment well below the current 90 percent. This would not necessarily require going below the International Atomic Energy Agency's (IAEA) 20 percent threshold because the 20 percent standard set by the IAEA as the difference between LEU and HEU is, at best, arbitrary. There is no evidence to suggest that reactors enriched to 25 to 30 percent are any more dangerous than those enriched to 19.75 percent.[18] This would at the very least give some leniency to reactor engineers to reduce the delta in core sizes and increase the lifetime of any LEU core. Although promising, the JASON report requires more data to provide anything conclusive on LEU reactors.

As confirmed in his *Conceptual Research and Development Plan for LEU* released in 2016, Admiral Caldwell, the director of Navy Nuclear Propulsion, indicated that any testing into LEU would require at least $1 billion in funding and at least 15 years to produce. His outlined plan does not have current "life of ship" reactors being converted to LEU reactors, which, given the reduced capabilities of naval shipyards as of late, may prove to be the best decision in the short term. The report is geared for LEU reactor implementation in aircraft carriers alone. The report outlines a timeline with three milestones: (1) assess fuel system performance using HEU fuel and identify if further pursuit is warranted by 2021, (2) assess final HEU and initial LEU irradiation test results for further indication of system feasibility by 2027, and (3) assess final results to determine feasibility in developing the infrastructure associated with developing a fuel system in enough quantity to power an aircraft carrier by 2032.[19] Although hopeful, the timeline leaves room for the program to reject LEU as a viable substitution early in the pipeline. The report seems to presume that LEU will be a failed pursuit but would generate the needed funds to continue to advance reactor technology; this causes frustration amongst skeptics who suggest the navy is using the promise of LEU to garner funding to maintain its research and development projects.

To further study the implications of a transition to an LEU design, it is imperative to consider other major world entities that have done so successfully. France is one such nation that has championed the use of LEU in both the military and civilian sectors. The decision to use LEU was made in the context of economic and safety imperatives, not to maintain submarine superiority. In terms of the economic impact, France built the nuclear propulsion model around its already established electricity generation paradigm; it was cheaper to use LEU processes in place rather than invest exorbitantly

17. JASON, *Low-Enriched Uranium for Potential Naval Nuclear Propulsion Applications*.
18. Ibid., 13.
19. Nation Nuclear Security Administration, *Conceptual Research and Development Plan for Low-Enriched Uranium* (Washington, DC: Department of Energy, July 2016), http://fissilematerials.org/library/doe16.pdf.

to pursue enrichment capabilities. In terms of safety, France has in place stringent regulations on civilian and military reactors that require inspection every 10 years. Submarine refueling periods have been built around regulatory schedules for efficiency. Another consideration for the French is the compulsory cuts in the pressure hulls for refueling. The cutting and rewelding limits the maximum operating depth for their submarines, a current non-issue for the United States. This does not mean the United States has to sacrifice tactical advantages for the sake of nuclear nonproliferation. Rather, it indicates that any investment into any form of LEU will require an improved shipyard apparatus to safely and swiftly conduct refueling—an apparatus that does not currently exist. Secondly, France's success with LEU misses the political context: the United States maintains the most powerful and capable submarine force in the world due to its nuclear propulsion capabilities. Any LEU reactor would need to meet the already established reactor power, longevity, and safety requirements established by the Naval Nuclear Propulsion Program.[20]

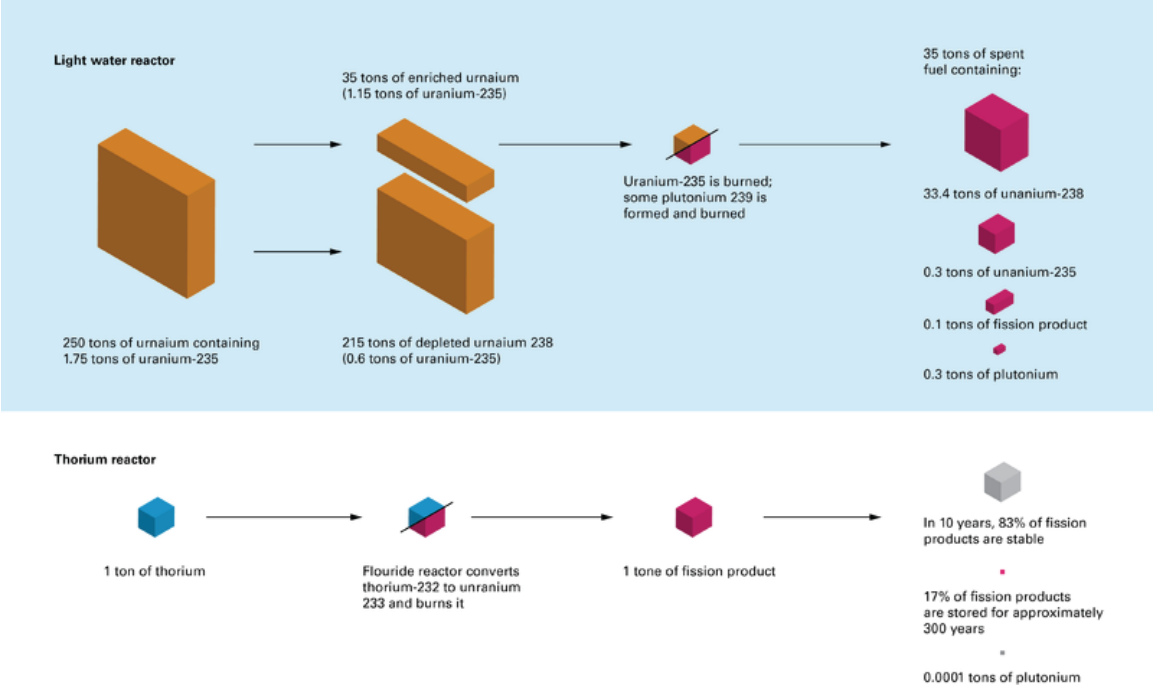
LEU remains an uncertain option for an HEU replacement as the result of institutional resistance rather than impossibility. Although any efforts to reduce the U.S. HEU stockpile are congruent with nonproliferation efforts, the weakening in operational performance and subsequent national security concerns necessitate an advanced reactor system. The most viable option would be to pursue some level beyond 20 percent, dubbed "LEU+." Naval reactors can perhaps look to France as an example to assist in this transition. This would at least demonstrate U.S. commitment to nonproliferation, and any such effort should be best tested on aircraft carriers and then transitioned to submarines.

THORIUM, THE PANACEA?

In an age when nuclear infrastructure is under intense scrutiny, many proponents of abandoning U-235 have turned to another potential candidate: thorium. At first glance, what makes thorium so attractive to politicians and scientist alike? Firstly, it is four times as abundant as uranium and does not require the same enrichment infrastructure;[21] Thorium-232 (Th-232), the most abundant isotope of the element, is what is required to sustain a nuclear chain reaction.[22] Unlike uranium, thorium is a fertile material—it generates more fissile material in the core than is inputted. In terms of radioactive wastes, the fission products it produces are much less harmful than those generated by current uranium LWR technology, by a factor of 10,000—a fact that may assuage the fears of groups that stand in opposition to nuclear energy.[23] A thorium/uranium fuel cycle generates much less waste and much less plutonium.[24] However, it is important to note that U-233, a part of the thorium fuel cycle, is highly radioactive and cannot be stored in any HEU storage facility.

20. Alain Tournyol Du Clos, *France's Choice for Naval Nuclear Propulsion: Why Low-Enriched Uranium Was Chosen* (Washington, DC: Federation of American Scientists, 2016), 1–2, www.jstor.org/stable/resrep18930.5.
21. Christopher J. Rhodes, "Current Commentary: Thorium-based Nuclear Power," *Science Progress (1933-)* 96, no. 2 (2013): 200–209, www.jstor.org/stable/43758807.
22. Robert Hargraves and Ralph Moir, "Liquid Fluoride Thorium Reactors: An Old Idea in Nuclear Power Gets Reexamined," *American Scientist* 98, no. 4 (2010): 304–313, www.jstor.org/stable/27859537.
23. Ibid., 309.
24. Ibid., 309.

Figure 1: Differences in Thorium/Uranium Fuel Cycle and the Enriched Uranium/ Plutonium Cycle Employed in Current LWR Technology



Source: Jonah Kellam, "Light Water Reactor vs Liquid Fluoride Thorium Reactor," Wikimedia, November 14, 2014, https://commons.wikimedia.org/wiki/File:LFTR_vs_LWR.png.

Lastly, and most important to the cause of nonproliferation, the nuclear wastes of thorium reactors do not produce enough weaponizable material to construct an atomic weapon. By some calculations, contingent on design, some thorium-based fuel reactors can reduce the amount of weaponizable plutonium by upwards of 80 percent.[25] There are multiple variations in which thorium could be introduced into the nuclear industry in both the private and military sectors. This paper will examine molten salt breeder reactors (MSBRs) and seed and blanket reactors.

Molten salt reactors, unlike their solid fuel counterparts that are currently employed, utilize a salt mixture containing fissile material to deliver the necessary heat to generate electricity. The history of molten salt reactors dates to the 1950s, when the U.S. military sought to exploit their compact design and high power density to power an aircraft for perpetual deterrence.[26] Although it did not come to fruition, the initial research into molten salt reactors laid the groundwork for future experimentation at Oak Ridge National Laboratory in the 1960s. This fuel is sent through a core containing a solid moderator to prompt the fission chain reaction. The most popular design, the lithium fluoride thorium reactor (LFTR), presents many advantages over LWR technology. First, the thermodynamic efficiency can reach 44 percent, much higher than current technology.[27] Unlike the long refueling processes required for solid-fuel designs, molten salt reactors can remove fission products and

25. Mujid S. Kazimi, "Thorium Fuel for Nuclear Energy: An Unconventional Tactic Might One Day Ease Concerns That Spent Fuel Could Be Used to Make a Bomb," *American Scientist* 91, no. 5 (2003): 408–415, www.jstor.org/stable/27858271.
26. M.W. Rosenthal, P. R. Kasten, and R. B. Briggs, "Molten-Salt Reactors—History, Status, and Potential," *Nuclear Applications and Technology* 8, no. 2 (1970): 107–117, doi:10.13182/nt70-a28619.
27. Ibid., 1.

refuel while operating via onsite processing plants. Due to extremely high boiling points (beyond any temperature required for operation), molten salt reactors operate at atmospheric pressure, which alleviates many of the inherent safety risks associated with the PWR. Another safety advantage is the high negative temperature and void coefficient of reactivity associated with molten salt.[28] If the temperature became too high in the core, the reactor would become subcritical without any operator intervention. Along with reactor dynamics, another safety feature engineered into the design is a freeze plug that would melt in the event of exceedingly high temperatures. In this case, the fuel would dump into containment tanks, rendering the reactor shutdown. The real question would be the adaptability of such a design to power a submarine while meeting the design criteria set forth by naval reactors.[29]

With these criteria in mind, there are a few setbacks to this design that may inhibit its utility on a submarine for years to come. First, graphite, the moderator, undergoes rapid irradiation that warrants its replacement every few years. Along with this, structural materials need to be researched and developed to withstand and contain molten salt to prevent radioactive leaks.[30] For land-based reactors, reprocessing and refueling is done with the reactor online in processing facilities. This will not be the case on any deploying platform, which may warrant increased shipyard availabilities. A stronger shipyard apparatus and infrastructure would have to be developed to ensure a rapid reprocessing and refueling period to maintain the required baseline force. Consideration needs to be given to how to deal with casualty on an underway platform; how will the ship contend with a loss of criticality due to a failed freeze plug, for instance? It is imperative that any design implemented on a warship be able to withstand potential shock and be conducive to rapid recovery.

Use of molten salt reactors onboard seagoing vessels may need to be a long-term solution due to the obstacles it presents. The Navy may need to invest in preliminary studies into the feasibility of such a design alongside its research into LEU.

Thus, despite certain important benefits, molten salt reactors may not be feasible in the short term. That is why a seed-blanket core would instead be more viable. In its infancy, one of the founding fathers of the naval nuclear power program, Alvin Radkowsky, envisioned a design in which a seed-blanket core can be employed in a PWR in an attempt to promote a fuel cycle that was in line with nonproliferation efforts and the "Atoms for Peace" initiative. The concept was to use the fertile thorium and enriched uranium separated spatially throughout the core. This design would use some form of enriched uranium to initiate the chain reaction, moderated by water, to react with thorium to generate uranium-233 (U-233). The subsequent fissions of the U-233 would generate the power needed to provide electricity. The reactor design in which a subcritical blanket was installed around supercritical seeds was dubbed "Radkowsky Thorium Fuel."

This design provides the ability to deal with thorium blankets and uranium seeds separately from one another and is completely adaptable to current PWRs. The added benefit is that the investment from enriched uranium to achieve a constantly critical thorium blanket is minimal and thus removes the need for large amounts of HEU. Like the LEU cores examined above, a seed-blanket design on submarines may incur the disadvantage of frequent shipyard availabilities to install new uranium

28. Ibid., 7.
29. "Molten Salt Reactor Fundamentals," YouTube video, posted by Pacific Northwest National Laboratory, October 15, 2018, 5:14, https://www.youtube.com/watch?v=aqPLU8ge-0w.
30. S. Banerjee, H. P. Gupta, and S. A. Bhardwaj, "Nuclear Power From Thorium: Different Options," *Current Science* 111, no. 10 (November 25, 2016): 1607–1623, https://www.jstor.org/stable/24909401.

seeds and redistribute the thorium blanket to ensure a constant distribution of power density. For example, a typical PWR core of Westinghouse would have to replace the seeds every 3 years and thorium blanket every 10 years.[31] An analysis of the current PWR onboard submarines would have to be conducted to ascertain the frequency of shipyard availabilities needed to maintain reactor operations over the life of the hull.

In short, the seed-blanket design would be the most viable option to employ thorium due to its proliferative-resistant nature, ability to be retrofitted to current PWR technology, and separate management of thorium and uranium. Any use of molten salt reactors would completely upend the entire infrastructure built around the use of HEU and current PWR technology—a task that no parties currently involved are willing to undertake. As climate change and nonproliferation make thorium a more attractive option to both the civilian and military sectors, more efforts should be made toward the seed-blanket design.

There are a few steps that the Navy can take to be proactive in this endeavor. First, the Navy should commission a team of engineers to explore the necessary steps required to implement such a design for both aircraft carriers and submarines. Second, the Navy should coordinate with officials from both the Department of the Navy and the Department of Energy to secure funding for research and development with due dates for milestones for accountability. Lastly, the Navy should look ahead in its construction timeline to determine the most appropriate platform to incorporate such drastic design changes and reengineer where possible to accommodate such designs. In Rickover's time, the ingenuity of both military and civilian genius was harnessed to accomplish something that at first seemed impossible. The Navy can do it again.

CONCLUSION

The Navy has before it multiple options to help it retain its place as the current leader in nuclear technology. Given the plethora of nuclear reactor designs and the excitement over generation-IV reactors, the Navy will have increasing pressure to readdress the issue of nonproliferation and its role in pioneering innovative ways to thwart proliferation. Based on its performance and safety requirements, it is most likely that any use of thorium, whether employed in a molten salt reactor or PWR via the seed-blanket design, will be a long way off. That does not mean the Navy should drag its feet on pursuing alternative means to wean off its addiction to HEU. A more likely scenario will be a multi-decade approach in which advanced LEU reactor designs will be employed somewhere beyond 20 percent enrichment and well below the 90 percent enrichment currently used. This would be a momentous step in the right direction and buy time while the Naval Nuclear Propulsion Program shifts toward a thorium-based fuel cycle—the overall goal. A second major consideration for the Navy would be to overhaul the current shipyard apparatus and cause a paradigm shift away from the infrastructure and operating procedures centered around HEU. Currently, the Navy's four public shipyards have a maintenance backlog of over $3.45 billion; shipyard inefficiencies will need to be remediated to facilitate any major shift in the nuclear fuel cycle.[32] As of 2017, the shipyards were 17 years behind in maintenance scheduling, including mission-critical items.[33] If the Navy has any hope

31. A. Galperin, A. Radkowsky , and M. Todosow, "A competitive thorium fuel cycle for pressurized water reactors of current technology (IAEA-TECDOC--1319)," International Atomic Energy Agency (IAEA), 2002, https://inis.iaea.org/search/search.aspx?orig_q=RN:33068570.
32. Megan Eckstein, "Aging Drydocks, Inefficient Layout Plague Yards: Navy Hopes To Speed Up Plan To Perform $3.5B In Shipyard Maintenance," *Inside the Navy* 26, no. 17 (2013): 1–12, www.jstor.org/stable/24850646.
33. Ibid., 12.

of adopting short-term measures, the shipyard maintenance timeline will have to be expedited to be commensurate with any ambition to use LEU. Perhaps looking to model the U.S. refueling process after France would expedite this shift.

It is often tempting to discount the advantages HEU has provided the submarine force for the better part of a century. A precipitous abandonment would therefore be detrimental to the prowess the United States has enjoyed and may threaten national security. This process should therefore be incremental, done with sound engineering, be cost effective, and maintain the currently high standards the Naval Nuclear Propulsion Program has set for its nuclear designs and operators. The U.S. commitment to non-proliferation is just as vital to national security as maintaining a top-tier submarine force. The actions taken by the Naval Nuclear Propulsion Program in the coming decades should be demonstrative of that guiding principle.

Crisis Stability, OODA Loops, and Hypersonic Weapons

Alan Cummings[1]

In the canon of nuclear deterrence literature, crisis stability is the capacity of adversaries to weather a crisis without escalating to nuclear conflict. Like most deterrence literature, it is an idea that was born from the nuclear tensions of the Cold War. Strategists in the United States and the Soviet Union, perceiving an existential threat from each other, endeavored to understand the risks that surprise attack, vulnerability, and misperception posed to nuclear deterrence. In the United States, Bernard Brodie's *The Absolute Weapon* identified some of those core concepts less than a year after the first bombs were detonated.[2] Other scions of nuclear strategy such as Thomas Schelling, Herman Kahn, and Colin Gray would build on U.S. deterrence theory broadly through the Cold War. Crisis stability coalesced as a component of deterrence theory in the wake of the 1962 Cuban Missile Crisis and, with a brief hiatus through the post-Cold War 1990s, has continued to be refined—and debated—by modern nuclear scholars. Today, international security is returning to a focus on the dynamics of great power competition, making various kinds of stability, including crisis stability, once again topics of interest. This is compounded by new threats derived from twenty-first century technology, such as hypersonic weapons—missiles capable of controlled horizontal flight at speeds greater than Mach 5. Policy debates have arisen as these weapons begin to enter Russian and Chinese arsenals, centered on questions of how they might be used against U.S. interests, increase the probability of conflict, or accelerate the pace of escalation—and, of course, on how the United States should respond to these concerns.

This paper seeks to explore how the advent of nuclear-armed, strategic-range hypersonic weapons in the hands of an adversary may affect crisis stability from the perspective of U.S. decisionmaking. To

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2. Bernard Brodie, ed., *The Absolute Weapon: Atomic Power and World Order*, 1st ed. (New York: Harcourt, Brace and Co, 1946).

begin, this paper offers an introduction to hypersonic weapons and a brief review of crisis stability. It then uses John Boyd's "OODA loop" (observe, orient, decide, and act) as a framework for organizing the elements of crisis decisionmaking and to discuss concerns about hypersonic weapons from the perspective of the United States. In doing so, it groups the observation and orientation functions together as the two elements which convey and characterize crisis stimuli for U.S. decisionmakers through surveillance capabilities, intelligence analysis, attribution, and norms of behavior. The decision and action functions are likewise grouped, as they characterize the decisionmakers' response in consideration of U.S. vulnerability, capabilities, and doctrine. These subordinate topics do not flow directly from Boyd's OODA loop; rather, they are selected to organize some of the features in current discussions about the risks of hypersonic weapons. This paper concludes that, from the U.S. perspective, nuclear-armed, long-range hypersonic weapons do not conclusively decrease crisis stability at the strategic level of war. While using shorter theater-range versions of these weapons may threaten local crisis superiority (i.e., the maintenance of U.S. military superiority, both nuclear and conventional, at all stages of a regional crisis), the robust and resilient U.S. nuclear arsenal remains a bulwark of crisis stability at the strategic level.

HYPERSONIC WEAPONS

The defining characteristic of a modern hypersonic weapon (HSW) is its ability to conduct horizontal flight at speeds greater than Mach 5 (i.e., five times the speed of sound, which is roughly 760 mph at sea level and 675 mph at 100,000 feet altitude).[3] While drawing the line precisely at Mach 5 is somewhat arbitrary, the hypersonic speed regime marks a real change where notable aerodynamic and thermodynamic phenomena that are inconsequential or manageable at slower speeds must now be given novel accommodations in the vehicle's design.[4] The horizontal flight orientation differentiates HSWs from ballistic missiles, which, although capable of reaching hypersonic speeds, are travelling along parabolic trajectories with a horizontal speed-over-ground component that is a fraction of its air speed. Put another way, hypersonic speed is merely a consequence of ballistic trajectories; for HSWs, it is a primary purpose.

Among modern HSWs, hypersonic glide vehicles (HGVs) can be considered an evolutionary step forward from ballistic warhead technology, hence why they have broadly speaking been the first to reach operational capability. Like ballistic missiles, HGVs use a rocket booster to impart the entirety of the warhead's velocity during the initial launch phase. That booster subsequently detaches, leaving the unpowered glide body to continue on toward its target some hundreds or thousands of miles away. This method has lent itself to both land-based systems using repurposed ballistic missile rocket motors as well as rocket-assisted air-launched systems.[5] Hypersonic cruise missiles (HCMs) are more challenging due to the addition of propulsion systems and more complicated thermal management requirements, but they may ultimately be more cost-effective once production methods are developed. HCMs are an evolution of existing cruise missiles in that they continue using the same basic anatomy: propulsion and steering components that are manipulated by onboard guidance systems to deliver a warhead. The most notable difference from contemporary cruise missiles is that, to sustain hypersonic speeds, HCMs need to use sophisticated supersonic combustion ramjet (scramjet) engines—a

3. James M. Acton, "Hypersonic Weapons Explainer," Carnegie Endowment for International Peace, April 2, 2018, https://carnegieendowment.org/2018/04/02/hypersonic-weapons-explainer-pub-75957.
4. Ivett A. Leyva, "The Relentless Pursuit of Hypersonic Flight," *Physics Today* 70, no. 11 (October 2017): 30–36, doi:10.1063/PT.3.3762.
5. Richard H. Speier et al., *Hypersonic Missile Nonproliferation: Hindering the Spread of a New Class of Weapons* (Santa Monica, CA: RAND Corporation, 2017), https://www.rand.org/pubs/research_reports/RR2137.html.

technology which, as of early 2020, is still being developed. Additionally, since scramjets are unable to start at speeds below around Mach 3, HCMs need to be launched using a rocket booster of their own, a supersonic aircraft, or an additional (potentially combined-cycle) engine.[6]

Some challenges are common to both HGVs and HCMs. While ballistic missiles spend the majority of their time outside the atmosphere, HSWs travel predominantly within it. Since an HCM's scramjet requires atmospheric oxygen for combustion, those systems must operate at altitudes low enough to provide sufficient oxygen but high enough to minimize atmospheric drag—typically 65,000 to 100,000 feet above mean sea level. HGVs can fly higher—between 100,000 and 300,000 feet—but must still have enough atmospheric density to generate lift in order to glide.[7] This means both types must endure longer exposure to atmospheric resistance than their ballistic predecessors. Consequently, thermal loading and shockwave behavior present severe challenges to the airframe's material composition and design geometry.[8] Included in this are control surfaces that are vulnerable to ablation or deformation in flight, as well as the possibility that those control mechanisms will have to compensate for the in-flight deformation of the vehicle itself. Furthermore, the ionization of atmospheric gasses near the vehicle's surface can interfere with communications to and from the weapon, complicating in-flight guidance, navigation, and control. Until there are materials that can withstand even greater stresses at lower (denser) altitudes, HSWs' flight profiles also mean that their terminal approach to target will either be constrained to diving maneuvers from high altitudes in order to maintain speed or will have to slow down to stay within material tolerances while flying lower approach trajectories.

Both genres also bring new operational capabilities for delivering either nuclear or conventional effects. HGVs and HCMs alike combine the speed of ballistic warheads with in-flight maneuverability. More importantly, they do this with much lower trajectories than ballistic missiles. This means that HSWs are able to retain the short flight times of ballistic missiles while challenging air and missile defense radars or avoiding them altogether. Their maneuverability also provides for the possibility of altering their final attack headings, a trait beneficial for fine-tuning conventional effects as well as concealing the intended target until the last moment. Paired with adequate guidance, maneuverability may also permit engaging mobile targets. Additional benefits include reducing an opponent's tactical depth as well as new ways to synchronize effects from hypersonic and non-hypersonic weapon systems.[9] The tremendous speeds coupled with steep, diving approach angles also offer energetic penetration capabilities, provided that the airframe is robust enough to fully endure the impact. According to policy analyst and physicist James Acton, an HSW could "penetrate more deeply than the Massive Ordnance Penetrator by a factor of 1.5 ± 0.4," which by his estimates would mean between 22 and 38 meters (72 to 124 feet) of reinforced concrete.[10]

As of mid-2020, the most advanced HSW efforts reside with the great powers—the United States, Russia, and China.[11] The United States does not yet have an operational HSW, and its developmental

6. Corin Segal, *The Scramjet Engine: Processes and Characteristics* (New York: Cambridge University Press, 2009), https://app.knovel.com/hotlink/toc/id:kpSEPC0003/scramjet-engine-processes?kpromoter=marc.Cambridge Aerospace Series 25 (Cambridge\\uc0\\u8239{}; New York: Cambridge University Press, 2009
7. Speier et al., *Hypersonic Missile Nonproliferation*.
8. Thomas Heppenheimer, *Facing the Heat Barrier: A History of Hypersonics* (Washington, DC: NASA, 2007), https://history.nasa.gov/sp4232.pdf.
9. Alan Cummings, "Hypersonic Weapons: Tactical Uses and Strategic Goals," War on the Rocks, November 12, 2019, https://warontherocks.com/2019/11/hypersonic-weapons-tactical-uses-and-strategic-goals/.
10. James M. Acton, "Supplement to Hypersonic Boost-Glide Weapons," *Science & Global Security* 23, no. 3 (2015): 191–219, http://scienceandglobalsecurity.org/archive/sgs23acton_app.pdf.
11. Kelley M. Sayler, *Hypersonic Weapons: Background and Issues for Congress*, CRS Report No. R45811 (Washington, DC: Congres-

efforts are focused exclusively on conventional capabilities. In comparison, Moscow has been the most vocal about their HSW program and frequently showcases its claims in various public media. Prominently displayed are: Avangard, an HGV launched via modified SS-19 ICBM; Kinzhal, an HGV that appears to be an Iskander SRBM warhead modified for launch from a MiG-31; and Tsirkon, a ship-launched HCM.[12] China is less transparent about its HSW program, though it showcased the DF-17 HGV in its 70th anniversary parade and the commander of U.S. Northern Command testified to the U.S. Senate that China is currently testing an intercontinental-range boost-glide weapon similar to Russia's Avangard. He specifically connected this with China's effort to "improve the survivability and penetrability of its nuclear forces."[13] It is important to note that there has been no independent open-source validation of Russia and China's declared HSW capabilities, and it is unclear if they are attempting to meet the same design objectives as U.S. programs.

Many analysts and journalists have forecast an inevitable threat to stability arising from the novel characteristics and applications for HSWs. A strikingly-titled article by R. Jeffrey Smith asserted that "The arrival of such fast weaponry will dangerously compress the time during which military officials and their political leaders — in any country — can figure out the nature of an attack and make reasoned decisions about the wisdom and scope of defensive steps or retaliation."[14] The analysis by Speier et al. for RAND states more succinctly that "hypersonic weapons encourage hair-trigger tactics that would increase crisis instability."[15] These concerns merit further discussion of the underlying thought processes and decisionmaking factors that could lead to crisis instability.

CRISIS STABILITY AND BOYD'S OODA LOOP

The United States' detonation of the world's first nuclear device in 1945, codenamed "Trinity," ushered in the era of nuclear weapons, and the Soviets' program fanned the flames of nuclear competition. The adversarial nature of the U.S.-Soviet relationship spurred strategists to lay the intellectual foundations of crisis stability within 10 to 15 years of Trinity. Albert Wohlstetter and Thomas Schelling were pre-eminent amongst early nuclear strategists, and their work remains highly relevant today. In his 1959 paper "Delicate Balance of Terror," Wohlstetter discussed the non-automaticity of deterrence and factors that would become critical in the subdiscipline of crisis stability: perception, vulnerability, operational capabilities, and others.[16] Schelling's papers on "The Reciprocal Fear of Surprise Attack" and "Surprise Attack and Disarmament," which were written for RAND in the late-1950s (then re-published in 1960 as chapters in *The Strategy of Conflict*), are cornerstone documents of nuclear deterrence writ large and crisis stability in particular. Whereas Wohlstetter described stability, Schelling derived it; he used game theory, history, and analogy to illuminate its nature. Especially prescient was Schelling's identification of accidental, rather than deliberate, war as a primary concern: "Deterrence, it is usually said, is aimed at the rational calculator in full control of his faculties and his forces; accidents may trigger war in spite of deterrence. But it is really better to consider accidental war as *the* deterrence problem, not a separate one."[17]

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sional Research Service, 2020), https://fas.org/sgp/crs/weapons/R45811.pdf.
12. "Missiles of Russia," Missile Threat, CSIS, accessed July 18, 2020, https://missilethreat.csis.org/country/russia/.
13. Terrence O'Shaughnessy, Statement before the Senate Armed Services Committee, February 13, 2020, https://www.armed-services.senate.gov/imo/media/doc/OShaughnessy_02-13-20.pdf.
14. R. Jeffrey Smith, "Hypersonic Missiles Are Unstoppable. And They're Starting a New Global Arms Race.," *New York Times Magazine*, June 19, 2019, https://www.nytimes.com/2019/06/19/magazine/hypersonic-missiles.html.
15. Speier et al., *Hypersonic Missile Nonproliferation*.
16. Albert Wohlstetter, "The Delicate Balance of Terror," *Foreign Affairs* 37, no. 1 (1958): 211. Emphasis added.
17. Thomas C. Schelling, "Meteors, Mischief, and War," *Bulletin of the Atomic Scientists* 16, no. 7 (September 1960): 292–300, doi: 10.1080/00963402.1960.11454123.

Wohlstetter and Schelling's early assessments were a prelude to the crisis stability ideas galvanized by the 1962 Cuban Missile Crisis. More than a decade after that fateful October, Paul Nitze would reflect on the Cuban Missile Crisis and the approach it solidified: "the basic aim [became] an underlying condition of what may be called 'crisis stability,' a situation where neither side could gain from a first strike, and of 'mutual assured destruction,' where each side would have a fully adequate second-strike capability to deter the other."[18] Another decade later, in 1989, Glenn Kent and David Thaler would provide a human-centric expression of crisis stability: that it relies upon "each leader's perception—influenced by emotional and psychological stress, miscalculation, and disinformation—of desperate alternatives in a crisis."[19] In 2013, Forrest Morgan described crisis stability more succinctly as "the degree to which mutual deterrence between dangerous adversaries can hold in a confrontation."[20] These two latter components, perception and confrontation, are hallmarks of crisis stability—ones that make John Boyd's OODA loop a useful framework for analysis.

John Boyd was an Air Force colonel, a fighter pilot, and a well-regarded student of military strategy throughout the late-twentieth century. Alongside his role in developing the F-16 and F/A-18 aircraft, one of his enduring legacies is a description of human decisionmaking known as the "OODA loop," which is comprised of four steps: observe, orient, decide, and act. The origins of this model were his days as an instructor at the Fighter Weapon School, where he taught tactics to the Air Force's best pilots. Initially developed as a way to describe their decisionmaking in the cockpit, Boyd eventually scaled it up into a more robust descriptive model with wider applicability.[21]

The OODA loop became a hallmark in U.S. military culture, with a simplified version of Boyd's model introduced through accession programs, formal professional education, and informal on the job training. It provides an intuitive description of human thought processes and therefore a gateway into defeating one's opponent. A relic of its dog-fighting origins, this is described as turning "faster" or "inside" an adversary's OODA loop just as a superior fighter jet can maneuver within the turn radius of its opponent. It is not surprising then that the speed-laden discussion of hypersonic weapons has already been connected with the OODA loop, including by officials such as Dr. Mark Lewis, the director of Defense Research and Engineering for Modernization.[22]

Given that crisis stability is the result of human decisionmaking, the OODA loop can serve as a useful proxy for organizing and exploring how it is influenced by HSWs. Rather than giving HSWs a single inject point, the OODA loop's four phases provide structure for considering how they as the independent variable can exert influence at each step in the decisionmaking process. To be clear, HSWs are only one variable in the crisis stability OODA loop; other military capabilities, leadership personalities, bureaucratic influences, domestic politics, competing but unrelated events, and numerous other factors also influence decisionmaking. As Frank Gavin points out, "the question of resolve and the military balance has already come into play before a crisis is even initiated." However, this paper isolates HSWs as the independent variable of interest and qualitatively evaluates whether

18. Paul H. Nitze, "Assuring Strategic Stability in an Era of Détente," *Foreign Affairs* 54, no. 4 (1976): 820–823, doi:10.2307/20039615.
19. Glenn A. Kent and David E. Thaler, *First-Strike Stability: A Methodology for Evaluating Strategic Forces* (Santa Monica, CA: RAND Corporation, R-3765-AF, August 1989), https://www.rand.org/pubs/reports/R3765.html.
20. Forrest E. Morgan, *Crisis Stability and Long-Range Strike: A Comparative Analysis of Fighters, Bombers, and Missiles* (Santa Monica, CA: RAND Corporation, 2013), https://www.rand.org/pubs/monographs/MG1258.html.
21. John Boyd, "The Essence of Winning and Losing," (unpublished lecture, Defense and the National Interest Project on Government Oversight, August 2010), http://dnipogo.org/john-r-boyd/.
22. "Department of Defense Press Briefing on Hypersonics," U.S. Department Of Defense, March 2, 2020, https://www.defense.gov/Newsroom/Transcripts/Transcript/Article/2101062/department-of-defense-press-briefing-on-hypersonics/.

their introduction increases or decreases crisis stability as the dependent variable or outcome. In conducting this analysis, two limitations are imposed. First, it examines decisionmaking from the perspective of U.S. decisionmakers as they confront an adversary who possesses nuclear-armed, long-range hypersonic weapons (a capability which the United States is currently not planning to acquire for itself). Second, it is focused on crisis stability at the strategic level (i.e., the prevention of prompt nuclear exchanges against the participants' homelands).

Four shortfalls must also be acknowledged. First, this paper presents the OODA loop in a linear manner in order to classify and examine its various inputs, many of which are closely related. In practice, the OODA loop is an iterative, non-linear process with frequent feedback opportunities. It would be rare to find a human decisionmaker who, in situ, implements the OODA loop as a unidirectional checklist process. Second, the OODA loop is a model of individual decisionmaking—applying it as done here is subject to the pitfalls of rational and unified actor approaches that do not capture the dynamics of decisionmaking in organizations and groups. Third, this is a largely monadic examination from the perspective of the United States. In reality, crisis stability is at least a dyadic matter that proceeds as a dialogue among adversaries and is influenced by the collective OODA loop processes occurring on each side as well as the OODA loops of numerous individuals. Fourth, this paper does not offer a quantitative method for scoring or weighting the various components presented. Future research should consider these shortfalls and respond to the gaps that they leave in this initial analysis.

Despite these shortfalls, this analysis is a step toward more comprehensive discussions on how HSWs affect nuclear decisionmaking. There are two reasons to do so using the OODA loop framework: its simple yet comprehensive description of human decisionmaking and its familiarity to U.S. defense officials. Existing crisis frameworks are policy-centric models that are helpful for planning, such as the U.S. Federal Emergency Management Agency's five-part framework of prevention, protection, mitigation, response, and recovery.[23] The OODA loop captures the factors of crisis decisionmaking in ways that planning frameworks do not, making the OODA loop superior for modeling acute circumstances. In fact, this is one reason it is favored in the defense community and leads directly to the second reason for using it: defense officials and policymakers are already widely acquainted with it. The OODA loop model organizes the factors which support or jeopardize crisis stability in a way that is familiar and readily digestible. Although this paper tailors its use of the OODA loop framework to explore the influences of hypersonic weapons, it could be used just as well with an emphasis on other variables that affect crisis stability decisionmaking, such as cyber warfare capabilities or domestic political factors.

OBSERVE AND ORIENT: EVALUATING THE ADVERSARY

The first two steps of the OODA loop are grouped together as the two elements which define crisis stimuli for U.S. decisionmakers. They are both oriented outward, as the U.S. works to understand the nature of the crisis and the adversary's actions through surveillance capabilities, intelligence analysis, attribution, and norms of behavior. This is done by gathering information through surveillance in the observation phase and then orienting it in the context of existing intelligence evaluations. These two initial steps are at the core of tactical and strategic warning activities that precede a crisis and are of paramount importance during one. Tactical warning is considered here to be the indications

23. "National Planning Frameworks," U.S. Federal Emergency Management Agency, last updated October 16, 2020. https://www.fema.gov/national-planning-frameworks.

of when, where, and how an adversary will manifest its hostile intentions via attack or other action. Strategic warning, however, is the indication that hostile intention is brewing in the first place—that an adversary may be arraying their national resources in preparation for or anticipation of a conflict.[24] Robust tactical and strategic warning capabilities facilitate crisis stability by providing decisionmakers with more time and space to evaluate the situation and a context in which to evaluate adversary actions.

U.S. INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE

Like many nations, the United States is highly dependent on its intelligence, surveillance, and reconnaissance (ISR) capabilities to monitor potential threats, including both the collection technology and the infrastructure needed to consolidate that ISR data for analysis.[25] In the context of crisis stability, the continued reliability and operability of ISR assets tasked with monitoring the actions and forces of an adversary are vital enablers of the National Command Authority's (NCA's) OODA loop. Unfortunately, HSWs have the potential to undermine U.S. assumptions about the reliability of ISR systems for tactical warning, and they expand the range of threats to their operability.

The first concern is that HSWs complicate the ability of U.S. ISR systems to reliably detect and monitor an attack. While satellite-based infrared sensors may identify the launch of HSW boosters or the heat signature of an HSW streaking through the atmosphere, the HSW's maneuverability hinders attempts to forecast its destination. In particular, it seems that maneuverable HGVs launched on modified rocket boosters completely negate the target extrapolation capabilities developed for the predictable physics of ballistic missiles which they might initially resemble. Furthermore, ground-based air defense systems responsive to the maneuvering threats that challenge overhead sensors are ill-equipped to cope with an HSW's combination of altitude, speed, and maneuverability. When it comes to the problem of warning for nuclear attacks, the ISR complications introduced by HSWs challenge the dual phenomenology standard in use today.

Yet, there is nothing that makes HSWs inherently invisible to detection. Radars already exist for the explicit purpose of tracking ballistic re-entry vehicles traveling at hypersonic speeds;[26] over-the-horizon or backscatter radars may negate the benefit of HSWs that stay below the earth's curve until the last moment;[27] and the developmental Hypersonic and Ballistic Tracking Space Sensor (HBTSS) seeks to add a look-down surveillance capability.[28] The problem of developing these sensors and giving them air search orientations is daunting, but it is fundamentally an engineering challenge that will likely be solved in the course of time. That the current technology has not yet evolved or adapted to detect HSWs should not be confused with the idea that it is impossible to do so. However, this leads to the heart of why speed and maneuverability matter. The fundamental aspect of greatly shortened flight times and target ambiguity for HSWs remains unchanged even when detection capabilities mature. From launch to impact, ISR systems will have only minutes in which to execute

24. Jack Davis, "Strategic Warning: If Surprise Is Inevitable, What Role for Analysis?," Central Intelligence Agency, *Occasional Papers* 2, no. 1, January 2003, https://www.cia.gov/library/kent-center-occasional-papers/vol2no1.htm.
25. In practice, the term "ISR" has come to refer predominantly to collection capabilities—the surveillance and reconnaissance activities—rather than the intelligence analysis.
26. "Upgraded Early Warning Radars (UEWR) – Missile Defense Advocacy Alliance," Missile Defense Advocacy Alliance, https://missiledefenseadvocacy.org/defense-systems/upgraded-early-warning-radars-uewr/.
27. "Over the Horizon Backscatter Radar: East and West," Air Combat Command, June 6, 2012, https://www.acc.af.mil/About-Us/Fact-Sheets/Display/Article/199120/over-the-horizon-backscatter-radar-east-and-west/.
28. Nathan Strout, "The Small Sat Solution to Hypersonic Weapons, Explained," C4ISRNET, August 6, 2019, https://www.c4isrnet.com/battlefield-tech/2019/08/06/the-small-sat-solution-to-hypersonic-weapons-explained/.

a perfect sequence of detection, assessment, and notification functions. Thus, the reliability of ISR in tactical warning has likely undergone a permanent alteration vis-à-vis HSW-capable adversaries.

A second issue, relevant to crisis escalation, is the use of HSWs to target U.S. ISR capabilities or supporting infrastructure. ISR is a prime target for an adversary who believes they must conceal the movement of their own forces (especially nuclear forces) in a crisis or who fears they are facing their last opportunity for pre-emptive self-defense. These are classic concerns in crisis stability, ones that have the potential to be extremely escalatory and are not unique to HSWs. What is new is the ability of an adversary to act on these pressures by targeting U.S. systems from much further away while retaining the advantage of minimal flight time. For example, a Russian 9M729 subsonic cruise missile would take over an hour to travel from Russia's border to the Aegis Ashore facility in Deveselu, Romania and almost two hours to reach the U.S. early-warning radar in Flyingdales, United Kingdom. A Mach-10 Kinzhal could reach those targets within 6 and 11 *minutes*, respectively. In short, U.S. ISR assets and infrastructure are now as vulnerable to an adversary's distant HSWs as they would have been to a subsonic weapon system at much closer ranges.

While the mere existence of HSWs and potential threats to ISR systems are not automatic triggers for instability, they nonetheless challenge the ability of U.S. ISR to facilitate the "observe" part of the OODA loop. The degradation of ISR and situational awareness inevitably lead to more uncertainty in the best of circumstances. The ability of HSWs to defy both space and ground-based ISR increases fears, real or perceived, that adversary aggression will catch U.S. decisionmakers unaware (i.e., that the "observe" function of their collective OODA Loop will be compromised). If HSWs are used, these fears may be realized in the acute form of a fait accompli enabled by HSWs or an enduring degradation imposed by the destruction of ISR assets. Unused, HSWs may still cast a temporary shadow over more mundane ISR degradations if edgy and sleep-deprived officials assume that an adversary HSW is to blame.

The threat to deterrence in crisis comes from successive applications of HSW against ISR capabilities or against ones that are specifically relevant to nuclear warning and evaluation, both jeopardizing the OODA loop. In this regard, the greatest threat stems from the adversary's targeting decision more than the HSWs themselves. This is further complicated by what James Acton has labeled "entanglement"—how intertwined the nuclear and non-nuclear roles of a targeted ISR (and other) systems are. Acton has observed that if an aggressor attempts to degrade the conventional component of a dual-use system, "it could be effectively impossible for the target to distinguish them from deliberate attacks intended to undermine its ability to conduct nuclear operations (including obtaining warning of an incoming nuclear strike)."[29] The facilities at Deveselu and Flyingdales are excellent examples of U.S. ISR assets which Russia may target in a crisis with the intention of protecting their own nuclear deterrent capabilities but which the United States may misinterpret as intended to degrade its warning systems. This is true whether the adversary uses an HSW or Schelling's ice pick, but the novel threat of HSWs comes from concentrating the factors discussed above on nuclear-related ISR targets.

ATTRIBUTION

Deception has always been a part of war, making proper attribution a cornerstone of observation and warning. For now, there is a chance that HSWs could be used in a way that hampers attribution.

29. James M. Acton, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War," *International Security* 43, no. 1 (August 1, 2018): 56–99, doi:10.1162/isec_a_00320.

A small number of tactical HSWs could be used during a crisis to sow uncertainty or confusion in a way that leaves more room for doubt than existing cruise and ballistic missiles, owing to the gap between HSW performance characteristics and ISR capabilities. This opens two possible contributions of crisis instability. One because sufficiently maneuverable and precise conventional HSWs could tempt an adversary into conducting such a limited strike, either to gain a specific advantage or to sober the United States by imposing marginal damage, possibly on an ally. For example, a single HSW could evade detection and destroy an unoccupied oil pipeline juncture. The cause of the damage would be suspicious, particularly under crisis conditions, but may not be immediately attributable or would be coupled with a persuasive information campaign to undermine attempts at public attribution. Second, confronting an HSW-capable adversary in a crisis could increase the hazard of mischaracterizing a suspicious event as a non-attributional attack. Both possibilities, while perhaps remote at present, are in keeping with historical attempts to use technology to its greatest advantage while minimizing attribution (submarine operations are a prime example). Fortunately, the potential improvement of ISR referenced above may bring with it an improvement in attribution that makes this a temporary feature of HSWs. Though only minorly applicable to HSWs, attribution is important to the overall OODA loop framework and should be considered if applied to other weapons, technologies, or tactics.

ASSESSMENTS OF THE ADVERSARY

Observations from ISR and other sources must be oriented against a body of prior information about the adversary. This knowledge, provided largely by cadres of intelligence and diplomatic professionals, is the foundation of strategic warning. Their long-term efforts combine multiple disciplines to uncover adversary intentions, and their analysis becomes the scaffolding that is used to characterize crisis activity as routine or abnormal. The intelligence and diplomatic communities thus play significant roles in providing context throughout the "left-of-launch" period as adversary HSW capabilities, logistics, and command and communication (C2) are being researched, developed, manufactured, and deployed. The incorporation of HSWs into an adversary's inventory will change some of this scaffolding, including arsenal characteristics, vulnerability, and doctrine.

In considering arsenal types, Schelling's conception of ideal second-strike and first-strike weapons is a useful illustration of the two extremes of nuclear force structures and worth quoting at length:

> At one extreme is the 'pure' strike-back type of weapon: the relatively inaccurate vehicle with a super-dirty bomb that can kill just about everything in the enemy's country except a well-protected or well-hidden retaliatory force, and is so well-protected or well-hidden as to be invulnerable to any weapons that the other side might possess. Ideally, this weapon would suffer no disadvantage in waiting to strike second and gain no advantage in striking first. At the opposite extreme is a weapon that is itself so vulnerable that it could not survive to strike second, or a weapon so specialized for finding and destroying the enemy's retaliatory forces before they are launched that it would lose most of its usefulness if it were held until the other side has already started. These "strike-first" weapons not only give their possessor a powerful incentive to strike first, and an incentive to jump the gun in the event of ambiguous warning rather than to wait and make absolutely sure; they are a tacit declaration to the enemy that one expects to strike first.[30]

30. Thomas C. Schelling, *The Strategy of Conflict* (Cambridge: Harvard University Press, 1960), 240–241.

This passage reflects one of Schelling's key insights on crisis dynamics: the incentive to wait versus the incentive to "jump the gun." As delivery vehicles, HSWs seem closer to the "strike first" end of Schelling's spectrum. For now, they are exquisite "silver bullets"—expensive, few in number, and well suited for use against high-payoff targets before those targets can be employed, dispersed, or otherwise secured. Similarly, HSWs may themselves be seen as high-value assets that would likely be targeted early on in a crisis in order to prevent their use, evoking "use it or lose it" fears.

The accuracy of adversary HSWs, both real and perceived, is a chief concern. Just as with other projectiles, improving accuracy to deliver more precise effects can reduce the amount of conventional explosive or nuclear yield needed. Given HSWs' penetration capabilities and steep attack angles, highly accurate HSWs (conventional or nuclear) could deliver enough concentrated energy on a precisely located target to reliably destroy or significantly damage hardened structures.[31] This sort of HSW would tend toward Schelling's counterforce conception (i.e., particularly valuable in rapidly and pre-emptively attacking hardened nuclear targets such as silos and C2 bunkers) with potentially added benefits of staying conventional. Highly accurate HSWs are also attractive vehicles for low-yield nuclear weapons since they would improve the probability of precise, reliable delivery despite advanced air defenses.[32]

Prior to launch, hypersonic technology does not appear to be inherently more or less vulnerable than existing weapon systems. Adversary HGVs with the greatest strategic impact (i.e., those with large payload capacities and intercontinental range) are still largely reliant on the same silo or truck-based rocket bodies that are used for ballistic warheads. Similarly, HCMs as well as the smaller tactical-range weapons bring no inherent advantage to survivability compared to their slower contemporaries. All of these weapons systems will continue to rely on existing solutions to vulnerability such as hardening, mobilization, concealment, or redundancy. However, an adversary may perceive vulnerability stemming from having few of these weapons in their inventory, thus incubating "use it or lose it" fears for these HSWs.

What makes the difference in the OODA loop's orientation phase are U.S. assessments of how an adversary perceives their own HSW capabilities and limitations. HSWs could mistakenly be dismissed as merely delivery systems and a non-factor to threat-driven selections of policy and doctrine (i.e., that HSWs are tools for a job, but they do not decide what the job is). This would be folly. Schelling's point is that the existing tools and capabilities are partially responsible for defining the options available to decisionmakers. If by equipping their HSWs with nuclear warheads an adversary increases their faith in their nuclear deterrent, then HSWs may contribute to crisis stability by increasing an adversary's ability to wait when faced with ambiguous warning. This is particularly true for Russia, which frequently cites U.S. ballistic missile defenses (BMD) as a threat to their deterrence capabilities and a motivation for developing HSWs.[33] The Russian argument ignores the limited capacity and capability of BMD as well as the truly exorbitant cost of scaling it up to the point that it could reliably defeat hundreds of warheads. Nonetheless, this perception of increased capability may contribute a net increase in crisis stability. On the other hand, HSWs that reinforce nuclear deterrence may underwrite a willingness to undertake more risky conventional behavior in a crisis (the stability-instability paradox), in turn leading to more

31. Acton, *Hypersonic Boost-Glide Weapons*.
32. While "sub-strategic," "tactical," or "low-yield" are accused of being misleading—any nuclear use is a strategic decision and any nuclear yield is noteworthy—the terms remain useful for describing smaller nuclear weapons.
33. Vladimir Putin, "Presidential Address to Federal Assembly," (speech, President of Russia, February 20, 2019), http://en.kremlin.ru/events/president/news/59863.

hazardous crises.[34] More acutely, an adversary that views their HSWs as a "silver bullet" due to either their performance characteristics or vulnerability is likely to use them in a crisis against high-payoff targets at the earliest justifiable moment. These HSW considerations must be evaluated *before* a crisis starts so that adversary activities can be oriented in the proper context.

NORMS OF BEHAVIOR

Orientation during a crisis is further aided by the ability to contextualize observations within norms of behavior. Desmond Ball et al. (including Ashton Carter and Condoleezza Rice) reflected on the role of norms when they observed in 1987 that "the superpowers appear to have developed a tacit code of conduct. A breakdown of that code could initiate an interlocking sequence of escalating alerts." The norms around HSWs are still being established as the weapons become operational. Russia is publicly establishing a direct and concrete relationship between their HSWs and their nuclear arsenal, the precise opposite of the United States, whose HSW program has been explicit in its conventional-only approach. Consistent with their history of opacity on military capabilities, China is characteristically vague about its HSW programs.

One potential for concern is through what Acton calls pre-launch ambiguity.[35] As Russia continues to emphasize the dual-capable nature of its HSWs, it increases the risk that, in crisis, the United States will either see a nuclear threat or signal where there is none, or that it will miss a nuclear signal that Moscow may try to communicate. In the Pacific, a lack of Chinese official transparency on capability leaves gaps in intelligence assessments that may lead to erroneous conclusions that are in turn translated into policy or action. This is complicated further by comingling conventional and nuclear armed variants of the same system.

In the absence of arms control, norms may offer some buffer against crisis instability related to HSWs. Schelling noted this pattern when he observed that while some negotiation over the kind of war to be fought might be explicit, "much of it would be tacit, in the patterns of behavior and reactions to enemy behavior . . . anything else that conveys intent to the enemy or structures his expectations about the kind of war it is going to be."[36] For example, efforts to distinguish nuclear-armed from conventional HSWs, or HSWs' roles in nuclear versus conventional missions, may give the other side an incremental incentive to wait during a crisis. How an adversary operates these units on a daily basis and how they incorporate them in their exercises is a useful pre-crisis signal that can allay fears during conflict or make a change in behavior conspicuous. Comparing the 2018 U.S. *Nuclear Posture Review* to a similar Russian document released in June 2020, Sarah Bidgood observed that "the parallels suggest that an agreement prohibiting attacks on nuclear command, control, and communications systems could be of interest to both Washington and Moscow."[37] Even without a formal agreement, adherence to a norm such as this could alleviate some of the concern about HSWs being used against C2 assets in a crisis—as long as one does not lose sight of the fact that norms are more precarious than formal arms control agreements (though they too can be viewed with skepticism).

34. Glenn Herald Snyder, "The Balance of Power and the Balance of Terror," in *The Balance of Power*, Paul Seabury, ed. (San Francisco: Chandler Publishing Co., 1965).
35. James M. Acton, *Is It a Nuke?: Pre-Launch Ambiguity and Inadvertent Escalation* (Washington, DC: Carnegie Endowment for International Peace, April 2020), https://carnegieendowment.org/2020/04/09/is-it-nuke-pre-launch-ambiguity-and-inadvertent-escalation-pub-81446.
36. Thomas C. Schelling, *Arms and Influence*, Henry L. Stimson Lectures, Yale University (New Haven: Yale University Press, 1966), 216, doi:10.2307/j.ctt5vm52s.
37. Sarah Bidgood, "Russia's New Nuclear Policy Could Be a Path to Arms Control Treaties," Defense News, June 8, 2020, https://www.defensenews.com/opinion/commentary/2020/06/08/russias-new-nuclear-policy-could-be-a-path-to-arms-control-treaties/.

DECIDE TO ACT: RESPONDING TO THE THREAT

The OODA loop's third and fourth steps are grouped together as the steps that encapsulate decisionmakers' response to crisis. Whereas observing and orienting are intelligence-centric functions, the OODA loop now transitions to the operations domain in considering one's own situation. These latter steps describe the process for selecting and implementing a response (or, alternatively, choosing not to respond) to the threat conditions identified previously. Accordingly, considerations of one's own vulnerability, capabilities and doctrine, and nuclear C2 come to the foreground.

U.S. VULNERABILITY

Against the hundreds of ballistic missiles in Chinese and Russian arsenals, the added threat of their HSWs yields only a marginal qualitative change in U.S. vulnerability to strategic nuclear weapons.[38] In the event of large-scale war, Moscow and Beijing would undoubtedly be able to inflict "unacceptable damage" on the United States—this is why strategic deterrence is truly a no-fail mission. The United States accepted this vulnerability throughout the Cold War, specifically to the Soviet Union's intercontinental and submarine-launched ballistic missiles. Until its demise, the 1972 Anti-ballistic Missile (ABM) Treaty held at its core the preservation of mutual vulnerability. It is worth noting though that this vulnerability was offset by elements of warning and verification which the ABM and other treaties safeguarded under the auspices of "national technical means."[39] That Cold War stability held despite of, or indeed because of, mutual vulnerability seems to be a reasonable precedent for concluding that HSWs need not be automatically destabilizing at the strategic level of war.

While strategic nuclear vulnerability remains largely unchanged in the face of HSWs, the situation is less optimistic at the theater level of war. Here, HSWs become highly relevant for limited delivery of conventional warheads or low-yield nuclear weapons in a way that defeats theater missile defenses which are more reliable, prevalent, and affordable than their national counterparts. This underlies the threats to ISR discussed above but extends to include a wide range of operational capabilities from troops to airfields to terrestrial and maritime chokepoints. It also encompasses the vulnerability of the U.S. homeland to long-range *conventional* HSWs that could be developed, although at great risk to the adversary of provoking an escalation from crisis to general war.

Perceptions of vulnerability greatly influence preferences within the decision phase of the OODA loop. To think of oneself as completely invulnerable is hubris; it invites unwarranted confidence and rash action. Although unappealing, the alternative—a sense of one's vulnerability—can be either a sobering inducement to caution or, as with wounded animals, can lead to more aggressive responses against perceived threats. Where on this spectrum one's decision falls depends in part on the capability and doctrinal options available. In March 2019, U.S. Strategic Command's General John Hyten told the Senate Armed Services Committee, "Our defense against hypersonics is our nuclear deterrent."[40] This indicates two possible perceptions within U.S. nuclear decisionmaking: that HSWs are so intrinsically threatening as to warrant a nuclear response, or that the U.S. nuclear arsenal is robust against them. Both are discussed below.

38. Andrew Reddie, "Hypersonic Missiles: Why the New 'Arms Race' Is Going Nowhere Fast," Bulletin of the Atomic Scientists (blog), January 13, 2020, https://thebulletin.org/2020/01/hypersonic-missiles-new-arms-race-going-nowhere-fast/.
39. "Anti-Ballistic Missile Treaty (ABM Treaty)," U.S. Department of State, https://2009-2017.state.gov/t/avc/trty/101888.htm.
40. "U.S. Strategic Command and U.S. Northern Command SASC Testimony," U.S. Strategic Command, March 1, 2019, http://www.stratcom.mil/Media/Speeches/Article/1771903/us-strategic-command-and-us-northern-command-sasc-testimony/.

U.S. CAPABILITIES AND DOCTRINE

Research and development efforts in the United States are currently designed to provide conventional-only HSW capabilities. Rooted in the Conventional Prompt Global Strike program, HSWs were originally envisioned as a rapid response against time-sensitive counterterrorism and rogue-state targets.[41] It is unsurprising though that HSW applications have expanded as great power confrontation returned to the foreground. While the details of how HSWs will be incorporated into U.S. doctrine are not yet clear, that doctrine must be prepared to confront HSW-capable adversaries today.

One reading of General Hyten's quote is that the U.S. government could see an adversary's hypersonic weapons as so uniquely threatening that being attacked with them would transgress the "vital interest" standard, thus warranting a nuclear response (e.g., a conventional HSW attack on the U.S. theater C2 facilities). This is an application of the calculated ambiguity underlying U.S. nuclear doctrine, or what Kent and Thaler called an "optimum instability."[42] This is accomplished by reserving the right to use nuclear weapons "in extreme circumstances to defend the vital interests of the United States, its allies, and partners" without defining the boundary of vital interests lest an adversary be attempted to approach it without crossing it.[43] When paired with a ready force posture, calculated ambiguity contributes to crisis stability by pushing an adversary's calculations toward the conclusion they can neither succeed in a first strike (deterrence by denial) nor get away unharmed if they attempt one (deterrence by punishment). If this characterization is accurate, confronting an HSW-capable adversary may hasten the decision point when U.S. leaders, amid an uncertain and escalating crisis, fear their ability to respond will be degraded if they wait further (i.e., the "use it or lose it" fear).

A second aspect that General Hyten's quote conveys is a more fundamental idea that not only negates the "use it or lose it" fears, but one that fortifies the United States against many of the most concerning implications of HSWs presented so far, namely that U.S. nuclear capabilities remain robust against hypersonic threats. Forty years of Cold War dynamics shaped the U.S. nuclear arsenal into one that is survivable thanks to diversification across the triad of air, submarine, and land-based delivery systems. This survivability supports crisis stability by complicating an adversary's targeting and weaponeering processes—a fact which is certainly known to U.S. decisionmakers. Furthermore, the technical capability of U.S. nuclear weapons to reliably access adversary targets can help stabilize a crisis by reducing incentives to "jump the gun."

The tension between the novel threats of HSWs and the survivability of the U.S. arsenal manifests in the latter half of the OODA loop. This tension is mediated by doctrine. U.S. nuclear decisions are not ad hoc affairs, but a tightly coordinated series of actions prescribed by doctrine and rehearsed in training.[44] This approach imposes discipline amid a chaotic and stressful crisis. The process is not infallible and there is a risk that repeated drills will lead to a rote response or path dependency of decisions taken in accordance with doctrinal prescriptions. Nonetheless, combined with a survivable nuclear force, it serves as a check against HSW-inspired fears of rash decisionmaking.

41. Amy F. Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles: Background and Issues for Congress*, CRS Report No. R41464 (Washington, DC: Congressional Research Service, 2020), https://fas.org/sgp/crs/nuke/R41464.pdf.
42. Kent and Thaler, *First-Strike Stability*.
43. Office of the Secretary of Defense, *Nuclear Posture Review* (Washington, DC: Department of Defense, 2018), https://purl.fdlp.gov/GPO/gpo88923.
44. Joint Chiefs of Staff, *Joint Publication 3-72 Nuclear Operations* (Washington, DC: U.S. Department of Defense, 2019), https://fas.org/irp/doddir/dod/jp3_72.pdf.

NUCLEAR COMMAND, CONTROL, AND COMMUNICATIONS (NC3)

The U.S. Department of Defense's Joint Publication 1-02 *Dictionary of Military and Associated Terms* defines command and control as "the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission."[45] In order to exercise that authority, nuclear command, control, and communications (NC3) cuts across both the decision and action phases of the U.S. OODA loop by fulfilling two distinct functions. The first can be thought of as "NC3 up" to signify its role in transmitting the observed and oriented information upward to the NCA and personnel who support the decisionmaking process (e.g., via secure messaging and teleconferencing capabilities). Having reached a decision, the nation must then be able to act to carry it out, thus a second "down" component of NC3 is needed, with the role of transmitting decisionmakers' orders and supporting information to the force.

The NC3 "always/never" standard is of primary importance during a crisis.[46] This is the idea that nuclear weapons must *always* be launched when given a valid order to do so and must *never* be launched under any other circumstances. This standard seeks to ensure that the NCA will be able to reliably launch its weapons if needed while also safeguarding those weapons against launch due to (among other things) human or system error, unauthorized launch attempts, or an inauthentic launch order from external actors. There is also an implicit notion that the "always/never" standard will endure through nuclear attack. This drives the need for NC3 systems to be survivable, redundant, and flexible enough to accommodate a range of doomsday scenarios. It also requires, in the United States, the mechanisms to ensure continuity of the presidency and NCA as the sole authorities permitted to release nuclear weapons.

HSWs may threaten NC3 in two ways. The first is a direct threat to the systems and infrastructure and replicates much of the discussion presented regarding threats to ISR. The second is that HSWs may allow an adversary to strike faster than NC3 can fulfill its functions up and down the chain of command, thus the fears of an adversary "turning inside" the U.S. OODA loop. It is hard to argue with the fact that the speed, maneuverability, and trajectory benefits of HSWs do not lead to such an operational advantage. But within the OODA loop, this consideration of NC3 brings the discussion full circle. In a hypersonic age, the decision advantage will rest with the side that can generate the most reliable tactical and strategic warning left of launch. In moments of ambiguity, the U.S. ability to "wait and see" continues to be provided by its robust arsenal crewed by disciplined operators along with NC3 that can ensure execution of retaliatory orders. It seems then that the lessons of Cold War of stability remain highly applicable against adversary HSWs.

CONCLUSION

The issue of hypersonic weapons and crisis stability is far from settled; much remains to be seen or answered, and the strategic community continues to fill in gaps not addressed here. Comparing these observations from the OODA loop framework with war game and simulation data would be useful for confirming or rejecting the framework's validity and content. A series of wargames where neither, one, or both parties of a dyadic confrontation were armed with HSWs would be particularly illuminating. The escalatory or de-escalatory behavior exhibited by the participants and qualitative comments

45. Joint Chiefs of Staff, *DOD Dictionary of Military and Associated Terms* (Washington, DC: Department of Defense, June 2020), https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/dictionary.pdf.
46. Peter Feaver, "On the Authority to Order the Use of Nuclear Weapons," Statement to the Senate Foreign Relations Committee, November 14, 2017, https://www.foreign.senate.gov/imo/media/doc/111417_Feaver_Testimony.pdf.

that capture vulnerability perceptions would be of broad interest. Of specific note would be testing for participants' reactions to adversary HSWs targeting ISR or C2 capabilities, theater or homeland forces, and other components of the OODA loop analysis. Re-examining historical source documents from the 1962 Cuban Missile Crisis or 1983 Able Archer incident with an eye toward how they may have been altered in the presence of HSWs could also prove illuminating. Finally, more exploration is warranted, especially for multilateral crisis stability, where additional nations are incorporated as active parties to the crisis, allies to one of the active parties, or as external and independent spoilers. With more than 20 additional countries engaged in hypersonic research, the possibility of HSWs exacerbating regional instability should also be included.[47]

For policymakers, this analysis means that concerns about the threat of HSWs to strategic stability should be taken with a grain of salt. Crisis stability often depends on more than the technology, especially among peer adversaries with robust military capabilities. This paper has endeavored to present some of the very real concerns about HSWs, but many of them required accompanying caveats. This shows that although HSWs have the potential to be destabilizing, it is not a foregone conclusion. Many of the threats to nuclear deterrence rely on how adversaries choose to employ HSW capabilities, making diplomacy and intelligence vital buffers against instability. In further practical terms, any magnitude of destabilization will also depend upon the adversary's inventory. A limited number of weapons means there is a limited number of targets that can be engaged and limited impetus to make deep changes to nuclear doctrine when redundancy or other mitigations may suffice. To the degree that HSWs may threaten strategic deterrence in a crisis, policymakers should also see the U.S. modernization of its secure second-strike capabilities as an investment that will continue to pay dividends against emerging threats.

Policymakers should also consider that the more plausible threat is from HSWs jeopardizing U.S. crisis *superiority* rather than stability (i.e., the ability to maintain a U.S. military advantage throughout all stages of a crisis). This largely stems from ISR challenges regarding HSWs and the operational reality that flight times from launch until impact are unarguably shorter than with non-ballistic predecessors. Changing the context to crisis superiority also emphasizes the more immediate threats that an adversary's *conventional* HSWs pose on the battlefield. In particular, coupling HSWs with cyber-enabled activities, information warfare, and traditional military forces may lead to a deeply challenging "combined arms dilemma" for the twenty-first century. Efforts to develop and deploy U.S. HSWs are already underway, but close attention should be paid to integrating them into military doctrine and ensuring that the United States is prepared to impose its own combined arms dilemma on its adversaries.

47. Speier et al., *Hypersonic Missile Nonproliferation*.

Deterring China

Creating a Framework for Advanced Military Cooperation in the Quadrilateral Security Dialogue

John H. Fernandez[1]

INTRODUCTION

Go is an ancient Chinese strategy game created over 4,000 years ago.[2] Unlike chess, where players capture and remove opponent's pieces from the board, the objective is instead to add stones in order to capture board space ("territory") and to surround the opponent's pieces (taking "prisoners"). The player with the most captured territory and prisoners wins the game. This board game's perspective of strategy parallels the need for the United States to understand a new strategic culture and adapt to the dynamic, competitive landscape of the twenty-first century. Any national security expert would agree that Russia is the United States' top peer military competitor at present. However, if the same question is asked approximately 5 to 10 years from now, many will likely change their answer to China.

Today's geopolitical environment introduces the question of how the United States will maintain the strategic balance of power against resurgent powers and emerging threats. The United States faces the task of fighting the Global War on Terror in the Middle East while simultaneously preparing for potential great power competition with Russia and China. Add to these the threats from revisionist powers such as Iran and North Korea and the United States finds that the challenges extend beyond the diplomatic and military capabilities of any one nation alone. The United States looks to its allies in the North Atlantic Treaty Organization (NATO), but the purpose of the organization geographically limits the scope to threats against proximal American and European allies. The United States must instead look beyond the horizon and into the future for a new deterrence strategy to meet the growing Chinese threat.

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2. Editors of Encyclopedia Britannica, "Go," Encyclopedia Britannica, https://www.britannica.com/topic/go-game.

In other words, the United States must develop a next-generation strategy to counter China's domination of the Indo-Pacific region. The 2018 *National Defense Strategy* (NDS) published by the Department of Defense (DOD) maintains the goal to keep "free and open trade" among states, while China intends to dominate and control the region's economic, political, and military spheres of influence.[3] Leaving this Chinese power unchecked, the United States will soon find itself in a position where it loses access to some of the world's largest economic markets and critical military positions, thus threatening the security and sovereignty of the United States and that of neighboring, Indo-Pacific regional states. To compete with China's expanding influence, this paper asks what steps the United States should take to elevate military cooperation with the Quadrilateral Security Dialogue (QSD). Newfound relations with partners such as Japan, Australia, and India would exponentially increase the hard and soft power capability to counter future strategic challenges.

Although not discussed in this report, other aspects of international relations such as economic ties form critical functions of cooperation. Before military cooperation can begin, the United States must be willing to make stronger trade agreements with regional partners. New trade deals that benefit both Indo-Pacific states and the United States form the basis for closer international relations, and as the United States negotiates such a mutually beneficial trade agreement, it should act to simultaneously develop military cooperation with each QSD state as well as other regional partners and allies. However, the emphasis of this report will focus on military cooperation.

This research analyzes the military relations between the United States and these three states, classifies the level of cooperation in a five-tier system, recommends a framework for strengthening cooperation with each nation in a two-phase approach, and assesses the impact of increased military relations on the regional power balance. The overall military objective for the United States in the region is to ensure free and open trade while simultaneously protecting regional states against future Chinese kinetic military action. Whether acknowledged or not, the United States and China are actively engaged in an unofficial game of Go to secure relations with regional states that will significantly impact the future strategic power balance. To win this game, the United States must enhance the methods in which it cooperates with allies and partners. "Winning" in this sense means that the United States achieves several objectives, including increasing the quantity of relations with Indo-Pacific states and more importantly increasing the quality of relationships with key allies through assured cooperation. The scope of this report focuses on the second objective. As an old proverb goes: "if you want to go fast, go alone, but if you want to go far, go together."

DEFINING CHINA'S MILITARY THREAT

Before discussing steps the United States can take to enhance relations with allies and partners, it is worth examining why China is a threat and how this impacts the United States. Without doing so, U.S. actions would be futile. President Xi Jinping makes his intent clear to grow the People's Republic of China (PRC) first into a regional power and subsequently a global power during this "period of strategic opportunity."[4] Beginning with "soft" economic power, China often advances financial investments in neighboring states to obtain influence, which then permits the leveraging of "political" power over foreign leaders to create policy favorable to Chinese interests. With these economic and political enablers, China can expand its anti-access/area denial (A2/AD) coverage over greater

3. Department of Defense (DOD), *Summary of the 2018 National Defense Strategy of the United States of America* (Washington, DC: 2018), https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf.
4. Christopher K. Johnson, "Thoughts from the Chairman: Xi Jinping Unveils His Foreign Policy Vision," CSIS, December 8, 2014, https://www.csis.org/analysis/thoughts-chairman-xi-jinping-unveils-his-foreign-policy-vision.

territory in the Pacific Ocean and South China Sea, modernize its conventional and nuclear military forces, and extend its projection of military power.[5]

To support and sustain success in the economic and political realms, China seeks to renew its military "hard" power. Detailed in its 2015 Defense White Paper, China defines the need to modernize the conventional and nuclear forces of the People's Liberation Army (PLA) to be capable of winning regional conflicts.[6] China considers both India and U.S. forces in Japan and South Korea as the main threats to its regional hegemony.[7] Although China maintains a no first use (NFU) policy, the verbiage within their nuclear doctrine does not specify what it considers a "first strike." As such, the PLA demonstrates "assured retaliation" by sustaining a "minimum deterrent" composed largely of second-strike weapon systems.[8] Land-based intercontinental ballistic missiles (ICBMs), submarine-launched ballistic missiles, and air-launched ballistic missiles make up China's diverse nuclear forces, but improvements to these weapon systems exponentially increase the credibility and capability of the PLA's retaliation forces. Stronger conventional and nuclear military forces will deter regional American and Indian forces, but achieving global power requires extending China's reach deeper into the East and South China Seas, beginning with its claim over Taiwan in its "One China" Policy.[9] The ability to expand the PLA's influence into its fabricated nine-dashed line territory, in addition to modernizing its conventional and nuclear forces, supports China's aim in achieving regional and global power status.[10] By answering why China's regional strategy directly conflicts with U.S. and Indo-Pacific stability, the question becomes what the United States is currently doing to counter these threats.

THE U.S. STRATEGY

The United States recognizes that China's aggressive economic, political, and military actions pose a direct threat to U.S. security and sovereignty and that of Indo-Pacific regional states. Lacking a U.S. response, China will continue on its path to dominate and control the Indo-Pacific geopolitical environment with its A2/AD strategy, thus shifting the nature of strategic deterrence toward imbalance as China develops the military capabilities to limit U.S. interaction with regional partners. For that reason, the U.S. response to these challenges encompasses a multi-domain, multi-faceted approach to economic, political, and military actions. Focusing on military action, the United States can wield unmatched, overwhelming power against an adversary who intends to harm the United States or its allies.[11] In having this ability, the U.S. deterrence strategy prevents an adversary from initiating conflict.

Security expert Dr. Henry Kissinger defines deterrence as "a product of three inter-related factors—capability, will, and perception."[12] Written in equation form, this looks like:

Capability x Will x Perception = Deterrence

5. Christopher Cowan, "A2/AD - Anti-Access/Area Denial," Real Clear Defense, September 12, 2016, https://www.realcleardefense.com/articles/2016/09/13/a2ad_-_anti-accessarea_denial_110052.html.
6. "China's Military Strategy," People's Republic of China Information Office of the State Council, May 26, 2015, Strategic Guideline for Active Defense, http://eng.mod.gov.cn/DefenseNews/2015- 05/26/content_4586748.htm.
7. Defense Intelligence Agency, *China Military Power: Modernizing a Force to Fight and Win* (Washington, DC: 2019), https://www.dia.mil/Portals/27/Documents/News/Military%20Power%20Publications/China_Military_Power_FINAL_5MB_20190103.pdf.
8. Ibid.
9. DOD, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China* (Washington, DC: Department of Defense, 2019), https://media.defense.gov/2020/Sep/01/2002488689/-1/-1/1/2020-DOD-CHINA-MILITARY-POWER-REPORT-FINAL.PDF.
10. Ibid.
11. DOD, *Summary of the 2018 National Defense Strategy of the United States of America.*
12. Lani Kass, "Rethinking Deterrence," *High Frontier* 5, no. 2 (February 2009), https://apps.dtic.mil/sti/pdfs/ADA513461.pdf.

Capability is a weapon system's ability to execute as needed, such as striking on target and on time. Will is the spirit of the nation's leaders and the people to respond with force when needed. Perception is the adversary's attitude about the target nation's response prior to the initiating attack. If any factor falls to zero, deterrence in turn becomes zero. When deterrence is zero, hostility is almost certain. China aims to narrow the deterrence gap with the United States by modifying its policy language (perception), developing an equivalent conventional and nuclear force (capability), and aggressively elevating its aim (will) to establish itself as a regional power.

In 2012, the Obama administration recognized this growing threat from China and introduced the "Pivot to Asia" strategy to shift the focus of U.S. interests from Europe and the Middle East to the Asia-Pacific region.[13] The Trump administration continued this trend of Asia-Pacific focus by publishing its 2017 *National Security Strategy* (NSS) and subsequently the 2018 NDS.[14] The NSS defines the existential threats to the United States and defines the objectives of its intelligence and security organizations. The NDS lays out more specific objectives relating to military affairs. With respect to the Indo-Pacific region, the NDS comprises objectives such as deterring adversaries from aggression against vital U.S. interests; maintaining favorable regional balances of power in the Indo-Pacific; defending allies from military aggression; bolstering partners against coercion; fairly sharing responsibilities for common defense; and ensuring common domains remain open and free.[15] Following the publication of the NDS, the DOD continued to define the specific objectives with its 2019 *Indo-Pacific Strategy Report* (IPSR).

The IPSR names the Indo-Pacific region as the priority theater for the DOD.[16] To achieve the NDS objectives, the DOD's Lines of Effort (LOE) in the IPSR highlights "Preparedness, Partnerships, and Promoting a Networked Region."[17] The IPSR details preparedness by listing modernization efforts that the U.S. military will take, including investing in research and development for next-generation technology and procuring advanced weapon systems. With respect to "promoting a networked region," a RAND Corporation's publication, *The Thickening Web of Asia Security Cooperation*, analyzes the interrelationship among Indo-Pacific partners and recommends measures for the United States to catalyze regional interstate relations.[18] Finally, although the IPSR lists partners with which the United States connects, it does not describe the methodology by which it will increase these partnerships. As the United States pursues strengthening Indo-Pacific military relations, the next section of this report introduces the system that defines the nature of military relations and presents specific, actionable steps to meet the NDS objectives in restoring deterrence against aggressive PLA action.

THE MILITARY COOPERATION HIERARCHY

To accurately characterize a state's military relations with the United States, this report introduces a novel system of classification that defines the nature of each relationship. In other words, a hierarchical system must clearly describe each state's level of military cooperation to draw the boundary between different levels of relations. By clearly discerning the lines of relations, a state can

13. Michael J. Green, "The Legacy of Obama's 'Pivot' to Asia," *Foreign Policy*, September 3, 2016, https://foreignpolicy.com/2016/09/03/the-legacy-of-obamas-pivot-to-asia/.
14. The White House, *National Security Strategy* (Washington, DC: December 2017), https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf.
15. DOD, *Summary of the 2018 National Defense Strategy of the United States of America*.
16. DOD, *Indo-Pacific Strategy Report: Preparedness, Partnerships and Promoting a Networked Region* (Washington, DC: 2019), https://media.defense.gov/2019/Jul/01/2002152311/-1/-1/1/DEPARTMENT-OF-DEFENSE-INDO-PACIFIC-STRATEGY-REPORT-2019.PDF.
17. Ibid.
18. Scott W. Harold et al., *The Thickening Web of Asia Security Cooperation: Deepening Defense Ties Among US Allies and Partners in the Indo-Pacific* (Santa Monica, CA: RAND Corporation, 2019), https://www.rand.org/pubs/research_reports/RR3125.html.

look to objective actions for how it can develop closer military relations with another state. Although similar concepts exist that classify the relations between the United States and another state, such as United Nations voting similarities, the system that this report introduces focuses on the bilateral military actions that demonstrate cooperation between the United States and other states.

For the purposes of this paper, the Military Cooperation Hierarchy (MCH) comprises a wide range of foreign policy tools within the security enterprise that are available for increasing military relations in a five-tier system. Tier 1 sets the foundation of the hierarchy as the lowest, most basic level of military cooperation and Tier 5 as the highest, most cooperative collaboration. To establish stronger ties between states, the United States and that state partner must negotiate policy agreements that would include at least one tool within the next tier to move from one lower tier to the next. Basically, one policy tool utilized in the next tier that enhances the relationship between the United States and the other nation now defines that relationship in the respective tier. Once the policy is accepted and enacted, the new tier will define the level of cooperation with that state. This process assumes several factors of the U.S State Department, such as that it will negotiate the terms of the policy initiative and that the agreement establishes favorable terms acceptable to the partnering nation.

For the purposes of this analysis, this report will not describe Tiers 1 and 2 in depth, as they are not the focus of Quad relations. However, it is important to describe the tools of Tier 1 and Tier 2 relations for the broader purpose of defining military relationships. At the most basic level of international military relations, the United States negotiates foreign military sales of weapons and technology as "a tool of first resort," as it increases military cooperation with allies and partners.[19] By supplying partners with advanced weapon systems, they will have increased military capabilities in defending their home nation. Tier 1 sets the foundation as the most abundant, basic level of cooperation.

Tier 2 relations reveal a deeper sense of commitment by demonstrating closer military cooperation between the United States and its partners. The United States actively engages with countries in multiple facets such as intelligence sharing or entrusting the safety and security of its forward-deployed forces through Strategic Partnerships. States that share common views or have shared interests with the United States will reveal or receive intelligence reports to further international security and combat international terrorism through "shared interests and a degree of trust."[20] Basic communication is the key to establishing foundational, committed relations between countries. Similarly, Strategic Partnerships in a military cooperation viewpoint defines U.S. accessibility to a host country's airfields, barracks, and naval ports. Countries with negotiated Strategic Partnerships allow U.S. aircraft, troops, and warships temporary housing until returning to U.S. facilities and permits U.S. forces temporary, safe accommodations in other nations for supplies or repairs without the immediate presence of other U.S. forces.

With Tier 3, joint exercises and training demonstrate a working relationship between the United States and its allies to coordinate strategic and tactical operations. Some examples of exercises include military campaigns against potential adversaries, while other examples demonstrate organized humanitarian aid and disaster relief efforts. At the same time, a Status of Forces Agreement (SOFA) is a negotiated policy that allows permanent residence of forces in a host nation for security or training measures.[21] The United States considers stationing military forces overseas as a tool for rapid, worldwide response. Additionally,

19. DOD, *Indo-Pacific Strategy Report*.
20. Michael DeVine, *United States Foreign Intelligence Relationships: Background, Policy and Legal Authorities, Risks, Benefits*, CRS Report No. R45720 (Washington, DC: Congressional Research Service, May 2019), https://fas.org/sgp/crs/intel/R45720.pdf.
21. "Status of Forces Agreement," United States Air Force Academy Legal Office, October 30, 2015, www.usafa.af.mil/Portals/21/documents/Leadership/JudgeAdvocate/SOFA.pdf?ver=2015-10-30-115236-060.

troops stationed in these countries provide training to local militaries, including ground-unit tactics, counterterrorism, and air and naval operations. From an ally's perspective, U.S. forces stationed within the host country amplify the level of assurance relative to an agreed treaty or policy in that an attack against U.S. forces will almost certainly result in a military response. An increased level of commitment between the United States and partners that allows for the coordinated exercises and deployment of U.S. forces in the host country characterizes a Tier-3 level of military cooperation.

Tier-4 military cooperation embodies a mutually defensive mindset where the United States proclaims the defense of another nation critical to its own security. In one example, the United States committed to the defense of the Republic of Korea (ROK) through a negotiated mutual defense treaty (MDT) following World War II to counter the Soviet-backed Democratic People's Republic of Korea (DPRK) in the north.[22] The U.S. assurance to the ROK prevented the DPRK from overwhelming the democratic state and uniting the peninsula under the communists. Similarly, the United States pledges extended nuclear deterrence with other nations, proclaiming that an attack by a nuclear weapon state against the ally will result in an in-kind U.S. response. Extended nuclear deterrence draws an ally closer to the United States when it feels secure from potential nuclear attack. The assurance to commit U.S. military forces and extend nuclear deterrence to an ally demonstrates a unique, unmatched level of commitment that depicts Tier 4 military cooperation.

Lastly, a Tier-5 level of military cooperation at the top of the MCH describes the deepest, most interconnected relations between the United States and a multi-nation coalition. For example, the U.S. commitment to NATO, a multilateral MDT organization, displayed the recognition of the common threat from the Soviet Union during the Cold War. Article Five of the NATO treaty outlined the concept of an attack by an adversary against a single NATO state resulting in all NATO members joining in the mutual defense of the target state. Equally important, the United States recognizes the need to enhance its deterrent capacity and those of its allies with a nuclear planning group. A nuclear planning group integrates coalition members to discuss the strategic employment of these weapons in a conflict. A Tier-5 level of military cooperation illustrates an unwavering, enduring relationship between the United States and a coalition organization through a negotiated multilateral MDT and a nuclear planning group.

Clearly defining the different levels of military cooperation allows the United States to better understand the quality of its relations with strategic allies and partners, not necessarily the value. More specifically, the United States values and holds closely every relationship with partners around the world. This system simply applies an objective measure toward the complexity and diversity of its international military cooperation. By classifying partners, the United States can more easily create the framework necessary for strengthening its military cooperation with any ally or partner.

ASSESSING U.S. AND INDO-PACIFIC RELATIONS

Assessing the nature of today's U.S. and Indo-Pacific relations remains critical to analyzing and transforming strategic partnerships into future first-class alliances. This process began with the 23 states identified in the IPSR where the United States works with regional countries to increase military relations, focusing on "like-minded allies and partners to address common challenges."[23] Allies and partners that recognize the common threat from China are more likely to develop closer relations with the United States to support their respective nation's defense.

22. "U.S. Security Cooperation With Korea," U.S. Department of State, July 27, 2020, https://www.state.gov/u-s-security-cooperation-with-korea/.
23. DOD, *Indo-Pacific Strategy Report*.

The scope of this strategy framework narrowed the IPSR's list of 23 states by focusing on specific allies with strong U.S. relations, that are strategically located, and that have relatively stronger regional militaries. Based on these criteria, the emphasis of this report concentrates on the QSD states: Japan, Australia, and India. The informal strategic cooperation established in 2007 by Japanese Prime Minister Shinzo Abe between these three nations and the United States is also known as the Quadrilateral Security Dialogue (also known as the Quad, or QSD).[24] To accurately describe the process of strengthening U.S. military cooperation, this report begins by categorizing each Quad nation within the MCH but focuses mainly on Tiers 3 to 5 because Tiers 1 and 2 are not relevant to this analysis. Following this classification, this report outlines a two-phase approach for increasing military relations in a multi-domain setting encompassing all Quad states and all tools of foreign policy. Defining these relationships will enable policymakers to identify the tools available for strengthening relations from each nation's respective tier to the next higher tier.

Beginning with the closest Quad partner, Japan and the United States share a unique and special relationship. Following the aftermath of the atomic bombing of Hiroshima and Nagasaki and the subsequent surrender of Imperial Japan, the United States retained military forces in Japan to ensure the security and reconstruction of the devastated nation. Rising from the ashes, Japan rebuilt its national infrastructure and economy into one of the world's premier powers, all while constitutionally limiting its military services in the Japanese Self-Defense Force (SDF). Today, the United States maintains a Tier-4 relationship with Japan based on the MCH. Table 1 below highlights examples of military cooperation with respect to each tier of the MCH. These examples clearly illustrate the close Tier-4 ties between the United States and Japan and describe how it will remain central to the future of strategic balance in the Indo-Pacific region.

Table 1: U.S.-Japanese Military Cooperation

MILITARY COOPERATION HIERARCHY	
Tier 4	▪ Bilateral MDT: 1960 Treaty of Mutual Cooperation and Security Between Japan and the United States.[25] ▪ Extended Deterrence: Clear "Three Non-Nuclear Principles" (no possession, production, or introduction).[26] Discussions beginning in 2011 over extended nuclear deterrence policy including U.S. ballistic missile defense (BMD) systems and the U.S. "nuclear umbrella" over Japan.[27]
Tier 3	▪ SOFA: Article VI of the MDT stationing roughly 54,000 troops in Japan.[28] ▪ Training/Exercises: Coordinating major exercises such as the annual Exercise Keen Sword and joint Exercise Malabar with Japan, the United States, and India.[29]

24. Tanvi Madan, "The Rise, Fall, and Rebirth of the 'Quad'," War on the Rocks, November 16, 2017, https://warontherocks.com/2017/11/rise-fall-rebirth-quad/.
25. Lindsay Maizland and Beina Xu,"The U.S.-Japan Security Alliance," Council on Foreign Relations, August 22, 2019, https://www.cfr.org/backgrounder/us-japan-security-alliance.
26. "Japan," Nuclear Threat Initiative, October 2018, https://www.nti.org/learn/countries/japan/nuclear/.
27. "Japan-U.S. Extended Deterrence Dialogue," Ministry of Foreign Affairs of Japan, June 10, 2019, https://www.mofa.go.jp/press/release/press4e_002470.html.
28. "Guidance from the Commander, U.S. Forces Japan," U.S. Forces, Japan, https://www.usfj.mil/About-USFJ/.
29. "U.S. Security Cooperation With Japan," U.S. Department of State, December 2, 2019, https://www.state.gov/u-s-security-cooperation-with-japan/.

Another relationship the United States values closely is its friendship with Australia. U.S. relations with Australia began before gaining its independence from the United Kingdom in 1901. With a deep connected history, "100 years of Mateship," fighting together in every major conflict since World War I, the United States and Australia remain close allies and friends today.[30] The relationship between the United States and Australia exemplifies a Tier-4 level of relations on the MCH. Table 2 below lists collaboration efforts with respect to each tier of the MCH. Australia remains one of closest partners to the United States in the region and will be a critical ally in the future of Indo-Pacific relations.

Table 2: U.S.-Australian Military Cooperation

MILITARY COOPERATION HIERARCHY	
Tier 4	▪ Bilateral MDT: 1951 Australia, New Zealand (NZ), and United States (ANZUS) Security Treaty (later withdrawing NZ in 1986 for its nuclear-free policy against U.S. ballistic missile submarines in NZ ports).[31] ▪ Extended Deterrence: Member of the NPT and 1986 Treaty of Rarotonga banning the "manufacturing, acquisition, possession, or control over any nuclear explosive device anywhere inside the treaty zone."[32] The United States provides nuclear deterrence through ANZUS treaty.
Tier 3	▪ SOFA: Rotating deployments for 2,500 U.S. Marines in Australia.[33] ▪ Training/Exercises: Coordinating major exercises including the biennial Exercise Talisman Saber involving 33,000 U.S. and Australian personnel and humanitarian aid and disaster relief (HADR) operations.[34]

The relationship between the United States and India has been developing in recent years. Similar to U.S.-Australia relations, U.S.-Indian relations began when India was a British colony. Following World War II, the United States developed close ties with India's rival, Pakistan, while India drew closer to the Soviet Union but remained diplomatically neutral with its official "Non-Aligned Movement" throughout the Cold War.[35] However, the United States and the democracy of India began negotiating closer ties when the idea of the Quad was first introduced.[36] Simultaneously, the United States affirmed India as a "Major Defense Partner" in 2016 and, with signing the 2018 Communications, Compatibility and Security Agreement (COMCASA), aligned the future of U.S. and Indian military collaboration.[37] Despite historical differences, the United States and India are now seeking to increase relations that can best be characterized with Tier 3 on the MCH, though Tier 2 is also shown in Table 3 to demonstrate further cooperation. Examples in Table 3 illustrate the close Tier-3 relationship between the United States and India. Plus, despite not being recognized by the Treaty

30. "The Australia, New Zealand and United States Security Treaty (ANZUS Treaty) 1951," U.S. Department of State, U.S. Department of State Office of the Historian, https://history.state.gov/milestones/1945-1952/anzus.
31. "South Pacific Nuclear-Free Zone (SPNFZ) Treaty of Rarotonga," Nuclear Threat Initiative, April 30, 2018, https://www.nti.org/learn/treaties-and-regimes/south-pacific-nuclear-free-zone-spnfz-treaty-rarotonga/.
32. Colin Packham, "Australia Says U.S. Plans to Build Military Infrastructure," Reuters, July 30, 2019, https://www.reuters.com/article/us-australia-usa/australia-says-u-s-plans-to-build-military-infrastructure-idUSKCN1UP0GY.
33. "U.S. Relations With Australia," U.S. Department of State, January 21, 2020, https://www.state.gov/u-s-relations-with-australia/.
34. "Australia-US Defense Relationship," Australia in the USA, January 12, 2017, https://usa.embassy.gov.au/defence-cooperation.
35. "Non-Aligned Movement (NAM)," Nuclear Threat Initiative, May 31, 2018, https://www.nti.org/learn/treaties-and-regimes/non-aligned-movement-nam/.
36. Madan, "The Rise, Fall, and Rebirth of the 'Quad'."
37. "U.S. Security Cooperation With India," U.S. Department of State, June 4, 2019, https://www.state.gov/u-s-security-cooperation-with-india/.

on the Non-Proliferation of Nuclear Weapons (NPT), India maintains its own triad of air, land, and sea-based nuclear weapons.[38] Strengthening future U.S.-Indian cooperation from the lens of strategic necessity would exponentially increase the deterrence power of Indo-Pacific states against China. As a nuclear power, India would change the nature of military cooperation, but the United States will need to incorporate other foreign and military tools to strengthen this relationship.

Table 3: U.S.-Indian Military Cooperation

MILITARY COOPERATION HIERARCHY	
Tier 3	▪ SOFA: None. ▪ Training/Exercises: Coordinating Exercise Tiger Triumph, the first exercise between the United States and India for coordinated HADR efforts.[39]
Tier 2	▪ Strategic Partnership: Access to Indian Armed Forces naval and air bases with the 2016 Logistics Exchange Memorandum of Agreement.[40] ▪ Sharing valuable intelligence to both U.S. and India. counterterrorism operations and national security.

The overall objective for the United States in strengthening its military cooperation with regional allies and partners is the strategic necessity to develop a force multiplier that will unite to keep free and open trade through the world's sea lanes and protect regional states from Chinese military invasion. The United States retains a wide range of options for how it can advance military cooperation, but the proposed strategy framework below gives a detailed account of how the United States will advance multiple allies and partners from one tier of the MCH to the next in both 2 to 5-year and 5 to 10-year timeframes.

QUADRILATERAL SECURITY DIALOGUE COOPERATION CHALLENGES

One critical note to address prior to discussion of the developing U.S. relations is that the two-phase Indo-Pacific security strategy proposed here is not without deficiencies. One of the most glaring issues in this two-step approach is the likelihood of changing policy in Japan and Australia toward favoring nuclear weapons via a joint U.S. nuclear planning group. Both nations remain resolute in distancing themselves from nuclear weapons, and it will be very difficult to convince the Japanese and Australian governments to change to a more nuclear-friendly policy. Japan especially has a strong case against nuclear weapons as the only victim in history to face these weapons during wartime. Tensions between the United States and Japan have healed, but the wound still resides within the memory of the Japanese people. The governments of both Japan and Australia would find it challenging to convince their citizens that changing their respective attitudes toward nuclear weapons through a nuclear planning group is beneficial to their national security when a negative perception regarding nuclear weapons already exists.

38. "How Is China Modernizing Its Nuclear Forces?," China Power Project, December 18, 2019, https://chinapower.csis.org/china-nuclear-weapons/.
39. Zach Montague, "U.S.-India Defense Ties Grow Closer as Shared Concerns in Asia Loom," *New York Times*, November 20, 2019, https://www.nytimes.com/2019/11/20/world/asia/india-military-exercises-trump.html.
40. Bradley Bowman and Andrew Gabel, "US, India Bolster Their Military Partnership in Tiger Triumph Exercise," Defense News, November 26, 2019, https://www.defensenews.com/opinion/commentary/2019/11/13/us-india-bolster-their-military-partnership-in-tiger-triumph-exercise/.

At the same time, U.S. relations with India are still in the early stages of development. India's long-held stance toward neutrality will be one of the substantial factors to overcome if the United States is to increase its level of relations. Additionally, India is experiencing significant domestic issues with respect to human rights violations and maintains relations with Russia in the sales of weapon systems. The United States will find it challenging to engage in deeper cooperation while India faces criticism from the international community and maintains its connections with Russia.

From the U.S. perspective, domestic views of alliance entrapment and equal contribution among allies remains problematic. The United States retains critical alliances with partners such as NATO, but questions arise about getting dragged into external conflicts because of the alliance as well as about all members of NATO meeting the minimum financial and resource contributions to the coalition. If multilateral organizations already demonstrate alliance issues, would the United States be prepared to form new ones?

The most important problem to address in the discussion of the future of U.S. and Indo-Pacific relations is how China will react to the proposed actions. The future holds infinite, unpredictable factors, but President Xi Jinping has made his intent clear (will) to develop China into a hegemonic power on the same economic, political, and military level as the United States. Should the United States begin a deliberate effort to increase Indo-Pacific relations, China will view these actions as a challenge to its own national security (perception), which could result in escalatory actions. Chinese actions may include but are not limited to: initiating economic trade warfare with vulnerable regional states; demonstrating advanced conventional and nuclear weapons systems (capability); deploying more A2/AD weapon systems, aircraft, and naval vessels near the Taiwan Strait or South China Sea; or forming closer ties with nuclear-armed Pakistan. China will pursue all economic, political, and military measures available to counter the actions posed by the United States and its Quad allies.

Although questions such as these remain critical to analyzing how the United States will develop closer Indo-Pacific relations, these challenges extend beyond the scope of this research and will not be pursued. At the same time, the United States should consider other measures to ease tensions with China through cooperative trade policies, healthcare services, or other means. The purpose of this section is to simply identify limitations up front to enable future research studies for strategic policy changes such as a two-phase Indo-Pacific security strategy.

PHASE 1: NEAR-TERM CHANGES

To strengthen Indo-Pacific relations, the United States must advance near-term policy goals that will shape the next 2 to 5 years of military cooperation with Quad allies. This period, Phase 1, can best be characterized as immediate and absolutely necessary for advancing future relations in the region. In other words, the United States must take immediate action to influence the future of military cooperation with the Quad states. For the purposes of this discussion, Quad states have already established Tier-3 and Tier-4 levels of military cooperation, so near- and mid-term policy changes will not discuss Tiers 1 and 2 other than to broadly recommend an expansion of respective policy tools for reinforced collaboration.

The first step to expanding success in any organization begins with recognizing where success already exists. For the United States, strengthening military cooperation among Quad states begins with its closest allies, Japan and Australia. The United States, Japan, and Australia already share mutual values and principles of democracy and, most importantly, recognize the mutual, imminent threat posed

by China. The next and most critical step in U.S., Japanese, and Australian relations begins in Tier 5 with a formal MDT coalition by combining the efforts of the Tier-4 bilateral U.S.-Japanese and U.S.-Australian relations. The Trilateral Security Dialogue (TSD) describes the preexisting framework for multilateral security relations between the United States, Japan, and Australia, but only in an informal sense.[41] To solidify the commitment between nations and send a strong message to China, the United States, Japan, and Australia would formalize a multilateral mutual defense treaty, incorporating many elements of the TSD. At the same time, U.S. policymakers would seek to negotiate joint strategic planning with Japan and Australia. In essence, Japan and Australia would not create or possess nuclear weapons, as their respective national policies forbid such actions, but in the interest of the alliance and strategic necessity, they would discuss U.S. nuclear planning with the coalition. The advantage of these types of weapons as a capability factor strengthens the hard power of the coalition. The policy would not be formulated during Phase 1, but to prepare for long-term commitments, the discussions for such policy would begin in the near-term phase.

Due to India's Tier-3 status, the United States would incorporate other policy tools, including an expansion of training and exercises among Quad states to enable a balanced policy among the states. Australia is a non-permanent participant in Exercise Malabar, but short-term goals would include making Australia a permanent member in the naval exercise for continuous coordination in joint operations. With respect to India, despite its historic ties with Russia, the United States would develop new agreements that would increase foreign military sales in Tier 2 (not illustrated but important to address for the discussion). At the same time, the United States would lobby for a SOFA that would allow forces permanent residence. Both the sale of advanced weapon systems as well as the SOFA integrate the plan to increase training and exercises among Quad states. The sale of new technology to India will allow for enhanced communication and striking capabilities, while the SOFA agreement will integrate joint operations training between the United States and India for display in the overarching operation, Exercise Malabar. Table 4 summarizes the recommended changes for Phase 1 near-term changes. Although other foreign policy tools exist for increased military cooperation, the purpose of Phase 1 establishes immediate and necessary changes and sets the foundation for the mid-term phase.

Table 4: Short-Term Comprehensive Action Plan

MILITARY COOPERATION HIERARCHY	
Tier 5	▪ Nuclear Planning Group: Discuss joint planning – United States, Japan, and Australia. ▪ Multilateral MDT: United States, Japan, and Australia.
Tier 4	▪ Bilateral MDT: None. ▪ Extended Deterrence: Maintain extended deterrence with Japan and Australia.
Tier 3	▪ SOFA: Coordinate U.S. Air, Navy, and ground forces in India. ▪ Training/Exercises: Expand Exercise Malabar to include the United States, Japan, India, and Australia (permanent participant).

41. Yuki Tatsumi, ed., *US-Japan-Australia Security Cooperation: Prospects and Challenges* (Washington, DC: Stimson Center, 2015), https://www.stimson.org/wp-content/files/file-attachments/US-Japan_Australia-WEB.pdf.

PHASE 2: MID-TERM CHANGES

Following the immediate and absolutely necessary changes, Phase 2 of the Indo-Pacific strategy would aim to bolster next-generation partnerships within the 5 to-10-year timeframe. This phase assumes the United States negotiates the Phase 1 changes to its military cooperation and must now build upon the success of foreign military policy to solidify its relations for future success in coalition operations. Any delay in Phase 1 policy would simultaneously postpone Phase 2 and should be revisited before pursuing Phase 2 actions.

Beginning at the Tier-3 level, the Quad states will expand mission capabilities in Exercise Malabar from strictly naval operations to include air, amphibious, naval, and ground maneuvers. The ability of the Quad coalition to increase the scope of operations among coalition states demonstrates a flourishing relationship capable of facing next-generation challenges posed by the PLA in various terrains and environments. Joint operations between multiple nations increases not only the capability factor of deterrence with increased strike proficiency but also the will factor of deterrence as the multinational coalition forms closer bonds in working together through joint operations.

At the Tier-4 level, the United States will continue the policy of extended deterrence with Japan and Australia, but given the nearly doubling nuclear stockpile in China, the United States will rely heavily on NATO to aid in other external deterrence challenges.[42] However, Japan and Australia will remain the primary partners in the Indo-Pacific region.

Lastly, with likely increasing tensions between China and other Indo-Pacific states in this 5 to 10-year timeframe, the TSD will form a nuclear planning group similar to NATO. By this time, the TSD coalition has formed a multilateral MDT and requires another foreign policy tool in Tier-5 relations. A nuclear planning group in this 5 to 10-year time period is more likely for the United States, Japan, and Australia due to the increased level of relations among these allies but also due to China's growing military power within the region. A nuclear planning group will allow the TSD to coordinate joint strategic planning operations not previously available in the multilateral MDT.

Table 5: Mid-Term Comprehensive Action Plan

MILITARY COOPERATION HIERARCHY	
Tier 5	▪ Nuclear Planning Group: **Implement joint planning – United States, Japan, and Australia**. ▪ Multilateral MDT: United States, Japan, and Australia.
Tier 4	▪ Bilateral MDT: **United States and India**. ▪ Extended Deterrence: **Maintain extended deterrence with Japan and Australia**.
Tier 3	▪ SOFA: U.S. Air, Navy, and ground forces in India. ▪ Training/Exercises: **Increase the scope of Exercise Malabar for the United States, Japan, India, and Australia to include other joint operations**.

42. Robert P. Ashley, "Russian and Chinese Nuclear Modernization Trends," (speech, Hudson Institute, Washington, DC, May 29, 2019), https://www.dia.mil/News/Speeches-and-Testimonies/Article-View/Article/1859890/russian-and-chinese-nuclear-modernization-trends/.

CONCLUSION

In essence, this two-phase Indo-Pacific security strategy allows the United States to exponentially enhance the number and quality of allies in this unofficial game of Go. With this two-phase approach, the United States would expand relations with QSD states through an augmentation of military cooperation efforts in the five-tier MCH system. China will react critically to developing relations between the United States and the other members of the QSD coalition, and the United States should prepare for this criticism. Despite these expected critiques, implementing a stronger level of cooperation among Quad states will allow the coalition to keep the PRC making critical statements rather than taking kinetic military action in the region. In addition to negotiating defensive relations, the United States would need to form alternative trade measures that would fill the trade gap between Indo-Pacific allies and China, namely those between China and Australia.

Trust between nations takes years to establish and develop, but when achieved through the lens of strategic necessity, the United States can elevate its strategic power alongside its economically, politically, and militarily powerful allies to ensure a free and open Indo-Pacific while simultaneously ensuring the sovereignty and security of regional states.

Cooperation in the Final Frontier

Reconciling Outer Space Treaties and Export Control Systems

B.M. Gautam[1]

PART 1: INTRODUCTION

In 2007, the International Space Station (ISS) Independent Safety Task Force submitted a report to NASA assessing vulnerabilities of the station that could result in its destruction or premature abandonment.[2] In its report, the task force noted that laws governing the export of technologies and research hamper the ability of U.S. contractors involved in the ISS to share critical data necessary for joint program management with Japanese, Russian, and European space agencies.[3] After assessing the vulnerabilities posed by these export control regimes, the task force called for "[a] remedy . . . that adheres to the principles intended by the laws protecting U.S. interests while providing some measure of flexibility" and warned that "if some relief is not forthcoming in the ISS Program, delays in critical capability [and] mission success . . . are possible."[4]

Comments from the task force highlight practical vulnerabilities arising from the application of export control regimes to dual-use outer space technologies that threaten the success of outer space missions reliant upon cooperation and resource-sharing with international partners.[5] The situation also highlights legal questions. Among other obligations, states party to the legally binding 1967

1. B. M. Gautam, Attorney (J.D. 2019, Georgetown University Law Center)
2. U.S. National Aeronautics and Space Administration (NASA), *Final Report of the International Space Station Independent Safety Task Force* (Washington, DC: NASA, 2007), 1, https://www.nasa.gov/pdf/170368main_IIST_%20Final%20Report.pdf.
3. Ibid, 73.
4. Ibid.
5. The term "dual-use" refers to items normally used for civilian purposes but which are determined to have the potential for military applications (e.g., the Global Positioning System, or GPS).

Outer Space Treaty (hereinafter referred to as the "OST") have agreed to "conduct all their activities in outer space with due regard for the corresponding interests of other States" and to "be guided by the principle of cooperation and mutual assistance" in such activities.[6] Given these affirmative obligations to carry out the exploration and use of outer space with regard to international cooperation, regulatory constraints on the sharing of items and data with international partners in outer space—constraints largely derived from domestic export control regimes—seem to exist in tension with the international law requirements.

This apparent tension raises two questions: to what extent do domestic laws governing export control systems risk conflicting with the system of international laws governing cooperative outer space activities, and how is the potential for such conflicts avoided? In the outer space field—wherein a large portion of the technology and research employed are classified as dual-use under prevailing export control systems—how do states comply with mandates relating to international cooperation, knowledge sharing, and other related principles derived from outer space treaty law? This paper argues that while a conflict between the underlying policy objectives of the two systems exists, the language of OST cooperative mandates are broad enough that domestic export control regulations do not run afoul of the mandates, and that states further mitigate the risk of conflict through their unique regulatory approaches to exports of space-related items and technology.

In making this argument, the paper explores the methods through which the export control systems of the United States and Europe, two key regional actors in outer space, fulfil nonproliferation functions while still complying with cooperative obligations under the OST and other authorities.[7] It proceeds as follows: following the introduction, Part II provides a brief overview of the relationship between international law and domestic law. Then, Part III applies this relationship in the context of international treaties governing outer space activities and domestic laws of the United States and Europe governing export control systems to identify where conflicts may exist. Part IV then turns to a case study of the specific ways in which the United States and Europe have mitigated the potential for this conflict through the respective regulatory approaches to export control provisions covering outer space technologies and research. This analysis examines the following factors for the United States and Europe, respectively: (1) allowances for cooperative outer space research through deemed exports or intangible technology transfer provisions; and (2) accommodations for international transfers of outer space-related items.

Following the case study, Part V concludes by assessing potential benefits and limitations of the U.S. and European approaches and exploring the extent to which each mitigates the risk for potential conflicts between international outer space law and domestic export control law. It considers lessons that may be derived from the approaches and offers insight into the relevance of both for the entry of new entities, including private sector actors, into the space-capable field.

6. "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies," United Nations Office for Outer Space Affairs, Article IX, December 19, 1966, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html (hereinafter referred to as the "Outer Space Treaty" or OST).
7. For the purposes of this paper, "Europe" will be considered as a single region consisting of the 19 member states to the European Space Agency (ESA) that are also members of the European Union (all 22 ESA member states with the exception of the United Kingdom, Switzerland, and Norway).

PART II: RELATIONSHIP BETWEEN INTERNATIONAL TREATIES AND DOMESTIC LAW

To understand the legal relationship between export control systems and outer space treaty obligations, it is necessary to first understand how legal systems interact more broadly. This section provides a brief overview of the relationship between international treaty law and domestic law.

The main sources of international law are treaty law, customary international law, and the general principles of law recognized by "civilized nations."[8] These sources of international law have binding legal effect, thus taking precedence over nonbinding, voluntary multilateral arrangements.[9] They also take precedence over domestic law; under the Vienna Convention on the Law of Treaties (and reinforced by long-held, widely-accepted general principles of international law), the domestic law of a state party to an international treaty in force may not prevail over the provisions of the treaty itself.[10]

Thus, from a public international law perspective, if the national legislation of a state presents a barrier to fulfilling obligations under a treaty to which the state is party, the legislative provisions may not be used as a justification for non-performance of the treaty obligations. Notably, a state may make a reservation to the treaty and in doing so may exclude or alter the legal effect of certain provisions of the treaty in their application to the state's domestic law.[11] Yet even if a state ratifies with reservations, those reservations must remain compatible with the "object and purpose" of the treaty text.[12]

Granted, the clear and hierarchical nature of this relationship muddies when viewed through a domestic lens.[13] In the United States, the U.S. Constitution designates treaties and statutes as equally "supreme," and—assuming potential tensions between treaty obligations and statutes cannot be resolved through the Charming Betsy doctrine (requiring domestic law to be construed so as not to conflict with international law, where possible)—conflicts between the two are resolved according to the later-in-time doctrine, whereby a more recently enacted statute may prevail over a previously

8. *Statute of the International Court of Justice*, United Nations, April 18, 1946, Art. 38(1) (Though note that judicial decisions and the teachings of highly qualified publicists also serve as subsidiary sources.)
9. See, e.g., Aaron Messing, "Nonbinding Subnational International Agreement: A Landscape Defined," *Georgetown Environmental Law Review* 30 (2018): 173–201, https://www.law.georgetown.edu/environmental-law-review/wp-content/uploads/sites/18/2018/05/30-1-Nonbinding-Subnational-International-Agreements-A-Landscape-Defined.pdf.
10. *Vienna Convention on the Law of Treaties*, United Nations, Treaty Series 1155, May 23, 1969, Art. 26–27, (on the *maxim pacta sunt servanda*); Permanent Court of International Justice, Advisory Opinion: *Certain German Interests in Polish Upper Silesia (Polish Nationals in Danzig) Case*, PCIJ Ser A/B (1932) No. 44, 24; (1930), 32, http://www.worldcourts.com/pcij/eng/decisions/1930.07.31_greco-bulgarian.htm. ("In the first place, it is a generally accepted principle of international law that in the relations between Powers who are contracting Parties to a treaty, the provisions of municipal law cannot prevail over those of the treaty."); see also, *Missouri v. Holland*, 252 U.S. 416 (1920) (In limited cases, a special class of legal rules stemming from custom may be deemed *jus cogens* and treated as peremptory over international treaty law, but export control laws do not fall into this category, which typically deals with fundamental human rights.).
11. *Vienna Convention on the Law of Treaties*, United Nations, Art. 2.
12. Ibid., Art. 19.
13. With respect to Europe, note that even though the Treaty on the European Union and the Treaty on the Functioning of the European Union require strict observance of international law and charge EU members to eliminate incompatibilities between their text and prior enacted treaties, agreements concluded by a member state without the union's participation (for example, in an issue area outside of the union's exclusive competence) form part of that state's national law and thus must yield to EU law in the case of a conflict. See, Consolidated Version of the Treaty on European Union, Art. 3(5), February 7, 1992, 2010 O.J. (C 83/01); Consolidated Version of the Treaty on the Functioning of the European Union Art. 216(2), Art. 351, December 13, 2007, 2010 O.J. (C 83/01); see, e.g., Allan Rosas, "The Status in EU Law of International Agreements Concluded by EU Member States," *Fordham International Law Journal* 34, no. 5 (2011): 1314, https://ir.lawnet.fordham.edu/ilj/vol34/iss5/7 ("From a purely public international law point of view, it may seem problematic that commitments entered into vis-á-vis third states cannot always be honored by an EU Member State.").

enacted treaty.[14] However, such domestic doctrines would not protect the United States from international liability should a breach of treaty obligations occur.[15]

Despite international law's predominance, in practice, issues involving hortatory or otherwise vague language in treaty text, inconsistent treaty interpretation by domestic courts, and difficulties with the enforcement of treaty mandates reflect an ongoing negotiation with respect to sovereignty, supremacy, and the dynamic relationship between international and domestic law.[16] Realist scholars criticize international law as uncertain (arguing that the international system lacks a centralized court to clarify legal norms), deficient in enforcement (arguing that the international system lacks a centralized enforcement mechanism to ensure compliance), and posing a risk to sovereignty (arguing that even consent-based theories of international governance exist in tension with the inherent sovereignty of a state).[17]

While treaties may be crafted to mitigate such difficulties—for example, by including robust verification provisions to address oversight and compliance or by including rules of construction and other interpretive guidelines beyond those provided by the Vienna Convention on the Law of Treaties to address potentially vague language—the nature of treaties as the product of negotiation and political bargaining results in certain challenges being inherent.[18] Commentators skeptical of international law have pointed to these challenges as barriers to the incorporation of ratified treaties into domestic legislation even though the justification seems to fly in the face of established, public international law principles on the subordination of domestic law to international law.[19]

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14. *Murray v. The Charming Betsy*, 6 U.S. 64, 118 (1804) ("an act of Congress ought never to be construed to violate the law of nations if any other construction remains"). For an overview of the later-in-time doctrine, *lex posterior derogat legi priori*, see Detlev F. Vagts, "The United States and Its Treaties: Observance and Breach," *American Society of International Law* 95 (2001): 313–343, doi:10.2307/2661398.
15. See, e.g., Louis Henkin, *Foreign Affairs and the U.S. Constitution* (New York: Oxford University Press, 1996), 209 ("Acts of Congress inconsistent with earlier treaty obligations have been given effect by the courts . . . . . Such legislation does not affect the validity of the treaty and its continuing international obligations for the United States, but it compels the United States to be in default."); David Koplow, "Constitutional Bait and Switch: Executive Reinterpretation of Arms Control Agreements," *University of Pennsylvania Law Review* 137 (1989): 1390, note 153, https://scholarship.law.upenn.edu/cgi/viewcontent.cgi?article=3848&context=penn_law_review.
16. See, e.g., William Park, "Treaty Obligations and National Conflicts in International Arbitration," *Hastings Law Journal* 58, no. 2 (2006): 251–298, https://repository.uchastings.edu/cgi/viewcontent.cgi?article=3643&context=hastings_law_journal; and Michael P. Van Alstine, "The Death of Good Faith in Treaty Jurisprudence and a Call for Resurrection," *Georgetown Law Journal* 93 (2005): 1885–1945, https://digitalcommons.law.umaryland.edu/fac_pubs/7/.
17. See, e.g., Jack Goldsmith and Daryl Levinson, "Law for States: International Law, Constitutional Law, Public Law," *Harvard Law Review* 122, no. 7 (2009): 1791–1868, https://harvardlawreview.org/2009/05/law-for-states-international-law-constitutional-law-public-law/; Mark A. Pollack, "Who Supports International Law, and Why? The United States, the European Union, and the International Legal Order," *International Journal of Constitutional Law* 13, no. 4 (2015): 873–900, doi:10.1093/icon/mov053 (discussing scholarly depictions of the United States as hostile to the internalization of international law); Jack Goldsmimth and Eric Posner, "Does Europe Believe in International Law?," *Wall Street Journal*, November 25, 2008, https://www.wsj.com/articles/SB122757164701554711 ("Europeans hold their values and interests dear, just as Americans do, and will not subordinate them to the requirements of international law. When a conflict arises, international law must yield."); and Harold Koh, "How Is International Human Rights Law Enforced?," *Indiana Law Journal* 74, no. 4 (Fall 1999), https://www.repository.law.indiana.edu/cgi/viewcontent.cgi?article=2279&context=ilj (summarizing the "common, skeptical" view of international law as follows: "International human rights law is not enforced, you might say, because human rights norms are vague and aspirational, because enforcement mechanisms are toothless, because treaty regimes are notoriously weak, and because national governments lack the economic self-interest or the political will to restrain their own human rights violations.").
18. See, Koplow, "Constitutional Bait and Switch," 1384 ("It is important to note that international agreements are characterized by an inherent degree of ambiguity and indeterminacy that makes interpretation challenging.").
19. See, e.g. Jack Goldsmith, "Should International Human Rights Law Trump US Domestic Law?," *Chicago Journal of International Law* 1 no. 12 (2000): 334, https://chicagounbound.uchicago.edu/cjil/vol1/iss2/12/ ("In the United States, enactment of a vaguely worded international human rights treaty [the ICCPR] is not an appropriate or effective remedy for particular gaps in domestic human rights protection. Any such deficiencies will be most effectively and legitimately rectified through targeted democratic lawmaking, not through wholesale incorporation of what would in effect be a new constitution for civil and political rights.").

PART III: APPLICATION TO OUTER SPACE LAW AND EXPORT CONTROL LAW

Keeping in mind the general predominance of binding international law over domestic law, but recognizing challenges to and criticisms of that relationship, this part now turns to how the relationship has manifested through the two systems driving the paper's central research question: international outer space law and domestic export control regulations. First, it provides a summary of relevant legal principles derived from outer space treaties to which the United States and member states of the European Space Agency (ESA) are party and interprets specific cooperative obligations arising from those treaties. Next, it summarizes the legal authorities governing the export control systems of the United States and Europe and notes sources of potential conflict between the two specialized systems.

A. LEGAL OBLIGATIONS DERIVED FROM OUTER SPACE TREATIES

Five international treaties and corresponding sets of legal principles govern international outer space law, in addition to various bilateral and multilateral agreements between states relating to outer space activities. For the purposes of this paper, the most significant of these legal authorities is the OST, as it covers the widest scope of outer space activities.[20] The United States and all 22 of the ESA member states are party to the OST and are thus legally bound to comply with each of its mandates.[21] Additionally, while international organizations cannot be party to the OST, the ESA itself has incorporated language from the OST directly into its convention and Council Rules of Procedure and has issued a declaration of acceptance of rights and obligations with respect to three of the other international treaties governing outer space law.[22] Thus, the ESA itself would likely be considered compliant with the OST if the entity were a party.

Under the treaty, states commit to refrain from placing weapons of mass destruction (WMDs) or objects carrying WMDs in orbit in outer space or on celestial bodies and from establishing military installations, testing weapons, or conducting military exercises on the moon and other celestial bodies.[23] In addition to these arms control mandates, this brief, 17-article document—described as surprisingly "optimistic" and "cooperative" for its time—requires that activities relating to the moon and other celestial bodies be carried out "exclusively for peaceful purposes."[24] Moreover, the use of

20. "The Outer Space Treaty at a Glance," Arms Control Association, last reviewed August 2017, https://www.armscontrol.org/factsheets/outerspace.
21. United Nations Office for Outer Space Affairs, "Status of International Agreements Relating to Activities in Outer Space," United Nations, January 1, 2020, https://www.unoosa.org/documents/pdf/spacelaw/treatystatus/TreatiesStatus-2020E.pdf. (Additionally, as of January 1, 2020, 25 of the 27 E.U. member states have signed and ratified the treaty; only Croatia and Latvia have not.)
22. The ESA has issued declarations with respect to the 1968 Agreement on the Rescue of Astronauts and the Return of Objects Launched in Outer Space, the 1972 Convention on International Liability for Damage Caused by Space Objects, and the 1975 Convention on Registration of Objects Launched into Outer Space. See, European Space Agency, *ESA Convention and Council Rules of Procedure* (Paris: December 2010), https://esamultimedia.esa.int/docs/LEX-L/ESA-Convention/SP-1317_EN.pdf; and United Nations Office for Outer Space Activities, *The European Space Agency as a mechanism and an actor of international cooperation*, (Vienna: April 2018), 2, https://www.unoosa.org/res/oosadoc/data/documents/2018/aac_105c_22018crp/aac_105c_22018crp_20_0_html/AC105_C2_2018_CRP20E.pdf ("ESA's activities are carried out for "exclusively peaceful purposes", a term directly linked to international space law. It is understood that the legal interpretation of this term is to be undertaken in consideration and respect of public international law, having due regard to instruments such as…the Outer Space Treaty."); and see, UNOOSA, "Status of International Agreements Relating to Activities in Outer Space."
23. "The Outer Space Treaty at a Glance," Arms Control Association.
24. Katie Wheeling, "Outer Space Treaties Didn't Anticipate the Privatization of Space Travel. Can They be Enforced?," *Pacific Standard*, August 14, 2019, https://psmag.com/social-justice/outer-space-treaties-didnt-anticipate-the-privatization-of-space-travel-can-they-be-enforced.

military personnel, equipment, and facilities in outer space are all authorized under the OST, so long as such use is "for peaceful purposes," in accordance with Article IV.[25] Thus, aside from the limited case of WMDs, the focus under the treaty is on the ultimate purpose of an item in outer space, rather than on the fundamental nature of the item as either military or non-military.

The OST further requires member states to abide by the following mandates relevant to international cooperation:

1. **Article I, clause 2:** Outer space shall be free for exploration and use by all states on a basis of equality and in accordance with international law.[26]
2. **Article I, clause 3:** There shall be freedom of scientific investigation in outer space, and states shall facilitate and encourage international cooperation in such investigation.[27]
3. **Article IX:** In the exploration and use of outer space, states shall be guided by the principle of cooperation and mutual assistance and shall conduct all their activities in outer space with due regard for the corresponding interests of other states.[28]
4. **Article XII:** All stations, installations, equipment, and space vehicles on the moon and other celestial bodies shall be open to representatives of other states on a basis of reciprocity.[29]
5. **Article XIII:** The provisions of this treaty shall apply to the activities of states in the exploration and use of outer space, regardless of whether such activities are carried on by a single state or jointly with other states.[30]

Of these, Article I, clause 3, and Article IX both impose an affirmative legal obligation on states party through the mandatory language: "States *shall* . . . ." However, the terms following these obligations are vague, providing room for diverging opinions in assessing the content of such obligations.[31] This vagueness emerges throughout the OST and has led to past disagreement over whether, for example, the term "peaceful" refers to activities that are "non-aggressive" (the opinion of the United States) or that are "non-military" (the initial opinion of the of the Soviet Union).[32]

Here, similar interpretive questions emerge.[33] Under Article I, clause 3, states are required to "facilitate" and "encourage" international cooperation; these terms imply a lower level of responsibility than a requirement to "ensure" such cooperation, for example, but the exact meaning of facilitation and encouragement in the context of export controls is unclear.[34] If a state adopts export control regulations so strict that their application to outer space items brings international cooperation in

25. Outer Space Treaty, Article IV.
26. Ibid., Article I, clause 2.
27. Ibid., Article I, clause 3.
28. Ibid., Article IX.
29. Ibid., Article XII.
30. Ibid., Article XIII. (Thus, even absent a technical assistance agreement with another state, a state party to the treaty must, for example, conduct outer space activities with due regard for the interests of the other state.)
31. Ibid.; see, also Barry Hurewitz, "Non-proliferation and Free Access to Outer Space: The Dual-Use Conflict Between the Outer Space Treaty and the Missile Technology Regime," *High Technology Law Journal* 9, no. 2 (1994): 218, https://www.jstor.org/stable/24122444 (Discussing interpretations of the binding nature of the Outer Space Treaty provisions during Senate consideration of the treaty).
32. Jackson Nyamuya Maogoto and Steven Freeland, "Space Weaponization and the United Nations Charter Regime on Force: A Thick Legal Fog or a Receding Mist?," *The International Lawyer* 41, no. 4 (2007): 1100-1101, www.jstor.org/stable/40707832.
33. In seeking to interpret the meaning of terms in the OST, this paper turns first to a good faith interpretation of the ordinary meaning of the text itself, per Article 31 of the Vienna Convention on the Law of Treaties.
34. As of September 1, 2020, the Merriam-Webster online dictionary defines "facilitate" as: to make easier; to help bring about. It defines "encourage" as: to inspire with courage, spirit, or hope; to attempt to persuade; to spur on; to give help or patronage to. Compare with "ensure," defined as: to make sure, certain, or safe; to guarantee.

outer space to a standstill, it would appear at first blush to have violated the Article I responsibility to "facilitate" international cooperation. However, if tailored export controls were employed as a necessary safety measure to allow for multilateral cooperative initiatives—by serving as a form of insurance that other states may not exploit proliferation vulnerabilities and thus should be treated more as partners and less as security risks—they could reasonably be viewed as a means of facilitation.

Similarly, the Article IX requirements that states be "guided by the principle of cooperation" and carry out outer space activities with "due regard" for the interests of other states do not provide clear-cut obligations in the context of export controls. Assuming the term "due regard" requires a state to take into consideration the existence of conflicting interests of other states and to balance their respective importance, how much balancing is sufficient?[35] Does "due regard" suggest that states should routinely review export control policies in outer space for their potential effects on the interests of other states? Does the requirement that actions be "guided by the principle of cooperation" impose any special obligation on states to avoid restricting the transfer of dual-use items in outer space? Or does it merely require that such restrictions be applied with the overarching goal of future cooperation in mind?

Taking the uncertain nature of this language into account, the OST provisions relating to international cooperation are broad enough that states party have significant leeway in adopting export control regulations for outer space items while still complying with a good faith interpretation of the treaty text. Moreover, subsequent practice in the application of OST obligations to export controls demonstrates that states continue to apply export controls to outer space activities without raising any accusations of treaty noncompliance.[36] Without court opinions clarifying the meaning of specific OST terms in the context of export controls, and in an absence of writings on their content by jurists or other interpreters of international law to the contrary, the content of U.S. and European obligations under the OST is by no means incompatible with reasonable export control regulations at the domestic level.[37]

For outer space activities carried out on or with respect to the ISS, the United States and the member states of the ESA are also party to the Intergovernmental Agreement on Space Station Cooperation of 1998 ("1998 ISS Agreement"). This treaty echoes language of the OST by setting forth "a long term international cooperative framework on the basis of genuine partnership" for the development and utilization of a space station "for peaceful purposes, in accordance with international law."[38] However, in a departure from the relatively vague language of the OST, Article 19 of the 1998 ISS Agreement includes specific provisions dealing with the exchange of technical data and goods.[39] This article states that the 1998 ISS Agreement "shall not require a Partner State to transfer any technical data and goods in contravention of its national laws or regulations" and includes an explicit recognition of items that may be protected for export control purposes under national laws, thus offering a potential resolution of the two systems that will be further addressed in Part V.[40]

35. See, Tullio Scovazzi, "'Due Regard' Obligations, with Particular Emphasis on Fisheries in the Exclusive Economic Zone," *International Journal of Marine and Coastal Law* 34, no. 1 (2019): 56–72, doi10.1163/15718085-23341041.
36. *Vienna Convention on the Law of Treaties*, United Nations, Art. 31–32.
37. See Goldsmith and Levinson, "Law for States," 1806–1807.
38. Department of State, *International Space Station (ISS) Intergovernmental Agreement* (Washington, DC: January 29, 1998), Art. 1, https://www.state.gov/wp-content/uploads/2019/02/12927-Multilateral-Space-Space-Station-1.29.1998.pdf (hereinafter "1998 ISS Agreement"); and "The International Space Station Legal Framework," European Space Agency, Accessed September 18, 2020, http://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/International_Space_Station/International_Space_Station_legal_framework.
39. Department of State, 1998 ISS Agreement, Art. 18.
40. Ibid.

B. CONFLICTING POLICY OBJECTIVES RELATING TO EXPORT CONTROLS

Despite the broad language of the OST and the explicit recognition that items may be subject to export control regulations under the 1998 ISS Agreement, this section demonstrates that tension still exists between underlying policy interests in international outer space cooperation (as embodied by U.S. and European participation in outer space law development) versus the policy objectives of export controls and the legal tools applied to achieve those policy objectives by the United States and Europe. These diverging objectives create the potential for future conflict if a state were either to enact a prohibitively strict export control regime for outer space activities or to interpret international cooperation obligations under the OST as requiring more specific technology exchanges or transfers.

While the legal system governing outer space activities is derived from international treaties and structured around general principles of multilateralism, cooperation, and shared scientific pursuit, the system governing exports of technical data and goods from one state to another is derived from voluntary arrangements and national legislation and structured around a central goal of national security—in particular, the nonproliferation of critical technical data and goods.[41] Additionally, while the outer space legal regime focuses primarily on peaceful purposes, the export control systems of both the United States and Europe generally focus instead on the characteristics of the item to be exported and whether those characteristics allow for potential military application, regardless of the ultimate intended purpose of such exports.[42]

At a legal hierarchy level, the difference in the two systems stems from the lack of a robust treaty regime on the subject of export controls.[43] Instead, at the multilateral level, the export control laws of the United States and Europe adhere to five voluntary, non-binding multilateral political arrangements (in addition to an array of UN Security Council sanctions and UN Security Council Resolution 1540).[44] These five arrangements are: the Nuclear Suppliers Group, the Australia Group, the Zangger Committee, the Wassenaar Arrangement (WA), and the Missile Technology Control Regime (MTCR), the latter two of which contain provisions particularly relevant to outer space export controls.[45] The WA is designed to control exports of dual-use items, thus covering the majority of items relating to outer space activities.[46] The MTCR controls exports of missiles capable of delivering WMDs (thus covering space launch vehicles and sounding rockets, among other items).[47] Because

41. See, e.g., "Research Administration and Compliance," University of Massachusetts Amherst, https://www.umass.edu/research/compliance/research-safety-and-security/export-controls.
42. *Cf.* 15 CFR § 7303.3 ("A "dual-use" item is one that has civil applications as well as terrorism and military or weapons of mass destruction (WMD)-related applications"); Outer Space Treaty, Article IV ("The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited").
43. Note that the Arms Trade Treaty in particular contains export control mandates for states party (the United States not being one) covering missile technologies relevant to outer space security and thus, while beyond the scope of this paper, it is a necessary topic for further study.
44. See, "United Nations Security Council Consolidated List," United Nations Security Council, updated September 20, 2020, https://scsanctions.un.org/fop/fop?xml=htdocs/resources/xml/en/consolidated.xml&xslt=htdocs/resources/xsl/en/consolidated.xsl; and United Nations Security Council Resolution 1540, April 28, 2004, S/Res/1540 (imposing affirmative duties on U.N. member states to implement appropriate measures to prevent WMD proliferation), https://www.un.org/disarmament/wmd/sc1540/.
45. "Export Controls," United Nations, accessed September 18, 2020, https://www.un.org/disarmament/wmd/export-controls/.
46. See, e.g., Frans von der Dunk and Fabio Tronchetti, *Handbook of Space Law* (Northampton, MA: Edward Elgar, 2015), 365 (noting that the Wassenaar Arrangement covers satellites, among other dual-use outer space items); Sa'id Mosteshar, "Space Law and Weapons in Space," Oxford Research Encyclopedias: Planetary Science, May 2019, doi:10.1093/acrefore/9780190647926.013.74 ("Although both the MTCR and the WA apply to certain space-related technologies, they do not address their placement or use in outer space. There are, however, limitations on the use of other weapons that apply both on Earth and in space, such as blinding lasers. These limitations would apply to use in space by virtue of the OST"); and Michael Mineiro, *Space Technology Export Controls and International Cooperation in Outer Space* (Dordrecht, Netherlands: Springer, 2012), 167–168.
47. Michael Mineiro, *Space Technology Export Controls and International Cooperation in Outer Space*, 167.

neither regime is legally binding, participating member states choose to opt into adopting and implementing national export control legislation in conformity with the rules of the WA and MTCR.[48]

In addition to participation in the WA and MTCR, the European export control system is also governed by Articles 113 and 223 of the Treaty of Rome and the Council Regulation (EC) (No. 428/2009), establishing a common framework for dual-use export controls for the European Union; by the Council Joint Action 2000/401/CFSP, an intergovernmental cooperation instrument set up by the Treaty on European Union; and by the Common Foreign and Security Policy (CFSP) Common Position 2008/944/CFSP, the EU framework for the export of military items.[49] Member states of the European Union follow a "principle of subsidiarity" in issuing national export control laws to complement these EU regulations.[50] However, certain member states have been criticized for national laws that fail to enforce compliance with overarching EU-wide regimes.[51]

In the United States, the export control system is governed by a complicated landscape of national legislation, in addition to the multilateral regimes described above. The Arms Export Control Act of 1976 authorized the International Traffic in Arms Regulation (ITAR) as the regulation controlling military items that may be placed on the United States Munitions List (USML) and subject to export and end-use controls accordingly. Three years later, the Export Administration Act of 1979 initially authorized the Export Administration Regulations (EAR) as the regime controlling commercial and dual-use items; since that act's expiration, the EAR has been continued through the invocation of the International Emergency Economic Powers Act and, most recently, through the Export Controls Act of 2018.[52] Under the EAR, dual-use items are placed on the Commerce Control List (CCL) and subject to separate licensing requirements and restrictions than those on the USML.[53]

Despite the somewhat patchwork nature of these U.S. and European authorities, scholars have derived three general policy principles associated with export control. National security interests—ensuring that WMD technology and research does not proliferate to actors capable of using such technology and research to harm the security of the state in question—and foreign policy objectives—for example, the movement to restrict exports to Communist states during the 1970s—

48. "Multilateral Export Control Regimes," Bureau of Industry & Security, U.S. Department of Commerce, https://www.bis.doc.gov/index.php/policy-guidance/multilateral-export-control-regimes; see, e.g., Daryl Kimball, "The Wassenaar Arrangement at a Glance," Arms Control Association, last reviewed December 2017, https://www.armscontrol.org/factsheets/wassenaar. (And note that while the MTCR is supplemented by The Hague Code of Conduct Against Ballistic Missile Proliferation, the Code presents a series of general principles, confidence building measures, and transparency steps for missile nonproliferation, rather than specific export control guidance.)

49. Center for Information on Security Trade Controls, *Historical Background of Export Control Development in Selected Countries and Regions* (April 2016), 21, http://www.cistec.or.jp/english/service/report/1605historical_background_export_control_development.pdf; Descartes Visual Compliance, "Understanding the EU Classification Regime," Export Compliance Journal, April 12, 2018, https://www.visualcompliance.com/blog/?p=1478; and Quentin Michel et al., "The European Union Dual-Use Item Control Regime: Comment of the Legislation Article-by-Article," European Studies Unit, Liége University, March 2020, 5, http://www.esu.ulg.ac.be/49/pdf/euduicr/euduicr_full.pdf.

50. Center for Information on Security Trade Controls, *Historical Background of Export Control Development*, 21.

51. Sibylle Baure et al., *Challenges and Good Practices in the Implementation of the EU's Arms and Dual-Use Export Controls* (Stockholm: Stockholm International Peace Research Institute (SIPRI), July 2017), 14, https://www.sipri.org/sites/default/files/2017-07/1707_sipri_eu_duat_good_practices.pdf; and Rosa Rosanelli, *Seeking Harmonisation: European Space Export Control at the Crossroads*, (Vienna: European Space Policy Institute, November 2011), https://www.files.ethz.ch/isn/136417/ESPI_Perspectives_54.pdf (See, for example, criticism of Romania's license application system).

52. Though note that the Export Controls Act of 2018 actually directs the president to implement the Export Administration Act of 1979 nonproliferation sanctions provisions pursuant to the International Emergency Economic Powers Act. See, section 1754(b) of the Export Controls Act of 2018 (50 U.S.C. 4813(b)) (on the relationship to IEEPA).

53. Ian F. Fergusson and Paul K. Kerr, *The U.S. Export Control System and the Export Reform Initiative*, CRS Report No. R41916 (Washington, DC: Congressional Research Service, updated January 2020), https://fas.org/sgp/crs/natsec/R41916.pdf.

are key motivating principles.[54] Scholars have also cited the promotion of domestic economic interests as a corollary factor: maintaining economic superiority through export regimes (the priority of the state implementing the export controls), versus seeking unfettered access to global markets and avoiding costly sanctions (the priority of the exporter).[55] While these economic goals may not be as prominent as those relating to national security or foreign policy in export control regimes writ large (as demonstrated through the removal of text speaking to economic protectionism in the United States' most recently enacted export control legislation), the outer space field in particular continues to have a major impact on the economy of states due to lucrative applications of space-related technologies, such as telecommunications and GPS systems.[56] Because of this, space-capable actors such as the United States and Europe retain a clear economic interest in applying export controls in a manner that maintains technological superiority in outer space.

At a policy objective level, these three underlying principles—national security, foreign policy, and, to an extent, economic interests—do not neatly align with the principles of international outer space law identified in Part II, such as the priority placed on freedom of peaceful exploration, mutual assistance, and international cooperation.[57] The focus on characteristics of the item, versus purpose for which the item will be used, also presents a fundamentally different framework between domestic export control regimes and international outer space law. Practically, these differences create a complicated landscape for actors within the outer space domain seeking to fulfil both policy objectives. Additionally, they raise the potential for future conflict between international and domestic law, if a state were to either adopt a prohibitively strict export control regime for outer space activities or interpret obligations under international law as requiring more specific cooperative actions.

54. See, e.g., Hurewitz, "Non-proliferation and Free Access to Outer Space," 243; Kenneth Abbot, "Linking Trade to Political Goals: Foreign Policy Export Controls in the 1970s and 1980s," *Minnesota Law Review* 65 (1981): 759, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1402954; Institute of Medicine, National Academy of Sciences, and National Academy of Engineering, *Finding Common Ground: U.S. Export Controls in a Changed Global Environment* (Washington, DC: 1991), 61, https://www.nap.edu/read/1617/chapter/8 ("The primary objective of the export controls authorized in the Export Control Act then became to prevent or delay improvements in Warsaw Pact (and Chinese) military capabilities that could be accomplished or facilitated through the acquisition of Western technology and end products.").
55. Rosa Rosanelli, "US Export Control Regulations Explained to the European Exporter: A Handbook," European Studies Unit, Liége University, 2014, 39, http://local.droit.ulg.ac.be/jcms/service/file/20140108134656_Handbook-RR-0801.pdf ; see also, "U.S. Export Controls," U.S. Department of Commerce, accessed September 20, 2020, https://www.trade.gov/us-export-controls ("The primary goal of BIS is to advance national security, foreign policy, and economic objectives by ensuring an effective export control and treaty compliance system, and promoting continued U.S. strategic technology leadership.").
56. Compare section 3(2) of the original Export Administration Act of 1979 (citing three policy objectives) to section 1752 of the Export Controls Act of 2018 (50 U.S.C. 4801 et seq.) (citing only two). The former lists the following objectives: (1) national security ("To restrict the export of goods and technology which would make a significant contribution to the military potential of any other country or combination of countries which would prove detrimental to the national security of the United States"); (2) foreign policy ("To restrict the export of goods and technology where necessary to further significantly the foreign policy of the United States or to fulfill its declared international obligations"); and (3) economic ("To restrict the export of goods where necessary to protect the domestic economy from the excessive drain of scarce materials and to reduce the serious inflationary impact of foreign demand"). The latter incorporates identical language relating to national security and foreign policy but removes the language relating to the domestic economy. See, e.g., Jean-Marie Bockel, "The Future of the Space Industry," NATO Parliamentary Assembly, Economic and Security Committee (ESC), November 17, 2018, https://www.nato-pa.int/document/2018-future-space-industry-bockel-report-173-esc-18-e-fin.
57. Though note that such export control principles may indirectly facilitate other obligations under the OST; for example, the national security principle of preventing other states from acquiring WMD capabilities may further the goals of the Article IV prohibition on the stationing of WMDs in outer space, as a state may not place WMDs in outer space if the state has not acquired the weapons in the first place. Outer Space Treaty, Article I ("There shall be freedom of scientific investigation in outer space"), Article IV ("The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited"); and see Hurewitz, "Non-proliferation and Free Access to Outer Space," 222.

PART IV: U.S. AND EUROPEAN APPROACHES TO EXPORT CONTROLS IN THE OUTER SPACE CONTEXT

How has this potential for conflict between outer space law and export control regimes been mitigated through the domestic approaches of the United States and Europe? This part analyzes the approaches of both actors with respect to domestic export control provisions covering outer space technologies and research, considering two factors, for the United States and Europe, respectively: (1) allowances for cooperative outer space research through deemed exports or intangible technology transfer provisions; and (2) accommodations for international transfers of outer space-related items. The analysis demonstrates that by adopting tailored regimes for export controls relating to dual-use outer space items and, in the case of Europe, by providing for knowledge exchanges of outer space technical data, both actors have mitigated the risks of potential conflicts between domestic export control regulations and international obligations for outer space cooperation.

A. U.S. APPROACHES

1. EXPORT OF KNOWLEDGE AND INTANGIBLE DATA RELATING TO OUTER SPACE RESEARCH

The United States does not provide an enumerated exception for the export of knowledge and intangible data related to outer space research activities. Under both the EAR and the ITAR, any release of military or dual-use technical data to a foreign person is considered to be an export to any country in which the person has held or holds citizenship or permanent residency.[58] Exports of controlled technology and information relating to outer space activities are frequently subject to this category of technical data.[59] Even when exports of outer space technology and information to foreign persons occur in the United States—for example, in a university lecture or a conference workshop—they are nevertheless considered deemed exports and require approval of a license application before the release may occur.[60]

The concept of deemed exports impacts outer space research and, in particular, multilateral collaboration in research initiatives, as broad categories of space systems and discourse related to such systems are controlled by the ITAR or EAR.[61] Thus, outer space projects involving collaboration with multilateral research partners, while echoing the goals of the OST cooperation provisions, are frequently hampered by rules relating to the export of knowledge and research.[62] As such, academic institutions and other research centers involved in outer space research have criticized the U.S. deemed export system for its precautionary approach to nonproliferation (mitigating risk through

58. 15 CFR § 734.2(b)(2)(ii); 22 CFR § 120.17.
59. See, e.g., U.S. Department of Commerce & U.S. Federal Aviation Administration, *Introduction to U.S. Export Controls for the Commercial Space Industry* (Washington, DC: November 2017), https://www.space.commerce.gov/wp-content/uploads/2017-export-controls-guidebook.pdf.
60. Mineiro, *Space Technology Export Controls and International Cooperation in Outer Space*, 51.
61. See, e.g., "Multilateral Export Control Regimes," U.S. Department of Commerce; David A. Broniatowski et al., "Balancing the Needs for Space Research and National Security in the ITAR," American Institute for Aeronautics and Astronautics, 2005, doi:10.2514/6.2005-6800, https://arc.aiaa.org/doi/abs/10.2514/6.2005-6800; and Morgan Dwyer et al., "The Global Impact of ITAR on the For-Profit and Non-Profit Space Communities," Massachusetts Institute of Technology, 25th Symposium on Space Policy, Regulations and Economics, IAC-12. International Astronautical Federation, 2012, https://dspace.mit.edu/handle/1721.1/80837 ("Spacecraft-related research activity previously subject to the fundamental research exclusion under National Security Directive 189 became subject to ITAR's strict export controls. This reform negatively impacted many actors within the non-profit space sector from national research labs to NASA to academic research facilities.").
62. Robert Hardy, "Export Controls and Universities: Licensing Research?," Council on Governmental Relations, 2004, 6, https://www.cogr.edu/sites/default/files/Presentation_on_Deemed_Export_Controls.pdf ("a broad USML category that presents a particular problem for the university space research community").

liberal use of restrictions), calling instead for a reactive approach (restricting research only once a risk is demonstrated).[63]

Granted, there exists a fundamental research exception within the U.S. deemed export system, by which "basic and applied research in science and engineering where the resulting information is ordinarily published and shared broadly within the scientific community" is exempt from license requirements under both the ITAR and EAR.[64] Once created in fundamental research, the information may be transferred abroad (or to foreign persons as a deemed export) without restriction.[65] However, under the same directive, research is not deemed to qualify as fundamental research if the university or research institution accepts any restrictions on publications resulting from the research (other than limited prepublication reviews by research sponsors), if the research involves government funding, or if the research falls under a number of other limitations.[66]

Additionally, the existence of a licensing system for deemed exports does not mean licenses relating to outer space research are never issued following review; even if the proposed research involves deemed exports of ITAR-controlled data subject to a presumption of denial, the exporter may still receive the license after meeting the required burden of proof. Practically, however, outer space researchers have criticized this approach as restrictive and expressed confusion about the application of the fundamental research exemption to space research projects.[67] Lawmakers have raised concerns that as a result of such confusion, universities and researchers interpret regulations conservatively and add unnecessary burdens to cutting-edge, collaborative outer space research.[68] This in turn risks creating a barrier to furthering the cooperative obligations of outer space law discussed in Part III.

2. ACCOMMODATIONS FOR INTERNATIONAL TRANSFERS OF OUTER SPACE-RELATED ITEMS

The U.S. export control system accommodates international transfers of items relating to outer space activities through unique mission-specific control frameworks, a carve-out for spaceflight passenger or participant experience, flexibility in transition of classifications between the ITAR and EAR, and exceptions relating to technical assistance agreements with cooperating governments.

First, the United States implements specific controls for certain outer space missions and passenger-related activities, whereby an item that would otherwise be subject to the USML is reclassified based on its ultimate use in outer space activities. For example, items (and the parts and components of such items) relating to the James Webb telescope are subject to a unique regulation that transfers their coverage to

63. Broniatowski, "Balancing the Needs for Space Research and National Security in the ITAR," 63; see also "Research Stakeholders Urge Caution in Creating Export Controls for 'Emerging Technologies'," American Institute of Physicists, January 22, 2019, https://www.aip.org/fyi/2019/research-stakeholders-urge-caution-creating-export-controls-%E2%80%98emerging-technologies%E2%80%99.
64. 22 CFR § 120.11(a)(8). https://www.law.cornell.edu/cfr/text/22/120.11.
65. Julie Norris, "Export Controls: The Challenges for U.S. Universities," (presentation, Massachusetts Institute of Technology), https://www.uh.edu/research/compliance/export-controls/Export_Controls_PPT.pdf.
66. Ibid.; and 22 CFR § 120.11(a)(8).
67. See, e.g., Norris, "Export Controls"; Tony Reichhardt, "Space researchers protest at 'disruptive' export controls," *Nature* 404, no. 321 (2002): https://www.nature.com/articles/35006225 ("A Hungarian scientist, for example, who built an instrument for a satellite being developed by Stanford University, was denied access to inspect his own instrument after it entered the United States.").
68. U.S. Congress, House, "Impacts of U.S. Export Policies on Science and Technology Activities and Competitiveness," Hearing Before the Committee on Science & Technology of the House of Representatives, 111th Cong., 2nd sess., February 25, 2009, https://science.house.gov/hearings/impacts-of-us-export-control-policies-on-science-and-technology-activities-and-competitiveness.

the less restrictive EAR (under ECCN 9A004) even though these items would otherwise meet the control text of USML Category XV, under the ITAR.[69] Items relating to the ISS are similarly subject to a mission-specific control and are listed under ECCN 9A004,[70] and both the ITAR and the EAR contain carve-outs for activities and technology required for spaceflight passenger or participant experience (such as space tourism and education).[71] Private industry actors in the civil space industry have called for an extension of these mission-specific controls to apply to additional outer space activities.[72]

Second, where a mission-specific or spaceflight passenger exception does not apply, the United States has demonstrated an implicit exception through flexibility in allowing transitions of outer space items between the ITAR and EAR. Beginning in 2001, the National Security Council created the Advisory Committee on Export Controls to resolve apparent conflicts surrounding "space qualified" items and rules governing their export, and in 2014, commercial communication satellite technologies were transferred from the USML to the CCL.[73] While the process of transition was slow-moving and lacked transparency, it nevertheless provided some measure of flexibility for outer space items.[74] Since 2014, the United States has continued a process of soliciting private industry comments to determine whether outer space items with potential commercial applications (for example, satellite thrusters, large aperture earth observation cameras, star trackers, and astrocompasses) should similarly be transitioned from the USML to the CCL.[75]

Finally, dual-use outer space items subject to the EAR and involving agencies of "cooperating governments" that have entered into a technical assistance agreement with the United States fall under the EAR license exception 740.11 ("License Exception GOV").[76] Thus, because the ESA is a civil intergovernmental organization in which all member states are "cooperating governments," direct transfers between NASA and the ESA for items regularly subject to the EAR may be exempt from license requirements under the EAR License Exception GOV.[77] For military items in outer space, the ITAR provides similar exceptions relating to exports of technical data in furtherance of government-approved agreements.[78]

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69. 82 Federal Register 2875 and 82 Federal Register 2889, Jan 10. 2017.
70. Ibid.
71. 15 CFR § 774, Supp. No. 1, Note 2 to ECCN 9E515(e), https://www.ecfr.gov/cgi-bin/text-idx?mc=true&node=ap15.2.774_12.1&rgn=div9 (e.g., human-rated centrifuge training, medical evaluation of the spaceflight passenger, training in "spacecraft" or terrestrial mock-ups).
72. For example, calling for expansion to the Lunar Gateway project and other astrophysics missions. See, "Request for Public Comments Regarding Review of Commerce Control List for Items Transferred From United States Munitions List Categories IV and XV," Federal Register, Bureau of Industry & Security of U.S. Department of Commerce, March 8, 2019, https://www.federalregister.gov/documents/2019/03/08/2019-04268/request-for-public-comments-regarding-review-of-commerce-control-list-for-items-transferred-from.
73. Christopher Byron Erickson, "The Evolution of U.S. Satellite and Space Launch Technology Export Control Policy," (Master's Thesis 2314, San Jose State University, 2002), https://scholarworks.sjsu.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=3310&context=etd_theses.
74. Commercial satellites were placed on the ITAR in 1976, then transferred to the EAR in 1984, then returned to the ITAR in 1998, then shifted back to the EAR in 2014. See, e.g., John Hoffner, "The Myth of ITAR-Free," CSIS, May 15, 2020, https://aerospace.csis.org/the-myth-of-itar-free/.
75. "Multilateral Export Control Regimes," U.S. Department of Commerce; Michael D. Beck et al., *To Supply or Deny: Comparing Nonproliferation Export Controls in Five Key Countries* (Netherlands: Kluwer Law International, 2003), 42–43.
76. "License Expectations," Bureau of Industry & Security of U.S. Department of Commerce, 24, https://www.bis.doc.gov/index.php/documents/regulations-docs/2341-740-2/file; and DDTC ITAR Exemption Codes, Exemptions 124.3A; 124.3B; 126.17E2, https://www.ups.com/worldshiphelp/WS20/ENG/AppHelp/Codes/DDTC_ITAR_Exemption_Codes.htm.
77. National Aeronautics and Space Administration (NASA), *NASA Export Control Program Operations Manual* (Washington, DC: October 10, 2017), 195, https://nodis3.gsfc.nasa.gov/NPR_attachments/N_AII_2190_001D_.pdf; see also, European Space Agency, *ESA's Cooperation with International Partners: Export Control Issues* (Paris: May 2004), http://www.esa.int/esapub/bulletin/bulletin118/chapter6_bul118.pdf.
78. 22 C.F.R. § 126.4 (transfers by or for agencies of the U.S. government); and 22 C.F.R. § 125.4(b)(3) (technical data in further-

B. EUROPEAN APPROACHES

1. EXPORT OF KNOWLEDGE AND RESEARCH RELATING TO OUTER SPACE RESEARCH

In a deviation from the U.S. system and its policy toward deemed exports, the European export control system does not cover in detail "intangible technology transfers" (ITTs) or exports of knowledge and information to foreign persons (for example, those enrolled in research courses at European universities or participating in industry research in Europe that involves intangible data relating to controlled items).[79] Some EU and ESA member states, such as Germany, further address ITTs to varying degrees in national law, but for the most part, references to ITTs are brief and merely address the fact that such transfers may constitute an export, with little guidance beyond this acknowledgment.[80] Due to the absence of detailed, overarching control over ITTs, an exception relating to the specific export of outer space knowledge is somewhat unnecessary.

Moreover, in its brief reference to intangible technology transfers of dual-use items, E.C. No. 428/2009 explicitly exempts from export authorization any intangible information that is "basic scientific research."[81] This exemption is broader than the "fundamental research" exemption employed by the United States; under the European system, any experimental or theoretical work undertaken principally to acquire "new knowledge of the fundamental principles and of phenomena or observable facts," not primarily directed toward a specific practical aim or objective, is not subject to export controls.[82] This is arguably more expansive than the U.S. exception, with its many qualifications, including those relating to publication and governmental restrictions. Moreover, the European exception has been interpreted broadly by EU member states due to Article 13 of the EU Charter of Fundamental Rights, in which academic freedom—interpreted to include the freedom to participate in learning, including through research projects, without discrimination—is enshrined as a core value.[83]

As a result of this more permissive approach to exports of knowledge and research relating to outer space activities, Europe is well positioned to engage in the kind of international scientific collaboration in line with objectives of the OST.

2. ACCOMMODATIONS FOR INTERNATIONAL TRANSFERS OF OUTER SPACE-RELATED ITEMS

The European export control system complements and expands upon the U.S. model by providing for outer-space specific exceptions and enumerated transfer guidance that are more concerned with the purpose of the export than with the characteristics of the item to be exported.

First, the European regime specifically carves out any dual-use items relating to outer space activities if the activities are to be conducted within the confines of the ESA or the national space agency of a member state.[84] While Category 9 of the E.C. No. 428/2009 "dual list" covers aerospace and propulsion controls—which include controls relating to spacecraft, space launch vehicles, propulsion systems, and related MTCR-controlled technologies—outer space related dual-use items may be exempted

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ance of TTA's, MLA's, under DOD directive, or in furtherance of an agency contract).

79. No. 428/2009, Article 2; Common Position 2008/944/CFS, Article 1 (clause 2); see also, Michel et al., "The European Union Dual-Use Item Control Regime," 21.
80. Baure et al., *EU's Arms and Dual-Use Export Controls*, 46.
81. See, Michel et al., "The European Union Dual-Use Item Control Regime."
82. Ibid., 17.
83. Baure et al., *EU's Arms and Dual-Use Export Controls*, 27.
84. Frans von der Dunk, "A European 'Equivalent' to United States Export Controls: European Law on the Control of International Trade in Dual-Use Space Technologies," *Astropolitics* 7, no. 2 (May 2009): 101–134, https://digitalcommons.unl.edu/spacelaw/10/.

from the category through this carve-out to Annex IV of E.C. No. 428/2009.[85] The carve-out applies to transfers of items that occur during any of the following scenarios:[86]

1. On the basis of orders pursuant to a contractual relationship with the ESA to accomplish its official tasks;
2. On the basis of orders pursuant to a contractual relationship with a member state's national space agency to accomplish its official tasks;
3. On the basis of orders pursuant to a contractual relationship placed in connection with an EU space launch development and production program signed by two or more European governments; and
4. To a state-controlled space launching site in the territory of an EU member state.

Granted, E.C. No. 428/2009 does not include "on the basis of compliance with legal obligations arising from international treaties relating to outer space" as an explicit scenario for dual-use item exemption.[87] However, the scenarios enumerated provide flexibility to fully comply with such obligations, as technical assistance agreements relating to collaborative, multilateral efforts in the outer space domain are generally entered into pursuant to one of the four scenarios. Thus, the European system provides an arguably broader carve-out than that of the mission-specific exception approach of the United States, as it covers any outer space mission transfers of dual-use items made on the basis of orders of the above.

Secondly, with respect to military items, the Council of the European Union's User Guide to Common Position 2008/944/CFSP explicitly states that member states should consider four enumerated factors when determining whether to grant a license application for the transfer of military technologies relating to space launch vehicle programs, with one factor being "[t]he recognition that States should not be excluded from utilising the benefits of space for peaceful purposes, but that in doing so, they must not contribute to the proliferation of ballistic missiles capable of delivering WMD."[88]

While this language does not provide for an explicit carve-out to transfers of outer space-related military items in the same way that E.C. No. 428/2009 provides licensing carve-outs for such dual-use items, it does encourage states to enforce export controls in adherence to principles of the OST, even when considering transfers of military space launch items, so long as such adherence does not contribute to WMD proliferation. Moreover, the enumeration of fixed factors itself provides a level of clarity and predictability for prospective exporters that the U.S. approach, with its gradual transfers of satellites between the ITAR and EAR and its dynamic, mission-by-mission approach toward other outer space endeavors, lacks.[89]

85. "UK Strategic Export Control Lists," U.K. Department for International Trade, December 2019, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/856510/UK_strategic_export_control_lists_20191231.pdf; and Jasper Helder et al., "International Trade Aspects of Outer Space Activities," Akin Gump, 11, https://www.akingump.com/a/web/61872/Outer-Space-Law-International-trade-aspects-of-outer-space-act.pdf.
86. European Commission, Regulation No. 428/2009; and Helder et al., "International Trade Aspects of Outer Space Activities."
87. See, European Space Agency, *ESA's Cooperation with International Partners: Export Control Issues*, 50.
88. "User's Guide to Council Common Position 2008/944/CFSP," Council of the European Union, 924/09, April 29, 2009, 36, https://data.consilium.europa.eu/doc/document/ST-10858-2015-INIT/en/pdf.
89. United States Department of Commerce, *Impact of U.S. Export Controls on the Space Industrial Base – BIS* (Washington, DC: 2014), https://www.bis.doc.gov/index.php/documents/technology-evaluation/898-space-export-control-report/file.

PART V: ANALYSIS

As demonstrated in Part IV, both the United States and Europe mitigate the risk of conflict between international law outer space obligations and domestic export control regimes to varying degrees and through slightly different means—for the United States, through tailored accommodations for international transfers of outer space-related items, and for Europe, through flexibility in transfers of outer space-related intangible technology in addition to broader accommodations and enumerated factors for tangible item transfers. This part of the paper now analyzes the effect of the two approaches, identifying benefits and limitations associated with each, and considers whether the 1998 ISS Agreement presents a separate path forward in clarifying the relationship between necessary outer space cooperation and vital export control functions.

A. ANALYSIS OF U.S. AND EUROPEAN APPROACHES

In general, the overarching European approach to export controls is more conducive to the knowledge sharing and collaboration required by international outer space law than that of the United States. Provisions such as those dealing with ITTs are more amenable to the legal obligations relating to free access and cooperation under the OST even without specific exemptions for outer space activities. Moreover, the European system treats outer space as a separate and unique domain for export controls through its creation of expansive carve-outs relating to dual-use items transferred pursuant to contracts with outer space agencies and its explicit acknowledgment of the rights of states under outer space law as a balancing factor in military item transfers.

This flexible approach may contribute to why Europe has been described as the most cooperative actor in the outer space domain.[90] The European space program was initially conceived of as primarily civil, rather than military, in application, and its export control regime governing outer space activities tracks with this distinction.[91] The civil focus itself further aligns with legal obligations under treaties relating to outer space, which were conceived of with a focus on peaceful use and civil exploration, and references to legal principles of the OST in official ESA documents, while not explicit, further demonstrate this harmonization.[92]

At a practical level, the more flexible European regime fosters cooperation through economic incentive, as compliance with the U.S. regime is costly for actors looking to export parts and components relating to outer space activities; in the past, this commercial competition was demonstrated through, for example, the marketing of "ITAR-free" satellites by the European company Thales Alenia Space.[93] Scholars have argued that certain changes in the U.S. system described in Part IV—for example, the transition of certain satellites to the less restrictive CCL—have arisen as a direct

90. See, e.g., Nicolas Peter, "Space Power and its Implications: the Case of Europe," *Acta Astronautica* 66, no. 3 (2010): 348–354, doi:10.1016/j.actaastro.2009.07.004; and Bohumil Doboš, *Geopolitics of the Outer Space: A European Perspective* (Switzerland: Springer, 2019), 41.
91. Doboš, *Geopolitics of the Outer Space*, 42.
92. Katie Wheeling, "Outer Space Treaties Didn't Anticipate the Privatization of Space Travel"; and ESA, ESA Convention, Art. XI (With respect to export controls specifically, the ESA Convention contains the following recognition: "The Council shall adopt rules under which authorisation will be given, *bearing in mind the peaceful purposes* of [the] ESA, for the transfer outside the territories of the Member States of technology and products").
93. PJ. Blount, "The ITAR Treaty and Its Implications for U.S. Space Exploration Policy and the Commercial Space Industry," *Journal of Air Law and Commerce* 73, no. 3 (2008): 713, https://core.ac.uk/download/pdf/147637485.pdf; see also, Steven J. Butow et al., *State of the Space Industrial Base 2020: A Time for Action to Sustain US Economic and Military Leadership in Space* (Washington, DC: CSIS, 2020), 18, http://aerospace.csis.org/wp-content/uploads/2020/07/State-of-the-Space-Industrial-Base-2020-Report_July-2020_FINAL.pdf ("US companies' potential market shares have been eroded by the rise of non-ITAR companies in Europe").

response to such commercial competition.[94] Where export controls are intended to fulfil economic goals, the U.S. approach has thus faced obstacles, as rigid export control policies risk driving purchasers away from cooperation with the United States and toward international competitors with more flexible regimes.[95]

However, these economic drawbacks of the stricter U.S. system are counterbalanced by the economic benefits of a system that, in theory, protects the relative exclusivity of the United States as a primary supplier in the space-capable field by denying critical technologies to new actors seeking to enter that field and offer market alternatives.[96] Moreover, it should be noted that the comparatively relaxed export control standards of Europe serve as a floor rather than a ceiling; as mentioned previously, under the principle of subsidiary, member states of the EU may impose harsher standards or interpret certain overarching export control provisions more narrowly.[97] For its part, the U.S. regime, while not as explicit in its deference to principles of cooperation in outer space, nevertheless includes separate regimes with tailored carve-outs for items and activities relating to outer space, and the entire regime benefits from uniformity Europe lacks.

This less flexible, more uniform approach reflects the importance of national security and nonproliferation to the U.S. regime and an acknowledgment of growing security risks in outer space, despite initial conceptions of outer space as a peaceful domain. As states export space launch capabilities by providing launch services to international clients (see, for example, Ukraine's efforts with Brazil to establish a launch facility in South America using Ukrainian technology), the landscape of space-capable actors is rapidly expanding.[98] Because of the dual-use nature of technologies such as space launch vehicles—which may be used to cover an intercontinental ballistic missile program—this expansion comes with an increased risk of WMD proliferation.[99] Other dual-use technologies in space contribute to military surveillance, reconnaissance, communication, and navigation.[100] Novel approaches in the private sector for using nuclear fuel for space launch and travel also carry obvious WMD proliferation concerns.[101]

94. See, P.J. Blount, "The ITAR Treaty and Its Implications."
95. Interview with John F. Hall, by Sandra Johnson, NASA Headquarters Oral History Project: Edited Oral History Transcript, August 2017, https://historycollection.jsc.nasa.gov/JSCHistoryPortal/history/oral_histories/NASA_HQ/Administrators/HallJF/HallJF_7-19-17.htm ("our high-tech [technology] companies were really starting to suffer vis-à-vis their competitors in the international marketplace, in part because of the cumbersomeness associated with the U.S. export control laws and policies"); Jana Robinson and Michael Romancov, "The European Union and Space: Opportunities and Risks," SIPRI, EU Non-Proliferation Consortium Non-Proliferation Papers, no. 37, January 2014, 7, https://www.sipri.org/publications/2014/eu-non-proliferation-papers/european-union-and-space-opportunities-and-risks.
96. Butow et al., *State of the Space Industrial Base 2020*, 41 ("Today, two US space solar cell vendors, SolAero and SpectroLab, command the largest global market share, but the combination of state-supported competition from China and Europe and insufficient incentives to 'buy American' put both at risk.").
97. Baure et al., *EU's Arms and Dual-Use Export Controls*, 42 ("The specific areas where concerns have been raised about different national practices are the implementation of 'catch-all' controls and different processing times for license applications.").
98. United Nations Institute for Disarmament Research, *Regional Perspectives for Norms of Behaviour for Outer Space Activities* (New York & Geneva: 2015), 23, https://www.unidir.org/files/publications/pdfs/regional-perspectives-on-norms-of-behaviour-for-outer-space-activities-en-622.pdf, 23.
99. See, Associated Press, "Iran Says It Launched a Military Satellite Into Orbit," *New York Times*, April 22, 2020, https://www.nytimes.com/2020/04/22/world/middleeast/iran-satellite-launch.html; see also, W. Bowen, *The Politics of Ballistic Missile Nonproliferation* (New York: St. Martin's Press, 2000), 25 (quoting the director of the Indian Space Research Organization as stating, "Any country which can place a satellite in orbit can develop an intermediate-range ballistic missile").
100. Melissa de Zwart, "New Technologies Symposium: Contested and Fragile: the Dual-Use Space Environment," Opinio Juris, July 5, 2019, http://opiniojuris.org/2019/05/07/new-technologies-symposium-contested-and-fragile-the-dual-use-space-environment/.
101. JoAnna Wendel, "Private Companies Find Role in Developing Nuclear Power for Space Travel," Space.com, April 6, 2020, https://www.space.com/commercial-nuclear-power-for-faster-space-travel.html.

While it may be something of a blunt instrument to address such proliferation risks, the U.S. export control system has nevertheless contributed to U.S. leadership in hard power and defense capabilities in outer space.[102] The tailored carve-outs and mission-specific controls implemented by the United States allow for compliance with legal obligations under the OST and other authorities while still mitigating these national security risks. Indeed, the nonproliferation function they serve may actually facilitate and encourage cooperation by creating a safeguarded environment in which other states may more easily be viewed as potential cooperative partners in outer space, rather than as potential proliferators.

To further advance cooperative obligations arising under outer space law treaties while maintaining vital nonproliferation functions, the United States could heed the call of private industry actors for an expansion of the mission-specific approach applied to the James Webb Space telescope and the ISS.[103] Additionally, the United States could review its policy on deemed exports to consider establishing an outer space research exception more aligned with the breadth of the European approach (for example, not requiring publication as a condition of the fundamental research license exception for outer space-related topics), or it could promulgate an enumerated list of arrangements that would qualify for a mission-specific exception, similar to the approach of E.C. No. 428/2009. Such a blend could allow the United States to more boldly advance the obligations arising under the OST while still maintaining the national security and nonproliferation standards necessary in the outer space domain.

B. THE 1998 ISS AGREEMENT

A separate approach toward clarifying the relationship between the two systems and their underlying policy objectives may be found in the 1998 ISS Agreement. Specifically, its Article 19 provisions stating that the agreement shall not require a state partner to contravene its domestic laws—including export control laws—is somewhat akin to a conflicts clause in contract law, by which a drafter stipulates which agreement will govern and control in the case of a legal conflict with another agreement.[104] This stipulation provides a clear roadmap for actors wishing to "facilitate" international cooperation and be "guided by principles of cooperation and mutual assistance" while still guarding against the proliferation of critical technologies and items relating to outer space (such as launch vehicles, spacecraft, and ground support equipment).

Moreover, Articles 8 and 10 of the agreement explicitly allow states to retain control over the operations of, and the equipment necessary for, their respective space station elements.[105] This provision further clarifies for states how exchanges of items and technical data may be permissibly limited even within the broader mandates of a multinational, cooperative project such as the ISS.

The approach taken in this 1998 treaty, enacted in the face of slightly more modern realities of international relations and emergent technologies, could be applied to future treaties to help further clarify the relationship between outer space treaties and domestic export control regulations and, in doing so, could help states and other space-capable actors avoid detrimental uncertainty as to compliance with each. Admittedly, it would be difficult to retroactively implement such a clause

102. Mateo Hahn, "Soft power, hard power, space power: Space programs of the United States and the United Kingdom," (Master's Thesis 1790536, Universiteit Leiden, 2018), https://studenttheses.universiteitleiden.nl/handle/1887/83971; nd Doboš, *Geopolitics of the Outer Space*, 41.
103. 82 Federal Register 2875 and 82 Federal Register 2889, Jan 10. 2017.
104. 1998 ISS Agreement, Art. 19, clauses 1 through 3 ("This Article shall not require a Partner State to transfer any technical data and goods in contravention of its national laws or regulations."); see, Jan B. Mus, "Conflicts between Treaties in International Law," *Netherlands International Law Review* 45, no. 2 (August 1998): 208–232, doi:10.1017/S0165070X00000218.
105. 1998 ISS Agreement, Art. 8, Art. 10.

to existing international laws such as the OST due to challenges with the process of amending or modifying preexisting multilateral treaties.[106] However, the approach still holds value for future collaborative endeavors in outer space that may require formal multilateral agreements, such as the Deep Space Gateway project.[107]

PART VI: CONCLUSION

In conclusion, there exists an inherent potential for conflict between the policy objectives of export control systems, which focus on national security and nonproliferation, and the principles of outer space law, which focus on peaceful use and international cooperation. Because outer space law is derived from international treaties, its associated obligations relating to cooperation preempt those of export control systems, which are derived from non-binding multilateral arrangements and domestic law. However, the language of the OST is broad enough that domestic export control regulations do not necessarily run afoul of its international law mandates relating to cooperation, and the 1998 ISS Agreement specifically allows for such regulations.

States may further mitigate the risk of conflict by adopting approaches to the exports of outer space-related items and data similar to that of the United States or, for even greater facilitation of cooperation, to that of Europe: through permissive approaches to collaborative outer space research and broader accommodations for international transfers of certain outer space items. Where a state seeks to increase international cooperation in compliance with and in furtherance of outer space treaties, it may draw from best practices in Europe, while it may look to the United States for lessons in uniformity and more security-focused regimes that nevertheless acknowledge outer space as a unique domain (such as through the adoption of more limited, mission-specific, end-use controls). The 1998 ISS Agreement offers a third potential path forward through its inclusion of a conflict clause and may be used as a model to clarify the relationship between export controls and outer space law in future treaty language.

Setting aside progress to be made in the outer space context specifically, there is inherent value in the process of recognizing a conflict between domestic and international law and assessing potential approaches toward achieving national compliance with existing international law obligations. This is especially true in a time when prospects for future arms control treaties—and international treaties more generally—grow increasingly uncertain.[108] Clarifying the relationship between outer space law and export control law is also useful for the United States and Europe given the role of private actors in both regions utilizing outer space for commercial and entrepreneurial purposes.[109] These actors are controlled by both international and domestic law, and setting a clear approach at the national level will facilitate compliance with each.

106. Noting that this may also result in negotiation difficulties at the forefront.
107. "Deep Space Gateway to Open Opportunities for Distant Destinations," NASA, March 28, 2017, https://www.nasa.gov/feature/deep-space-gateway-to-open-opportunities-for-distant-destinations (quoting William Gerstenmaier, associate administrator for Human Exploration and Operations at NASA Headquarters: "I envision different partners, both international and commercial, contributing to the gateway and using it in a variety of ways with a system that can move to different orbits to enable a variety of missions.").
108. *See*, Robert Einhorn, "Prospects for Arms Control in the Next Decade," Brookings, December 2019, https://vcdnp.org/wp-content/uploads/2019/12/Einhorn-Russia-US-dialogue-Moscow-Nov-2019.pdf; and Jeremiah Smith, Jr., "The Controversial Status of International and Comparative Law in the United States," *Harvard International Law Journal* (August 2010), https://harvardilj.org/2010/08/online_52_minow/.
109. Doboš, *Geopolitics of Outer Space*, 42.

Finally, given the practical realities of increasing globalization, the study of how outer space law principles on international cooperation may be incorporated into export control regimes is vital to progress in a globalized community. In a 2017 interview, the former NASA director for Export Control and interagency liaison reflected on the practical need for international cooperation, stating, "with regard to international participation . . . space costs a lot of money, requires a lot of talent, and there are resources and talent available all across the globe for shared scientific and engineering objectives, so yes, cooperation is very important."[110]

This paper has attempted to provide a starting point for a broader conversation on how such international cooperation, required by outer space law authorities, has been reconciled with nonproliferation and national security objectives under export control regimes.

110. Interview with John F. Hall by Sandra Johnson.

Who's To Say? Technical Dimensions of Nuclear Disinformation

Matty S. Golub[1]

Humanity has experienced 75 years of nuclear weapons not being used in conflict. The phenomenon is singular and much studied, leading politicians and scholars to treat them as unique and distinct from all other types of weapons.[2] Their exceptional concentrated power and devastating effects have rendered their use inconceivable in all but the most severe scenarios. In the literature, nuclear non-use has assumed the status of a normative "taboo," which imparts noteworthy strength. A country's use of even one nuclear weapon invites widespread condemnation, economic and political backlash, and military response or regime-changing intervention.[3] This structure is maintained by the assumption that international consensus on nuclear weapons, or at least on the consequences of their use, translates into a de facto rule that guides states' actions. It is based on an "action-consequence" paradigm, in that the community of nations imposes consequences on actions that violate agreed-upon norms of behavior.

This principle also informs deterrence of aggression, in that the potential for retaliatory action influences state behavior. Nuclear deterrence, in particular, is founded on the devastating effects of nuclear weapons. It may be "deterrence by denial," a strategy of making an adversary's goals infeasible or unlikely to succeed, or "deterrence by punishment," based on the threat of severe consequences.[4]

1. Matty S. Golub is a PhD candidate at Johns Hopkins University researching advanced computational methods for policy development and intelligence.
2. Robert Jervis's work is the authority on the subject. He asserts that acceptance of mutual vulnerability to nuclear weapons between adversaries has a stabilizing effect, enforcing "peace between the superpowers." Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca, NY: Cornell University Press, 1989), 45.
3. George H. Quester, "If the Nuclear Taboo Gets Broken," *Naval War College Review* 58, no. 2 (2005): 71–91, https://digital-commons.usnwc.edu/nwc-review/vol58/iss2/5.
4. Michael J. Mazarr, "Understanding Deterrence," RAND Corporation, 2018, doi:10.7249/PE295.

Both stem from the magnitude of destructive power but the latter is of particular interest.[5] The nuclear non-use norm is premised on the severity and widespread destruction of nuclear detonations and the global catastrophe that would follow a nuclear exchange. Therefore, the consequences of nuclear use are so severe that it is not generally considered.[6] The prospect of widespread international reaction helps explain the United States' nuclear restraint in wars over the last seven decades.[7] Underlying this state of affairs is a deeper assumption that any nuclear detonation will be readily apparent and its occurrence a matter of fact. The characteristics of current global competition, however, weaken this assertion.

The driving question of this inquiry is if and to what extent effective disinformation about nuclear weapon use ("nuclear disinformation" for short) is possible. Recent history shows that disinformation is a potent tool of interstate and intrastate competition. As fabricated news stories and social media influence campaigns have proliferated, the information landscape has become a fractured battleground of competing narratives and realities. In this context, where does subjectivity end and undeniable, objective fact begin? Nuclear weapons, by virtue of being the most physically destructive weapons in existence, present an intriguing test case. They are an "absolute"—of destructive effect and of symbolism of human conflict. Given that severity, it is vital to examine the strength of nuclear weapons as a conceptual backstop of subjective reality (i.e., a singular phenomenon about which there can be no doubt).

To that end, this work frames the concept of nuclear disinformation as a function of the nuclear detonation and its effects, the observation of the event by outside actors, and a state's capacity for controlling the flow of information. It begins with an examination of disinformation as a weaponization of the postmodern perspective. Aspects of information operations salient to nuclear use are presented and then connected to nuclear effects. Nuclear weapon effects are presented as an array of signals—information that can be observed or sensed. It is shown that these signals vary with the type of nuclear detonation. In the context of disinformation, the barriers to nuclear use transform into a question of blocking, attenuating, or otherwise obscuring the evidence. As discussed below, this is a challenge for which modern information warfare may be well suited. However, growth in open-source monitoring has occurred in parallel and may serve to mitigate nuclear disinformation. This paper concludes by presenting avenues for further inquiry that build upon the technical foundations of this analysis, including implications for the nuclear taboo writ large.

DISINFORMATION IN THE POSTMODERN ENVIRONMENT

Disinformation campaigns are effective because they take advantage of the "postmodern condition" of the global information environment. Paul Cilliers defines this condition as one in which co-exist a "multiplicity of heterogenous discourses," and in which the only legitimate perspectives are local.[8] Marginalized and marginal voices have gained power through opposition to hegemony of given narratives—for example, the supremacy of the scientific method or the history of the United States—a key feature of postmodern processes. Furthermore, understanding narratives as competing with each

5. Jean-François Bélanger and T. V. Paul, "Nuclear Taboo" in *The SAGE Encyclopedia of Political Behavior*, Fathali M. Moghaddam, ed. (Thousand Oaks, CA: SAGE Publications, Inc., 2017), 550, doi:10.4135/9781483391144.n247.
6. Ibid.
7. Nina Tannenwald, *The Nuclear Taboo: The United States and the Non-Use of Nuclear Weapons Since 1945* (Cambridge: Cambridge University Press, 2007), 122, 205, 299.
8. Paul Cilliers, *Complexity and Postmodernism: Understanding Complex Systems* (New York: Routledge, 1998), 114.

other between identity groups directly informs the strategy of modern disinformation operations.[9] The Russian disinformation campaign during the 2016 U.S. election specifically focused on "socially divisive issues—such as race, immigration, and Second Amendment rights—in an attempt to pit Americans against one another and against their government."[10] Furthermore, Russia is actively engaged in a "postmodern war with the West," aiming to weaken its opponents through hybrid warfare, which involves "fomenting disruption, division, and confusion."[11] Therefore, this aspect of hybrid warfare can be understood as efforts to exacerbate narrative competition to weaken the target state.

The postmodern foundation of hybrid warfare and the effectiveness of disinformation campaigns in obfuscating coherent narratives have already had significant impact on global events. The 2014 Russian invasion of Crimea included use of extensive information warfare within Russia and Ukraine and dissemination in Western countries, setting the stage for Russian intervention.[12] Through the course of the conflict, armed Russian agents with no insignia, known colloquially as "little green men," furthered Russian objectives, including organizing and leading destabilizing protests and occupying key infrastructure. While their activities benefitted Russia, their lack of insignia provided Moscow deniability and injected uncertainty into the information environment. Russia was then able to promulgate the narrative of liberating Crimea, generating a competing narrative bolstered by an ambiguous conflict environment. This case demonstrates the weaponization of narrative competition as a feature of the postmodern environment.

The Crimea example provides a reference point when considering nuclear weapons, in that the intensity of the armed conflict was very low. There was no bombing campaign, no cities came under large-scale attack, and very few military or civilian deaths occurred. Nuclear attack ostensibly presents the opposite extreme, the most intense conflict imaginable. If information operations could so effectively shape low-intensity conflict, could they affect the highest? From the postmodern perspective, could competing narratives or "alternative" sets of facts contest the occurrence of absolute destruction? While troubling, these questions call for examining nuclear use and assessing its susceptibility to obfuscation. The most pressing question then becomes: could a state conceal the effects of a nuclear detonation?

INFORMATION OPERATIONS AND NUCLEAR USE

The ability to sow doubt on a cohesive narrative of a given event has weaponized subjective reality and uncertainty to great effect. Information tools have evolved drastically over the last two decades, revolutionizing the international information environment and providing additional opportunities for states to exert influence. Russian interference in the 2016 U.S. election influenced segments of the U.S. body politic, generating an aggregate change in its political discourse.[13] The exacerbation of political divisions has accelerated U.S. decline in relative international power. Nations' adoption of

9. Ibid., 116.
10. United States Senate Select Committee on Intelligence, *Report of the Select Committee on Intelligence United States Senate on Russian Active Measures Campaigns and Interference in the 2016 U.S. Election, Volume 2: Russia's Use of Social Media with Additional Views* (Washington, DC: United States Senate), 6, https://www.intelligence.senate.gov/sites/default/files/documents/Report_Volume2.pdf.
11. Patryk Babiracki, "Putin's Postmodern War with the West," *Wilson Quarterly*, 2018, https://www.wilsonquarterly.com/quarterly/the-disinformation-age/putins-postmodern-war-with-the-west/.
12. United States Army Special Operations Command, *'Little Green Men': A Primer on Modern Russian Unconventional Warfare, Ukraine 2013-2014* (Fort Bragg, North Carolina: August 2016), 52–53, https://www.jhuapl.edu/Content/documents/ARIS_LittleGreenMen.pdf.
13. United States Senate Select Committee on Intelligence, *Report of the Select Committee on Intelligence United States Senate on Russian Active Measures Campaigns and Interference in the 2016 U.S. Election*, 28–29.

full-spectrum disinformation operations, but especially in digital media, has muddied the distinction of what is considered aggressive interstate action. The larger effect over the past decade has been to make disinformation, alternate narratives, and revisionist history tools of state power with a weakening effect on the coherence of Western alliances and worldviews.[14] Democratic governments are especially susceptible to this sort of information warfare, as their structures empower dissenting voices.[15] The emergence of modern information operations can be understood as the exploitation of narrative competition in service of state power. While peaceful disagreement is generally a strength of democratic forms of government, it can weaken or prevent coherent responses to adversaries' actions.

Russia's information operations illustrate three salient effects of modern information operations. First, planting alternate narratives to divide public opinion weakens national consensus, as evidenced by Russian information operations in the United States in 2016. The substance of the interference and its goal are still the subject of fierce disagreement in American politics, and the bitter divisions that define it are features of the intended effect.[16] Second, information operations have amplified voices sympathetic to Russia, a known Russian information tactic.[17] Third, Russia's support for and empowerment of isolationist factions in U.S. domestic politics has fomented considerable uncertainty about the United States' role internationally. President Donald Trump's questioning of the North Atlantic Treaty Organization's (NATO) relevance and the political forces that brought it to power provide clear illustration. Trump's base of support adheres to a strongly anti-globalization worldview, which views international organizations with skepticism. It also claims that the international community has taken advantage of the United States at the expense of the white working class.[18] As mentioned above, the confluence of nationalism, anti-globalist sentiment, and white grievance provided fertile ground for Russian information operations.[19] Additionally, Russian information sources have supported and fed into American narratives criticizing NATO members and have amplified other pro-Russian narratives.[20] Support for right-wing voices in the United States has served Russia's ends, as NATO allies have become uncertain of the United States' commitment to the alliance and the Trump administration has actively disparaged transatlantic partnerships.[21] The Trump administration has generated uncertainty in the alliance structure and relationships that weathered the Cold War. It has prompted observers to question whether the United States would respond to Russia in a military crisis when its allies, which may not fit into a narrowing definition of "vital interests," are at stake.[22] While America's divisions were deepening for decades before the 2016 election, the concerted Russian information campaign succeeded in accelerating it and creating division between the United States and its traditional allies.

14. Media Ajir and Bethany Vailliant, "Russian Information Warfare: Implications for Deterrence Theory," *Strategic Studies Quarterly* 12, no. 3 (2018), https://www.jstor.org/stable/26481910.
15. Joseph Nye, "Protecting Democracy in an Era of Cyber Information War," Hoover Institution, *Governance in an Emerging New World* 318, November 13, 2018, https://www.hoover.org/research/protecting-democracy-era-cyber-information-war.
16. Ibid.
17. Ajir and Vailliant, "Russian Information Warfare," 76.
18. Tom McTague and Peter Nicholas, "The World order that Donald Trump Revealed," *The Atlantic*, October 20, 2020, https://www.theatlantic.com/international/archive/2020/10/donald-trump-foreign-policy/616773/.
19. Morgan Chalfant, "Russia's propaganda machine amplifies alt-right," *The Hill*, August 26, 2017, https://thehill.com/policy/cybersecurity/348054-russias-propaganda-machine-amplifies-alt-right.
20. Kate Starbird, "Information Operations and Online Activism within NATO Discourse" in *Three Tweets to Midnight*, Harold A. Trinkunas, Herbert S. Lin, and Benjamin Loehrke, eds. (Washington, DC: Hudson Institute, 2020), 93, https://www.hoover.org/research/three-tweets-midnight.
21. Ibid., 93.
22. Richard Fontaine, "Profound Uncertainty in Munich: Is the united States Committed to European Security?," War on the Rocks, February 21, 2017, https://warontherocks.com/2017/02/profound-uncertainty-in-munich-is-the-united-states-committed-to-european-security/.

The effectiveness of modern information operations and presents a challenging question for the nuclear taboo and the prospect of future nuclear use. How could information operations facilitate breaking the nuclear taboo? The using country would need to obscure the circumstances of use and undermine agreement on the facts. A guiding principle of Russian information warfare is the destabilization of established facts, creating an environment where the truth can never be known.[23] The mobilization of social media, notably with large numbers of "bots" that automatically disseminate large quantities of content, would provide a source of information to compete with official sources. It has been shown that people's likelihood of accepting a statement as true is commensurate with the number of times they have been exposed to it, a tactic that Russia has integrated well.[24] In an environment of global disunity and myriad competing narratives, the information environment, its fragmented character a manifestation of the postmodern condition, has great potential to affect international response to nuclear use or the threat of it.

To successfully conduct nuclear disinformation, a country would need to minimize the likelihood and strength of international response to nuclear use. It could do so by conducting a campaign of information warfare to obscure truth, exacerbate divisions, and encourage nonintervention. It would also conduct information dissemination campaigns intended to create significant uncertainty surrounding the circumstances of its nuclear use. One effect would be to keep countries on the sidelines. Clouding the facts with uncertainty and amplifying domestic and international voices of dissent would hinder organized response, thereby slowing or preventing a consensus from coalescing. Injecting uncertainty and undermining trust in official statements, and often facts more generally, is an established strategy of both Russian and Chinese information operations.[25] President Trump also engages in disinformation campaigns against the U.S. populace, frequently using the bully pulpit to undermine consensus and contest recorded facts.[26]

Simply conducting a disinformation and influence campaign, however, is no guarantee that the nuclear taboo would be broken with minimal consequences. As discussed above, part of its strength rests on the consistent perception of nuclear weapons as distinct and unique from all other types of weapons. They are considered disproportionately destructive and have unacceptable lingering effects. Nuclear weapon employment options are diverse, however, with implications for a state's ability to minimize consequences of their use. Simply put, not all explosions are created equal.

MANAGEABLE SIGNAL OF NUCLEAR WEAPONS EFFECTS

Nuclear weapons have a broad range of yields, detonation types, and effects, with significant differences between various combinations. The concept of "nuclear use" is thus multifaceted, with implications for the persistence of non-use. Pervasive disinformation campaigns could transform the barrier to nuclear use. Instead of being a nearly unthinkable prospect, nuclear use could become a matter of controlling the observability of their effects. In this discussion, the "signal" of a nuclear detonation is defined as the combination and magnitude of its observable effects. These consist of

23. Christopher Paul and Miriam Matthews, "The Russian 'Firehose of Falsehood' Propaganda Model: Why it Might Work and Options to Counter It," RAND, 2016, https://www.rand.org/pubs/perspectives/PE198.html.
24. Ibid., 4.
25. Ajir and Vaillaint, "Russian Information Warfare"; Jean-Baptiste Jeangene Vilmer and Paul Charon, "Russia As A Hurricane, China As Climate Change: Different Ways Of Information Warfare," War on the Rocks, January 21, 2020, https://warontherocks.com/2020/01/russia-as-a-hurricane-china-as-climate-change-different-ways-of-information-warfare/.
26. Leonard Downie, Jr., *The Trump Administration and the Media: Attacks on press credibility endanger US democracy and global press freedom* (New York: Committee to Protect Journalists, April 2020), 17–18, https://cpj.org/reports/2020/04/trump-media-attacks-credibility-leaks/.

the seismic and acoustic signatures, observable electromagnetic radiation, blast and fire damage, and remaining sources of ionizing radiation. The characteristics of the detonation, comprised of yield and height of burst, affect those characteristics.

The smallest nuclear device generated and tested, the U.S. Davy Crockett munition, produced a yield equivalent to 20 tons of TNT.[27] The largest, the Soviet-made Tsar Bomba, had a yield of 50 megatons, more than 2 million times larger. A comparison of effects of a range of yields for a surface-level detonation is shown in Table 1.[28] It presents the approximate radii of 5 pounds per square inch (psi) of overpressure, thermal radiation that causes third-degree burns, and ionizing radiation. The effect of 15 kilotons is clearly much different than that of a 100 kiloton or 1 megaton detonation. All components of detonation signal scale with yield of explosive; when considered in isolation, a smaller yield would therefore generate a smaller signal to be managed.

YIELD / **Radius of:**	***20 t*** (Davy Crockett munition)	***15 kt*** (Little Boy, dropped on Hiroshima)	***100 kt*** (W-76 warhead, carried by U.S. and UK submarines)	***5 mt*** (carried on DF-5 Chinese ICBM)	***50 mt*** (Tsar Bomba, largest bomb ever detonated)
Third-degree burns	140 m	1.68 km	3.9 km	21.3 km	51.4 km
5 psi overpressure (collapses residential buildings)	120 m	1.13 km	2.12 km	7.83 km	16.9 km
500 rem acute radiation dose (causes 85% fatality in 1 month)	430 m	1.34 km	1.82 km	3.05 km	5.05 km

Source: Alex Wellerstein, "Nuke Map," Nuke Map, https://nuclearsecrecy.com/nukemap/.[29]

Height of burst (HOB) has a significant role in determining detonation signal and some effects. Detonation above ground, at or near surface level, and below ground or underwater each generate different phenomena; above-ground detonations are the focus of this discussion. Within this category, the HOB is categorized into surface, air, and high-altitude burst.[30] Surface and air bursts generate extreme pressure and radiation that comprise the destructive effect of the weapon. A surface burst generates more concentrated destruction and is more suited for destroying a specific target.[31] Its fireball, which generates temperatures on the order of tens of millions of degrees, occurs at or very

27. Matthew Seelinger, "The M28/M29 Davy Crockett Nuclear Weapon System," US Army Historical Foundation, https://armyhistory.org/the-m28m29-davy-crockett-nuclear-weapon-system/.
28. These effects were generated using Alex Wellerstein's Nuke Map, with the height of burst type set as "Surface." Alex Wellerstein, "Nuke Map," Nuke Map, https://nuclearsecrecy.com/nukemap/.
29. Per the FAQ, Dr. Wellerstein allows use of the site as an educational resource, so long as credit is given. This section of the FAQ site addresses it: https://nuclearsecrecy.com/nukemap/faq/#terms
30. A burst is considered high-altitude if it is detonated above 20 km. Office of Secretary of Defense for Nuclear Matters (OSD-NM), *Nuclear Matters Handbook 2020* (Washington, DC: U.S. Department of Defense, 2020), 240, https://www.acq.osd.mil/ncbdp/nm/nmhb/; Any burst where the fireball does not touch the ground is considered an air burst, and a surface burst occurs either at or slightly above the actual surface of the land or water. Samuel Glasstone and Philip J. Dolan, eds., *The Effects of Nuclear Weapons* (Washington, DC: U.S. Department of Defense, 1977), 9, 11, https://www.dtra.mil/Portals/61/Documents/NTPR/4-Rad_Exp_Rpts/36_The_Effects_of_Nuclear_Weapons.pdf.
31. North Atlantic Treaty Organization, *NATO Handbook on the Medical Aspects of NBC Defensive Operations* (Washington, DC: U.S. Department of Defense, 1994), 46 (3-6), http://large.stanford.edu/courses/2019/ph241/abbate2/docs/fm8-9.pdf.

near the surface, effectively vaporizing anything caught within it.[32] Holding yield constant, an air burst has a much larger area of effect due to accompanying increase in the radius of maximum pressure. It also experiences constructive interference of its pressure wave, which increases the maximum dynamic pressure generated. The pressure wave generated by the nuclear fireball and extreme heating expands spherically, and the portion that contacts the ground below the detonation rebounds and combines with the pressure wave moving outwards laterally. The resulting peak pressure can be multiple times higher than the maximum pressure generated by a similar yield detonation at surface level, or at any other point where constructive interference does not occur.[33] The detonation signal of a surface burst is smaller than for an air burst for the same weapon yield. Specifically, the radius of damage due to overpressure is smaller. For the purposes of military targeting, the intended target generally dictates HOB, as a surface burst is more suited for reinforced structures and the detonation altitude of an air burst can be optimized to achieve the largest radius of maximum pressure. Doing so generates maximum damage over the largest area. From the perspective of concentrating damage to minimize extent of physical destruction, a surface burst may seem desirable.

The fireball of a surface burst, which contacts the ground, vaporizes and draws in thousands of tons of material, exposing it to an intense flux of neutron radiation. Neutrons interact with this material at the level of its atomic nuclei, rendering much of it radioactive.[34] Induced radiation in tons of material comprises radioactive fallout, which, being too heavy to stay aloft in the atmosphere, "falls out" of the nuclear fireball as it rises into the atmosphere.[35] Prevailing wind will carry this material over a long distance, forming a "plume" of radioactive material that ultimately falls back to earth, contaminating all it touches. The intensity of this fallout, used here as a proxy for the danger it poses to life, depends on the yield of the detonation and exact HOB. General area radiation levels along the main axis of plume transport would be extremely dangerous for short-duration exposure. While the most severe levels of radiation decay to survivable levels after five to seven days, remaining contamination in water and soil can pose long-term health hazards.[36] As such, fallout as a signal that a weapon generates is perhaps hardest to manage, as it is observable evidence that would be almost impossible to obscure in any conceivable use scenario.

A high-altitude burst generates a distinctly different signal than an air or surface burst. The destructiveness of thermal radiation, pressure wave, and fallout are not significant. Instead, the extreme intensity of radiation generates an electromagnetic pulse (EMP), the main effect of this HOB.[37] The intense wave of x-rays and free electrons can damage or destroy electronics and cause power surges in electrical transmission lines. It is for these reasons that the U.S. EMP Commission was formed, as the threat of an electrical blackout or, more fantastically, a Dark Age-inducing event has stoked fear for decades.[38]

The effects of a high-altitude burst present an interesting case of observable signal. The Starfish Prime high-altitude detonation test in 1962 caused damage to satellites and generated a band of

32. Glasstone and Dolan, *The Effects of Nuclear Weapons*, 27.
33. OSD-NM, *Nuclear Matters Handbook 2020*, 230; and ibid., 90.
34. OSD-NM, *Nuclear Matters Handbook 2020*, 236.
35. Ibid., 237.
36. Ibid., 236; and United Nations Environmental Programme, *Radiation: Effects and Sources* (Vienna: 2016), 37, http://large.stanford.edu/courses/2017/ph241/kwan2/docs/unep-2016.pdf.
37. OD-NM, *Nuclear Matters Handbook 2020*, 240.
38. Aaron Mak, "Why Are Right-Wingers So Obsessed With Electromagnetic Pulses?," Slate, May 31, 2019, https://slate.com/technology/2019/05/emp-weapons-conservatives-trump-gingrich-huckabee.html.

high-energy particles that persisted in low earth orbit (LEO) for months.[39] Another high-altitude test caused interference in radio communications that lasted for approximately seven hours.[40] Induced radiation (i.e., fallout) was almost nonexistent when compared to a surface burst, and the blast caused no immediate injuries. The lasting effects of a high-altitude burst, therefore, arguably have much lower impact to human life than most other types of detonations. While the effect on satellite and other radio communications could be severe, as there are thousands more satellites in LEO now than when those tests occurred, the nearly nonexistent fallout and blast damage—which translate to humanitarian impact—could serve to mitigate international outcry. Given that the nuclear taboo is in part based on the perception that nuclear weapons' effects are too severe for their use, the prospect of limited humanitarian impact could effectively provide a low-barrier manner of use.[41]

Finally, the 1979 Vela incident presents an intriguing case study of uncertainty surrounding nuclear signature. A Vela satellite, designed to monitor Earth for evidence of nuclear detonations, detected a "double flash" of electromagnetic energy on September 22, 1979 over the South Atlantic Ocean.[42] The Central Intelligence Agency (CIA) concluded it was consistent with the signature of a nuclear test, but a White House panel rejected the conclusion. This panel was criticized as serving the Carter administration's political needs at the expense of the truth. It was suspected that Israel, in concert with South Africa, had conducted the test, but publicly stating that would have precipitated a political crisis.[43] In the aftermath, documents related to the incident remained secret, resisting declassification requests for decades. As much of the evidence was regarded as inconclusive, the truth of the event was obscured from public view. The incident and subsequent events highlight the susceptibility of investigation to political influence, rendering an event's true characteristics and cause uncertain for an extended period.

The range of nuclear weapons effects provide many options for managing detonation signal. When the potency of information operations is factored in, nuclear use appears less inconceivable than is usually assumed.

NUCLEAR EFFECTS AND OPEN-SOURCE REPORTING

Nations maintain classified monitoring technologies and platforms as part of their national security architecture. These capabilities are not fully known to the public, though some have been acknowledged as part of nuclear arms control efforts.[44] In a global landscape of division and contested information environment, countries' published evidence of a nuclear detonation may be

39. Edward E. Conrad et al., *Collateral Damage to Satellites from an EMP Attack* (Fort Belvoir, VA: Defense Threat Reduction Agency, August 2010), https://apps.dtic.mil/dtic/tr/fulltext/u2/a531197.pdf.
40. Glasstone and Dolan, *Effects of Nuclear Weapons*, 47; and William Robert Johnson, "High-altitude nuclear explosions," Johnston's Archive, last updated January 28, 2009, http://www.johnstonsarchive.net/nuclear/hane.html.
41. As an example of high-altitude bursts not being considered in humanitarian literature, the International Committee of the Red Cross dedicated an entire issue of its International Review to the "human effects of nuclear weapons." Electromagnetic pulse is not mentioned, though there are extensive discussions of radioactive fallout, detonation-induced fires, and long-term ecological and humanitarian impacts. International Committee of the Red Cross, "The human cost of nuclear weapons," *International Review of the Red Cross* 97, no. 899 (2015), https://international-review.icrc.org/reviews/irrc-no-899-human-cost-nuclear-weapons.
42. This type of flash is a unique signature to nuclear detonations. William Burr and Avner Cohen, eds., "The Vela Incident: South Atlantic Mystery Flash in September 1979 Raised Questions about Nuclear Test," George Washington University National Security Archive, December 6, 2016, https://nsarchive.gwu.edu/briefing-book/nuclear-vault/2016-12-06/vela-incident-south-atlantic-mystery-flash-september-1979-raised-questions-about-nuclear-test.
43. Avner Cohen and William Burr, "What the U.S. Government Really Thought of Israel's Apparent1979 Nuclear Test," Politico, December 8, 2016, https://www.politico.com/magazine/story/2016/12/1979-vela-incident-nuclear-test-israel-south-africa-214507.
44. Office of the Historian, "Strategic Arms Limitations Talks/Treaty (SALT) I and II," United States Department of State Foreign Service Institute, accessed July 19, 2020, https://history.state.gov/milestones/1969-1976/salt.

viewed with skepticism, especially as global power concentrations shift. Countries once known as anti-nuclear activists may find their interests better suited by silencing their criticism of another country's nuclear activities, especially if continued economic activity between them is at stake. Of great interest, then, are unclassified, public sources of information that could provide evidence of nuclear use. The expansion of open-source monitoring in the past few decades is a development that has augmented transparency in nuclear policy spaces.[45] Organizations informal and formal, non-governmental and intergovernmental, have evolved into a significant role in collecting and disseminating information. Their activities collect scientific and firsthand data on a wide array of topics that encompass or intersect with the nuclear field.

First among these groups is the Comprehensive Test Ban Treaty Organization (CTBTO). It maintains a global network of sensors that monitor for nuclear activity, including seismic, infrasound, hydroacoustic, and radionuclide monitoring stations and testing laboratories.[46] This capability makes the CTBTO the premier authority for documenting and presenting evidence of a nuclear detonation anywhere on Earth. Its instrument network detects signature of the blast, with each sensor best suited for underground, underwater, or above ground/atmospheric detonations. The radionuclide detection infrastructure monitors for radioactive particles and radioactive noble gases in the air. This signal is arguably the strongest evidence of nuclear activity, as there are multiple radionuclides generated in nuclear reactions that do not exist in nature.[47] The participation of dozens of countries in the CTBTO's sensor network and data sharing makes it the exemplar of international cooperation with regard to nuclear transparency. Independent actors comprise another critical source of information, especially in contested environments.

Sources of information about a nuclear detonation would consist of eyewitness videos, pictures, and accounts, which would spread globally in traditional media. In an uncontested information environment, these sources would conceivably serve as a reliable source of information. In a contested environment, one in which the nuclear-using country is attempting to control the flow of information about the event, targeting of traditional sources of information would be expected. The vulnerability of traditional media sources has been somewhat offset by the development of the open-source intelligence (OSINT) community. This informal group of practitioners has developed a significant role in documenting and disseminating reporting on conflicts as they occur. Recent instances include spreading information about the Syrian Civil War, the conflict on the Israel-Gaza border, unrest in Iran, and armed clashes in Jammu and Kashmir.[48] These groups serve as a conduit for amplifying firsthand accounts which, at other times, might not achieve widespread circulation.

Finally, the proliferation of publicly available, frequent-coverage satellite imagery has contributed to greater transparency of nuclear weapons activities. Multispectral and synthetic aperture radar (SAR)

45. For example, the Beyond Parallel project, run out of the Center for Strategic and International Studies, has used unclassified satellite imagery to discover undeclared ballistic missile bases and associated facilities in North Korea. Its stated purpose is to deliver "greater clarity and understanding to policy makers, strategists, and opinion leaders about Korean unification. "About," CSIS Beyond Parallel, https://beyondparallel.csis.org/about/; Joseph Bermudez, Victor Cha, and Lisa Collins, "Undeclared North Korea: Missile Operating Bases Revealed," CSIS Beyond Parallel, November 12, 2018, https://beyondparallel.csis.org/north-koreas-undeclared-missile-operating-bases/.
46. Interactive map displaying all international monitoring system sites available at https://www.ctbto.org/map.
47. "Radioactive Fallout from Nuclear Weapons Testing," U.S. Environmental Protection Agency (EPA), accessed 4 June 2020, https://www.epa.gov/radtown/radioactive-fallout-nuclear-weapons-testing; and "Radionuclide Basics: Cesium-137," EPA, accessed 4 June 2020, https://www.epa.gov/radiation/radionuclide-basics-cesium-137.
48. Twitter handles @AuroraIntel, @IntelCrab, @ELINTNews are prominent examples. Bellingcat is a well-known investigative journalism outlet that practices OSINT: https://www.bellingcat.com/; and additionally, https://auroraintel.net/ aggregates the work of the Aurora Intel network.

data is collected constantly by a growing collection of satellites, and access to many of them is free to the general public. The physical evidence of a nuclear detonation—for example, blast damage, a crater, and widespread fires and smoke—would be obvious in satellite images.

These public information sources and actors, however, are not impervious to state influence. Two examples illustrate both the role of open-source monitoring and reporting and the ability of states to hinder their work. In 2019, the government of India pressured Twitter into banning multiple OSINT users who were reporting on the border conflict between India and Pakistan.[49] It demonstrates both the significance of the online OSINT community and the attempts of sovereign governments to block sources of information regarding military conflicts. Information suppression of this type would be expected in another crisis between India and Pakistan, as each would attempt to control the prevailing narrative. Given that both states are nuclear-armed, control of information in a nuclear crisis, in the lead-up to and following nuclear use, is a logical next step.

While a formal organization with an international legal mandate, the CTBTO monitoring system was nevertheless interfered with in 2019. It occurred after the Nyonoska radiation incident, in which a nuclear energy source, reportedly for an experimental Russian weapon, failed and exploded, generating a seismic signature detected by the CTBTO monitoring system.[50] It is a central example of the limits that international structures have when a state simply refuses to comply. As the evidence of the Nyonoska radiation incident began to spread, the Russian government ceased reporting information to the CTBTO's stations in the area, effectively stifling the flow of information.[51] While Russia did later provide the withheld data, this incident highlights the vulnerability the CTBTO system and the weakness of a system based on voluntary reporting. While it is difficult to imagine complete erasure of the objective scientific evidence of a nuclear detonation, the Nyonoska incident demonstrates a state's ability to insert uncertainty into the aftermath of a nuclear event.

A NOTE ON TIME CONSTRAINTS

Given the speed at which digital media enables the flow of information, it is important to consider the time horizon for nuclear disinformation. While a high-altitude EMP would induce a communications blackout for some time after detonation, it could be expected that data and accounts would spread out of the affected area quickly from any source just outside the radius of effect. The number of observers, sensors, and communications pathways all but guarantees that data and evidence will spread. Roughly speaking, the time for information of an event to be communicated widely is inversely proportional to the number of outlets and pathways for such communication. Therefore, the time available for implementing effective nuclear disinformation is likely short. The acting nation, however, may yet be able to achieve its goals quickly, both through selection of its objective and the use of disinformation tactics. Therefore, while the international community will almost certainly attribute the nuclear detonation eventually, using disinformation tactics to amplify uncertainty surrounding nuclear use may provide ample time to act. A straightforward example is

49. Kevin Poulsen, "India Bullies Twitter Into Banning Accounts of American, British Students Thousands of Miles Away," Daily Beast, June 18, 2019, https://www.thedailybeast.com/india-bullies-twitter-into-banning-accounts-of-american-british-students-using-censorship-law-15.
50. Matthew Bodner, "An explosion. A radiation spike. Evacuations planned and canceled. What's happening in Russia?," Defense News, August 13, 2019, https://www.defensenews.com/global/europe/2019/08/13/an-explosion-a-spike-in-radiation-evacuation-preparations-what-exactly-happened-in-russia/.
51. Francois Murphy, "Global network's nuclear sensors in Russia went offline after mystery blast," Reuters, August 19, 2019, https://www.reuters.com/article/us-russia-blast-ctbto/global-networks-nuclear-sensors-in-russia-went-offline-after-mystery-blast-idUSKCN1V9183.

China using a high-altitude EMP to cause a communications blackout which, when coupled with disinformation, would provide enough time for Chinese troops to gain a foothold in its invasion of Taiwan. The truth would propagate globally, but China would have begun forcefully reuniting with Taiwan and therefore would achieve its goals.

CONCLUSION

In presenting the concept of nuclear disinformation, this study does not speculate on the likelihood of nuclear use. Rather, it sets the stage for further inquiry. If the premise of nuclear disinformation is accepted, its effect on state decisionmaking must be considered. How does the concept of nuclear disinformation influence states' willingness to use nuclear weapons? If a state believes that it can successfully obscure its nuclear use, at least long enough to achieve its objective, such use may become more likely. Nuclear use could therefore be viewed as less extreme in all aspects, resulting in a weakened taboo. With respect to the effects and intensity of any detonation, the incentives and perceived benefit would have to be enormous for a country to devote such effort to mitigating potential backlash. Given the enormous impact of multiple nuclear detonations, the public's general fear of radiation and the global network of nuclear monitoring equipment, it is conceivable that efforts to prevent consensus and obscure objective reality could be successful in a circumstance of only one nuclear detonation. Increasing amounts of abnormal radioactivity from particulate fallout or gaseous radioisotopes and the energy signatures of multiple detonations would be increasingly difficult to obscure in the information environment. It also bears repeating that the third instance of nuclear use in anger would be a watershed moment. Nuclear competition between the United States, Russia, and China represents a new nuclear age, and strategic interactions are now more complex than those that characterized U.S.-Soviet Union competition during the Cold War.[52] The integration of all forms of digital media into information warfare has already had unprecedented effects, and the international norms of behavior have been strained or broken in ways that have shocked the international community.

While it may indeed be unlikely that a country would bet its post-nuclear-use future on the success of disinformation, the possibility should not be discounted. This discussion's goal is to widen the range of possibilities considered when assessing the continued incentives of refraining from nuclear use. While it is fortunate that no country has broken the boundaries of the nuclear taboo, its persistence should be founded on the diligence of the international community to emerging and novel challenges. Successfully transforming the fact of a nuclear attack into a matter of opinion may seem far-fetched. But considering nuclear weapons in isolation from developments in other aspects of global affairs or the dynamics of postmodern perspectives, regardless of how remotely related they may seem, is an avoidable mistake.

52. Thomas G. Mahnken et al., *Understanding Strategic Interaction in the Second Nuclear Age* (Washington, DC: Center for Strategic and Budgetary Assessments, May 2019), 1, https://csbaonline.org/research/publications/understanding-strategic-interaction-in-the-second-nuclear-age/publication/1.

U.S. Conventional Intermediate-Range Missiles in East Asia

Can They Deter without Being Destabilizing?

Eric Gomez[1]

INTRODUCTION

The demise of the Intermediate-Range Nuclear Forces (INF) Treaty on August 2, 2019 will have important strategic reverberations. Arms control supporters and advocates have warned of new arms races and strategic instability. Some defense analysts, meanwhile, have pointed out the potential benefits of conventional U.S. ground-launched cruise and ballistic missiles with ranges between 500 and 5,500 kilometers (hereafter referred to as "intermediate-range missiles") as the United States prepares for an extended period of great power competition.

Moscow's test of a ground-launched cruise missile with treaty-violating range was the proximate cause of Washington's decision to leave the INF Treaty, but China's growing missile arsenal also nudged the United States toward withdrawal. According to a February 2019 report by the U.S.-China Economic and Security Review Commission, "Beijing has built up the world's largest and most diverse arsenal of ground-launched missiles. China's inventory contains more than 2,000 ballistic and cruise missiles, approximately 95 percent of which . . . would violate the INF Treaty if China was a signatory."[2] China's precise, long-range missile capabilities are especially threatening to the relatively few fixed sites in the region that the United States relies on to maintain a forward-deployed military presence, such as air and naval bases.

1. Eric Gomez is director for defense policy studies at the Cato Institute.
2. Jacob Stokes and Alec C. Blivas, *China's Missile Program and U.S. Withdrawal from the Intermediate-Range Nuclear Forces (INF) Treaty* (Washington, DC: U.S.-China Economic and Security Review Commission, February 4, 2019), https://www.uscc.gov/sites/default/files/Research/China%20and%20INF_0.pdf.

Under what circumstances can intermediate-range missiles contribute positively to conventional deterrence without causing significant damage to U.S.-China strategic stability? Supporters of the U.S. decision to withdraw from the INF Treaty argue that U.S. intermediate-range missiles will be beneficial for strengthening general deterrence against China's unwanted military activities, reassuring allies, and a host of other strategic goals.[3] The operational flexibility that intermediate-range missiles create could be very beneficial to the U.S. conventional position in East Asia. However, not all intermediate-range deployment models are created equal.

Intermediate-range missiles can enhance conventional deterrence without degrading strategic stability if the United States employs them in a certain way. A narrowly-defined target set and emphasis on denying easy movement for China's power projection forces would enhance the United States' conventional position while being more palatable to allies and less risky for U.S.-China strategic stability.

Before exploring the strategic implications of U.S. intermediate-range missiles in East Asia, it is valuable to briefly explain the definitions of some key terms and set the scope of analysis.

STRATEGIC STABILITY

Analysts and policymakers frequently invoke the term "strategic stability," but there is much disagreement over what strategic stability is. States frequently label the actions of their rivals as destabilizing even if the accuser is taking similar actions that it regards as stabilizing. For example, when the United States deployed a Terminal High Altitude Area Defense system to South Korea, China was quick to denounce the move as destabilizing even though Beijing is developing similar missile defense capabilities.[4] This amounts to "strategic stability for me, but not for thee."

This cynical yet popular formulation of strategic stability obscures its value as a tool for analyzing the merits of different military postures and policies. For this paper, "strategic stability" refers to a stable form of mutual deterrence where neither the United States nor China faces incentives or pressures for using nuclear weapons first in a conflict, either intentionally or inadvertently.[5] This definition of strategic stability is sometimes referred to as "first-strike stability."[6] Policies, actions, or weapons systems that increase incentives or pressures for nuclear first use are destabilizing, while those that decrease them are stabilizing.

INTERMEDIATE-RANGE MISSILES

Although the INF Treaty has "nuclear" in its name, it banned *all* ground-launched ballistic and cruise missiles with ranges between 500 and 5,500 kilometers, not just nuclear ones. The treaty was the result of the 1979 "dual-track decision," which entailed simultaneous deployments of U.S. nuclear-armed, land-based missiles to counteract similar Soviet missiles that threatened North Atlantic Treaty

3. Scott A. Cuomo, "It's Time to Make a New Deal: Solving the INF Treaty's Strategic Liabilities to Achieve U.S. Security Goals in Asia," *Texas National Security Review* 2, no. 1 (November 2018): 110, doi:10.26153/tsw/866.
4. "THAAD Deployment Undermines China-US, China-ROK Strategic Mutual Trust: Spokesman," Xinhua, August 26, 2016, http://www.globaltimes.cn/content/1002960.shtml; and Oki Nagai, "China Claims Success in Missile Shield Test," *Nikkei Asian Review*, February 7, 2018, https://asia.nikkei.com/Politics/China-claims-success-in-missile-shield-test. In the 2018 *Nuclear Posture Review*, the United States cited Russia's large arsenal of non-strategic nuclear weapons as an indicator of a dangerous "escalate to deescalate" approach to nuclear war. The Trump administration dealt with these destabilizing weapons by adding similar capabilities to the U.S. arsenal.
5. Justin V. Anderson and Amy J. Nelson, "The INF Treaty: A Spectacular, Inflexible, Time-Bound Success," *Strategic Studies Quarterly* 13, no. 2 (Summer 2019): 99, https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-13_Issue-2/Anderson.pdf.
6. Austin Long, "U.S. Nuclear Strategy toward China: Damage Limitation and Extended Deterrence," in *America's Nuclear Crossroads: A Forward-Looking Anthology*, Caroline Dorminey and Eric Gomez, eds. (Washington, DC: Cato Institute, 2019), 50, https://research.cato.org/americas-nuclear-crossroads.

Organization (NATO) allies and concurrent diplomatic efforts to get Moscow to reduce its deployed missiles.[7] When the INF Treaty entered into force, the United States and Soviet Union were not the only states to possess such missiles, but they had the largest and most advanced arsenals.

The intermediate-range missile landscape has changed significantly since the late-1980s. The proliferation of missile capabilities to a growing number of states hastened the INF Treaty's demise, given the treaty's unequivocal ban on the United States and Russia possessing any equivalent systems.[8] While the U.S. and Soviet missiles that helped create the INF Treaty carried nuclear warheads, improvements in precision mean that modern, conventional missiles can threaten some of the strategic capabilities that could previously only be reliably destroyed by nuclear weapons.[9]

In this paper, "intermediate-range missiles" refers to ground-launched missiles with ranges between 500 and 5,500 kilometers. Secretary of Defense Mark Esper has stated that the United States will not deploy intermediate-range missiles armed with nuclear warheads.[10] Therefore, this analysis assumes that future U.S. intermediate-range missiles will be conventional only. In the rare instances when this paper refers to U.S. air- or sea-launched missiles with ranges between 500 and 5,500 kilometers (several of which are dual-capable), this paper will make clear that these are distinct from the "intermediate-range missiles" definition.

INADVERTENT ESCALATION

The final important term to define is "inadvertent escalation," as this is the most likely way that a U.S.-China conflict could result in nuclear use. Inadvertent escalation occurs when conventional military operations unintentionally infringe upon the ability of a targeted state to effectively use its secure second-strike nuclear forces.[11] As stated by Barry Posen, author of the seminal work on inadvertent escalation, "[d]irect conventional attacks on critical nuclear forces, attacks that degrade strategic early warning or command and control systems, or even attacks on general-purpose forces that protect strategic nuclear forces, could all produce strong reactions from the party on the receiving end."[12] Actions that blur the lines between conventional and nuclear systems—such as using a common capability for nuclear and conventional command and control, deploying dual-capable systems in close proximity to each other, or having an ambiguous nuclear-use policy—can increase the risk of inadvertent escalation.[13]

7. Anderson and Nelson, "The INF Treaty," 92–96; and Kristina Spohr Readman, "Conflict and Cooperation in Intra-Alliance Nuclear Politics: Western Europe, the United States, and the Genesis of NATO's Dual-Track Decision, 1977-1979," *Journal of Cold War Studies* 13, no. 2 (Spring 2011): 39–89, https://muse.jhu.edu/article/435666.
8. Anderson and Nelson, "The INF Treaty."
9. Terence Roehrig, *Japan, South Korea, and the United States Nuclear Umbrella: Deterrence After the Cold War* (New York: Columbia University Press, 2017), 156. South Korea, for instance, has successfully tested a conventional ballistic missile capable of destroying buried North Korean leadership bunkers used for nuclear command and control. Elizabeth Shim, "Report: South Korea Tested New Ballistic Missile with Larger Warhead," UPI, May 7, 2020, https://www.upi.com/Top_News/World-News/2020/05/07/Report-South-Korea-tested-new-ballistic-missile-with-larger-warhead/5581588857625/.
10. Thomas Gibbons-Neff, "Pentagon Chief in Favor of Deploying U.S. Missiles to Asia," *New York Times*, August 3, 2019, https://www.nytimes.com/2019/08/03/world/asia/us-missiles-asia-esper.html.
11. Caitlin Talmadge, "Would China Go Nuclear? Assessing the Risk of Chinese Nuclear Escalation in a Conventional War with the United States," *International Security* 41, no. 4 (Spring 2017): 53–54, https://cpb-us-e1.wpmucdn.com/blogs.gwu.edu/dist/b/1590/files/2018/07/Talmadge-IS-2017-y16c9h.pdf.
12. Barry R. Posen, *Inadvertent Escalation: Conventional War and Nuclear Risks* (Ithaca, NY: Cornell University Press, 1991), 3.
13. James M. Acton, "Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War," *International Security* 43, no. 1 (Summer 2018): 56–99, https://carnegieendowment.org/2018/08/08/escalation-through-entanglement-how-vulnerability-of-command-and-control-systems-raises-risks-of-inadvertent-nuclear-war-pub-77028; James M. Acton, *Is It a Nuke? Pre-Launch Ambiguity and Inadvertent Escalation* (Washington, DC: Carnegie Endowment for International Peace, 2020), https://carnegieendowment.org/files/Acton_NukeorNot_final.pdf; and ibid., 12–22.

Although the risk of intentional nuclear escalation in a U.S.-China conflict is minimal, the likelihood of inadvertent escalation is higher and growing. While China's nuclear arsenal is increasing its number of warheads and adding new capabilities—a recent Defense Intelligence Agency assessment predicts the force will double in 10 years, though past assessments have not been accurate—it will still have a much smaller force compared to the United States.[14] China has an officially-stated no first use (NFU) posture, which is reflected in Chinese government statements on nuclear policy, the People's Liberation Army Rocket Force's (PLARF) exercises, and authoritative PLARF doctrine documents.[15] America's conventional position in East Asia is challenged by China's growing military power, but it is highly unlikely that it will deteriorate to the point that intentional U.S. nuclear escalation becomes Washington's preferred strategy. However, both the United States and China are taking actions that could increase inadvertent escalation risks. China, for instance, has increased the number of dual-capable missile systems in the PLARF's arsenal, and some Chinese strategists have started questioning the value of adhering to a strictly defined NFU posture.[16] The United States has (perhaps unintentionally) entangled its nuclear and conventional command and control systems in outer space, which China already had incentives to target even in a purely conventional conflict.[17]

SCOPE OF ANALYSIS

This paper discusses how U.S. intermediate-range missile deployment options could impact U.S.-China strategic stability. Although the United States did not leave the INF Treaty solely to counter China's missile threat, and a close examination of the stabilizing or destabilizing effects of intermediate-range missiles on the U.S.-Russia and U.S.-North Korea relationships is warranted, this paper does not address them.[18]

Unfortunately, there is very little unclassified information about U.S. intermediate-range missiles, in terms of both technical characteristics and the strategic rationale of the systems. Given this lack of official information, this analysis turns to theoretical arguments, media reports, and think tank assessments for evidence about potential missile characteristics and strategic purposes.

DOES THE UNITED STATES NEED INTERMEDIATE-RANGE MISSILES IN EAST ASIA?

How will U.S. intermediate-range missiles change the strategic picture in East Asia to America's benefit? The U.S. government has not released substantial information about its deployment plans

14. W.J. Hennigan and John Walcott, "U.S. Intelligence Expects China to Quickly Double Its Nuclear Stockpile," *Time*, May 29, 2019, https://time.com/5597955/china-nuclear-weapons-intelligence/; Hans M. Kristensen and Matt Korda, "Chinese Nuclear Forces, 2019," *Bulletin of the Atomic Scientists* 75, no. 4 (2019): 171–178, doi:10.1080/00963402.2019.1628511; and Hans M. Kristensen, "DIA Estimates For Chinese Nuclear Warheads," Federation Of American Scientists, May 31, 2019, https://fas.org/blogs/security/2019/05/chinese-nuclear-stockpile/. Kristensen and Korda estimate that in 2019 China had approximately 300 warheads stockpiled. The United States has roughly 4,500 warheads stockpiled and 1,400 deployed. China keeps warheads de-mated from missiles in peacetime.
15. Fiona S. Cunningham and M. Taylor Fravel, "Assuring Assured Retaliation: China's Nuclear Posture and U.S.-China Strategic Stability," *International Security* 40, no. 2 (Fall 2015): 12–15, doi:10.1162/ISEC_a_00215; and Gregory Kulacki, "Would China Use Nuclear Weapons First in a War With the United States?," *The Diplomat*, April 27, 2020, https://thediplomat.com/2020/04/would-china-use-nuclear-weapons-first-in-a-war-with-the-united-states/.
16. Cunningham and Fravel, "Assuring Assured Retaliation," 24–26, 46–47; and Eric Gomez, "Meet the DF-31AG and the DF-26: The Big Ballistic Missiles at China's Military Anniversary Parade," *The Diplomat*, August 8, 2017, https://thediplomat.com/2017/08/meet-the-df-31ag-and-the-df-26-the-big-ballistic-missiles-at-chinas-military-anniversary-parade/.
17. Acton, "Escalation through Entanglement."
18. For an initial assessment of intermediate-range missiles and U.S.-North Korea strategic stability, see Ankit Panda, "New U.S. Missiles in Asia Could Increase the North Korean Nuclear Threat," *Foreign Policy*, November 14, 2019, https://foreignpolicy.com/2019/11/14/us-missiles-asia-inf-north-korea-nuclear-threat-grow/.

and has flight tested only two potential missile designs since withdrawing from the treaty in August 2019 and the spring of 2020.[19] Therefore, most of the existing literature on the benefits of U.S. intermediate-range missiles in East Asia comes from defense analysts in think tanks and security studies scholars in academia. These analyses frequently connect the strategic utility of intermediate-range missiles to the operational flexibility they bring to America's conventional military posture.

The United States faces a challenging conventional deterrence picture in East Asia. China's conventional missile forces are both numerous and highly accurate, making them ideal systems for holding large, fixed targets at risk. Given the region's distance from the U.S. homeland, U.S. warfighting posture and extended deterrence commitments in East Asia are heavily dependent on a handful of air bases and port facilities.[20] Regional missile defense capabilities are improving, but it is relatively easy for China to make incremental improvements to offensive systems and overwhelm missile defenses.[21] While air- and sea-launched intermediate-range missiles were not prohibited by the INF Treaty, their launch platforms (ships, submarines, and aircraft) depend on these bases for logistical support.[22]

U.S. ground-based intermediate-range missile capabilities will undoubtedly increase the operational flexibility of the U.S. military vis-à-vis China. These operational benefits are directly linked to the technical characteristics of intermediate-range missiles.

The primary U.S. operational benefit would be improved survivability for offensive systems. It is generally much easier for modern sensor capabilities to locate a moving ship or aircraft than a ground-based vehicle because land presents a much more complex background for the sensor. As stated by security scholars Stephen Biddle and Ivan Oelrich, "[l]and-based missiles deployed amid a complex background thus enjoy systematic [reconnaissance, surveillance, and target acquisition] advantages against airborne or sea-surface foes."[23] China could still find and destroy intermediate-range missiles, but the task would likely take longer and be more challenging than targeting a U.S. warship or destroying an airfield with a missile salvo.

This enhanced survivability means that intermediate-range missile forces could stay within the range of China's anti-access/area denial (A2/AD) capabilities that might effectively push out U.S. aircraft and ships or, at a minimum, degrade their combat effectiveness.[24] Deploying ground-based missiles on friendly territory within the first island chain (e.g., in Japan, Taiwan, and the Philippines) would also help the United States gain more strategic depth by requiring China to surveil a larger area to

19. The two missiles were a ground-launched version of the Tomahawk cruise missile, which has been in service since 1983, and ballistic missile that appears visually similar to targets used in U.S. missile defense testing. Aaron Mehta, "Watch the Pentagon Test a Previously Banned Ballistic Missile," Defense News, December 16, 2019, https://www.defensenews.com/space/2019/12/12/pentagon-tests-previously-banned-ballistic-missile/; and Aaron Mehta, "Watch the Pentagon Test Its First Land-Based Cruise Missile in a Post-INF Treaty World," Defense News, August 26, 2019, https://www.defensenews.com/pentagon/2019/08/19/pentagon-tests-first-land-based-cruise-missile-in-a-post-inf-treaty-world/.
20. Anderson and Nelson, "The INF Treaty," 105; Thomas G. Mahnken et al., *Tightening the Chain: Implementing a Strategy of Maritime Pressure in the Western Pacific* (Washington, DC: Center for Strategic and Budgetary Assessments, 2019), 13–14, https://csbaonline.org/research/publications/implementing-a-strategy-of-maritime-pressure-in-the-western-pacific.
21. Cuomo, "It's Time to Make a New Deal," 107; and Eric Gomez, "It Can Get You into Trouble, but It Can't Get You Out: Missile Defense and the Future of Nuclear Stability," in *America's Nuclear Crossroads*, 19–20.
22. Eric Sayers, "The Intermediate-Range Nuclear Forces Treaty and the Future of the Indo-Pacific Military Balance," War on the Rocks, February 13, 2018, https://warontherocks.com/2018/02/asia-inf/.
23. Stephen Biddle and Ivan Oelrich, "Future Warfare in the Western Pacific: Chinese Antiaccess/Area Denial, U.S. AirSea Battle, and Command of the Commons in East Asia," International Security 41, no. 1 (Summer 2016): 12, doi:10.1162/ISEC_a_00249.
24. Jacob Cohn et al., *Leveling the Playing Field: Reintroducing U.S. Theater-Range Missiles in a Post-INF World* (Washington, DC: Center for Strategic and Budgetary Assessments, 2019), 18–19, https://csbaonline.org/research/publications/leveling-the-playing-field-reintroducing-us-theater-range-missiles-in-a-post-INF-world.

detect incoming threats.[25] Moreover, intermediate-range missiles increase the target set for Chinese forces. Reducing U.S. striking power is much easier if that force depends on a handful of large air and naval bases, but if mobile missiles can distribute their logistics and support facilities, it will take more Chinese strikes to achieve a similar level of disruption to U.S. operations.[26]

Improved survivability of U.S. offensive systems could enhance strategic stability by reducing incentives for China to take preemptive action in a conflict or crisis. Under the current system, where most U.S. striking power is tied to relatively few bases, Beijing faces a strong incentive to conduct preemptive attacks so it can seize a decisive advantage.[27] Distributing U.S. striking power using intermediate-range missiles could reduce China's preemption incentive by reducing the relative benefit of early offensive action. China would still improve its chances of victory by attacking U.S. air and naval bases, but this would represent a smaller proportion of America's overall military strength in the region, so the relative benefits of attacking are lower. However, the potential stabilizing effect of U.S. intermediate-range missiles depends in large part on how many missiles the United States deploys and their envisioned target set. A smaller deployment that mostly targets Chinese enabling capabilities (e.g., sensors, command and control nodes, communications systems), for example, would likely aggravate preemption incentives for both the United States and China instead of reducing them.

U.S. intermediate-range missile units could also improve the operational flexibility of U.S. air and naval forces. First, ground-based missile units could reduce the number of ships and aircraft required for effective conventional deterrence.[28] The United States may not have to deploy a bomber squadron to Guam, for example, if a missile battery can hold the same target sets at risk.[29] Moving ships and aircraft further away from China's A2/AD systems would reduce the risk of their early destruction—although such movements could make it harder to reassure allies.[30] The second positive knock-on effect of intermediate-range missiles for U.S. air and naval forces is the ability of ground-based missiles to free up payload space. Putting an Arleigh Burke-class destroyer's land-attack cruise missiles ashore would free up magazine space for missile defense interceptors or anti-ship munitions. Finally, ground-based intermediate-range missiles could improve the operational effectiveness of air and naval forces by punching holes in China's air defense networks.[31] Strikes that degrade Chinese situational awareness of follow-on attacks will make those secondary attacks more likely to succeed. However, such operations could also carry a higher risk of inadvertent escalation.[32]

COMPLICATING FACTORS: ALLIANCE POLITICS AND THE TARGET SET DEBATE

The strategic benefits of intermediate-range systems examined in the preceding section will have to be considered alongside two other factors: allies' willingness to deploy the missiles and what

25. Cuomo, "It's Time to Make a New Deal," 114.
26. Cohn et al., *Leveling the Playing Field*, 8–9, 15.
27. Thomas Shugart and Javier Gonzalez, *First Strike: China's Missile Threat to U.S. Bases in Asia* (Washington, DC: Center for a New American Security, June 2017), 2–3, https://www.cnas.org/publications/reports/first-strike-chinas-missile-threat-to-u-s-bases-to-asia.
28. Cuomo, "It's Time to Make a New Deal," 119.
29. Michael J. Mazarr, "Toward a New Theory of Power Projection," War on the Rocks, April 15, 2020, https://warontherocks.com/2020/04/toward-a-new-theory-of-power-projection/; and Sayers, "The Intermediate-Range Nuclear Forces Treaty and the Future of the Indo-Pacific Military Balance."
30. Peter Layton, "Discontinued: America's Continuous Bomber Presence," War on the Rocks, May 8, 2020, https://warontherocks.com/2020/05/discontinued-americas-continuous-bomber-presence/.
31. Cohn et al., "Leveling the Playing Field," 12.
32. Gomez, "It Can Get You into Trouble, but It Can't Get You Out," 23–25.

the missiles will target. Early reactions from U.S. allies suggest that they are not eager to accept unconstrained deployments, while the target set debate has significant implications for inadvertent escalation and strategic stability.

ALLIANCE POLITICS: WHAT IF THE UNITED STATES BUILT MISSILES BUT HAD NOWHERE TO PUT THEM?

The enhanced survivability of intermediate-range missiles could have strategic value for the United States' relationship with its East Asian allies. China's growing military capabilities pose a relatively minor threat to the U.S. homeland, but Washington is very worried about Beijing's ability to throw its weight around East Asia. If the United States lacks a convincing conventional deterrent to Chinese aggression, then both China and U.S. allies could begin questioning the viability of Washington's commitments.[33] Politically, deploying intermediate-range missiles on allied territory might restore confidence in friendly capitals that the United States is willing to uphold its commitments by providing more "boots on the ground" that would act as a tripwire should conflict break out.[34] Militarily, more survivable U.S. conventional strike platforms ought to enhance deterrence and crisis stability, which in turn should reassure allies of America's ability to come to the rescue.

This rosy picture may come to pass, but U.S. allies may not welcome missile deployments with open arms. Shortly after the United States announced its withdrawal from the INF Treaty, the governments of both Australia and South Korea indicated that they were not considering U.S. missile deployments.[35] Japan, home to the most U.S. forward-deployed troops in the region, would face considerable domestic political hurdles to approving a U.S. missile deployment.[36]

Some of the operational benefits of ground-based intermediate-range missiles have political downsides for alliance management. The mobility of ground-based missiles improves their survivability, but maximizing this operational benefit will require moving missile batteries around allied territory. Such maneuvers could expose more civilians to danger via accidents or Chinese strikes. Deploying away from populated areas would reduce some of the political risks but increase the challenges associated with keeping the missiles supplied and maintained. The U.S. military could concentrate missile garrisons and support facilities in fewer locations to make for a more palatable deployment, but fewer facilities are easier to target. Stationing the missiles near existing U.S. military facilities is another option with lower political risk, but these sites are already high on China's target list. Concentrating U.S. missiles around existing bases would undermine the ability of ground-based intermediate-range missiles to stress China's targeting capabilities. These points should not suggest that allies will categorically reject U.S. missile deployments. However, it is important for U.S. analysts and policymakers to keep allied concerns in mind given the limitations that allies might set on deployments, which in turn will alter the operational and strategic effectiveness of missiles.

33. Andrew S. Erickson, "Good Riddance to the INF Treaty," Foreign Affairs, September 2, 2019, https://www.foreignaffairs.com/articles/china/2019-08-29/good-riddance-inf-treaty; Sayers, "The Intermediate-Range Nuclear Forces Treaty and the Future of the Indo-Pacific Military Balance"; Benjamin Schreer, "After the INF: What Will U.S. Indo-Pacific Allies Do?," *Washington Quarterly* 43, no. 1 (Spring 2020): 147, doI:10.1080/0163660X.2020.1736885.
34. Schreer, "After the INF," 147; Toshi Yoshihara and Jacob Cohn, "The Case for Deploying U.S. Land-Based Missiles in Asia," *National Interest*, May 13, 2019, https://nationalinterest.org/blog/buzz/case-deploying-us-land-based-missiles-asia-57322.
35. Australia and South Korea did not explicitly rule out a deployment, but both said that they were not yet considering deployments. Franz-Stefan Gady, "Australia, South Korea Say No to Deployment of US INF-Range Missiles on Their Soil," *The Diplomat*, August 6, 2019, https://thediplomat.com/2019/08/australia-south-korea-say-no-to-deployment-of-us-inf-range-missiles-on-their-soil/; and Chris Mills Rodrigo, "Prime Minister Says US Won't Deploy Missiles in Australia," *The Hill*, August 5, 2019, https://thehill.com/policy/defense/456150-prime-minister-says-us-wont-deploy-missiles-in-australia.
36. Benjamin Rimland, "Into the Crosshairs - INF Withdrawal and Japan's Security," Tokyo Review, January 1, 2019, https://www.tokyoreview.net/2019/01/inf-withdrawal-japan-security/.

Comparing NATO's decision to deploy nuclear-armed ballistic and cruise missiles in the late-1970s and early-1980s—part of the "dual-track decision" that led to the INF Treaty—to alliance dynamics in modern East Asia helps explain why future U.S. missile deployments in Asia could be difficult. The most important feature of the dual-track decision was the leading role that U.S. allies played in making it happen. The United States was reluctant to deploy nuclear ballistic and cruise missiles to Europe, but NATO allies insisted that the missiles were necessary as visible symbols of U.S. support for the alliance.[37] As explained by Justin Anderson and Amy Nelson of the National Defense University, "[t]he U.S. decision to develop and deploy intermediate-range platforms was a direct response to NATO European allies' requests for assurance rather than an effort to fill some type of gap within the United States' nuclear deterrence strategy, posture, or force structure."[38]

In other words, NATO allies valued the signal the missiles sent above their military utility. Henry H. Gaffney, a Department of Defense official who was directly involved in the negotiations to deploy U.S. nuclear missiles in Europe, wrote in a 2014 article: "In all the discussions with the [NATO High Level Group] and in Washington, I never heard any mention of what any of these missiles might be targeted against, other than Soviet territory. *Having* them was all that was important for deterrence."[39] U.S. allies were in the driver's seat in the dual-track decision. European NATO countries were acutely worried about Soviet intermediate-range nuclear missiles and pushed the United States to deploy similar systems despite initial U.S. ambivalence. This strong political support helped NATO governments resist domestic pressure to reverse or halt the missile deployments.

The United States faces a very different set of circumstances in modern East Asia. While Washington is eager to make progress on intermediate-range missile deployments, friendly capitals seem less enthusiastic. Allies are not clamoring to accept deployments of new U.S. intermediate-range missiles, at least not publicly.[40] This lack of enthusiasm could stem from several sources. First, unlike the Soviet Union, China poses a primarily conventional threat to its neighbors rather than a nuclear threat, which is easier for allies to counteract. Japan, South Korea, Australia, and Taiwan have all taken steps to increase defense budgets, improve indigenously-produced weapons, and place themselves in a better position to counter China's growing military power.[41] While allies will certainly welcome greater U.S. support, they can also be discerning about what form this support takes. A serious deterioration of the East Asia security environment (which could come about due to the Covid-19 pandemic) could increase support for U.S. missile deployments, but demand for these systems appears low.

Second, U.S. allies have a more economically and politically entangled relationship with China than NATO allies had with the Soviet Union. Going along with more competitive U.S. policies carries greater risks and potential costs that allies need to factor into their decisionmaking.[42] Beijing is not

37. Readman, "Conflict and Cooperation in Intra-Alliance Nuclear Politics," 42–43.
38. Anderson and Nelson, "The INF Treaty," 94.
39. Henry H. Gaffney, "Euromissiles as the Ultimate Evolution of Theater Nuclear Forces in Europe," *Journal of Cold War Studies* 16, no. 1 (Winter 2014): 196–197, doi:10.1162/JCWS_a_00435. Emphasis in original.
40. Allied governments may very well be demanding missile deployments behind closed doors in discussions that will not be available for some time due to classification. Available public statements about missile deployments, however, make allies seem ambivalent at best and uninterested at worst.
41. Michael MacArthur Bosack, "What to Make of the Record Defense Budget," *Japan Times*, February 20, 2020, https://www.japantimes.co.jp/opinion/2020/02/20/commentary/japan-commentary/make-record-defense-budget/; Adam P. Liff, "Whither the Balancers? The Case for a Methodological Reset," *Security Studies* 25, no. 3 (2016): 420–459, doi:10.1080/09636412.2016.1195624; and Jennifer Lind, "Japan's Security Evolution," Cato Institute, Policy Analysis no. 788, February 25, 2016, https://www.cato.org/sites/cato.org/files/pubs/pdf/pa-788.pdf.
42. Uri Friedman, "America Is Alone in Its Cold War with China," *The Atlantic*, February 17, 2020, https://www.theatlantic.com/politics/archive/2020/02/us-china-allies-competition/606637/.

afraid to remind allies of this fact. When South Korea agreed to let the United States field a missile defense system in 2017, China conducted a targeted economic pressure campaign in an attempt to reverse the deployment.[43] China ultimately failed to get the missile defense system removed, but Seoul did agree to some limitations on future missile defense cooperation with Washington in order to lift the pressure. Chinese government officials have already warned that Beijing would "not stand idly by" if the United States deploys intermediate-range missiles to Asia.[44] Veiled threats of punishment may misfire and increase support among U.S. allies for missile deployments, but U.S. policymakers need to take the economic and political interests of its allies into account.

The strategic impacts of U.S. intermediate-range missiles are heavily dependent on the perceptions and preferences of America's allies. The United States could deploy intermediate-range missiles only on its own territory in East Asia, but this would make for longer flight times and limited deployment areas. This would reduce missiles' operational effectiveness and make them more vulnerable to attack. Moreover, the long distances that U.S. missiles would have to cover in this scenario means that they will need to be larger, more complex, and more expensive. The United States may find it easier to deploy ground-based anti-ship missiles on allied territory given that many allies are already investing in such capabilities for their own militaries.[45] Taking the politically easier route, however, could constrain the types and numbers of missiles the United States deploys, which will have follow-on effects for operational utility and strategic impact.

THE TARGET SET DEBATE: MAXIMIZERS VS. REFORMERS

Are U.S. intermediate-range missiles the missing piece of an otherwise sound strategy? Or could they form the foundation of a new strategy with different objectives and an alternative theory of victory? This is the most contentious issue in the intermediate-range missile debate and the most consequential for U.S.-China strategic stability and inadvertent escalation.

There are two broadly defined camps among supporters of deploying intermediate-range missiles: maximizers and reformers. These two groups have distinct views on how land-based missile capabilities fit into a broader picture of U.S. conventional deterrence vis-à-vis China and target sets—the Chinese systems on the receiving end of missile strikes.

Maximizers see the missiles as an important tool for achieving military overmatch in East Asia, which they regard as essential for preventing China from achieving revisionist goals using military force.[46] In the maximizer scenario, U.S. intermediate-range missiles should have a broadly defined target set that includes enabling capabilities deep in Chinese territory and the integrated air defense networks that protect them.[47]

Maximizers argue for a wide variety and large number of U.S. strike platforms for two reasons. First, it gives the U.S. military the ability to hold high-priority targets at risk from greater distances and allows for layered strikes—using more advanced, faster missiles to get around or open up holes in

43. Kristin Huang, "Chinese Companies Join Boycott of S. Korean Retailer Lotte Over Missile Shield Plans," *South China Morning Post*, March 3, 2017, https://www.scmp.com/news/china/diplomacy-defence/article/2075574/chinese-companies-join-boycott-s-korean-retailer-lotte; and Michael D. Swaine, "Chinese Views on South Korea's Deployment of THAAD," *China Leadership Monitor*, no. 52 (Winter 2017): 2, https://carnegieendowment.org/files/CLM52MS.pdf.
44. Alan Yuhas, "China Warns U.S. Against Sending Missiles to Asia Amid Fears of an Arms Race," *New York Times*, August 6, 2019, sec. World, https://www.nytimes.com/2019/08/06/world/asia/china-us-nuclear-missiles.html.
45. Mahnken et al., *Tightening the Chain*, 4–6.
46. Cuomo, "It's Time to Make a New Deal," 107.
47. Cohn et al., "Leveling the Playing Field," 23.

air defense networks that slower, more numerous missiles can then exploit.[48] Second, being able to threaten more targets further inside Chinese territory could force the People's Liberation Army into spending more money on costly missile defense capabilities to protect these newly vulnerable targets. Resources going toward protecting against U.S. intermediate-range missiles are those that cannot be used to expand China's navy, air force, or other offensive capabilities.[49] The goal of this competitive strategy is to drive Beijing toward counter moves that are both expensive and less capable of threatening China's neighbors.

The reformer camp generally favors a narrowly defined target set for U.S. intermediate-range missiles and tends to be skeptical of the value of overmatch. Reformers argue that the primary targets of intermediate-range missiles should be China's power projection forces, especially its navy.[50] Deep strikes against enabling capabilities are still possible, but these targets are not as high of a priority.

The strategic goal of such a deployment would be to stymie a Chinese offensive, make it difficult for Beijing to accomplish fait accompli military actions against its neighbors, and increase doubt and uncertainty about the success of quick, conventional action.[51] This approach mirrors many aspects of China's A2/AD strategy by using land-based missile forces to reduce the effectiveness of an adversary's naval and air power that deters by denial of military objectives rather than threat of punishment.[52]

RIGHTSIZING U.S. MISSILE STRATEGY: THE CASE FOR THE REFORMER APPROACH

U.S. intermediate-range missile deployments in East Asia should follow the reformer approach and focus on land-based sea denial. This approach will be politically easier for the United States to implement and carry lower inadvertent escalation risks while still improving America's conventional position vis-à-vis China.

The reformer perspective is enjoying some early victories. In March 2020, the U.S. Marine Corps released their 2030 force design document, which outlines a plan to shift the service away from amphibious power projection missions and toward a land-based, sea-denial force armed with mobile anti-ship missiles.[53] There is no guarantee that the 2030 force design will be fully implemented as intended, but FY 2021 budget requests indicate that the Marine Corps wants to quickly introduce intermediate-range anti-ship missiles to its arsenal.[54]

48. Cohn et al., 12, 22–23.
49. Cohn et al., 21–22; Cuomo, "It's Time to Make a New Deal," 124; Alexander Lanoszka, "The INF Treaty: Pulling Out in Time," *Strategic Studies Quarterly* 13, no. 2 (Summer 2019): 63, https://www.airuniversity.af.edu/Portals/10/SSQ/documents/Volume-13_Issue-2/Lanoszka.pdf; Sayers, "The Intermediate-Range Nuclear Forces Treaty and the Future of the Indo-Pacific Military Balance"; and Yoshihara and Cohn, "The Case for Deploying U.S. Land-Based Missiles in Asia."
50. Thomas G. Mahnken, "Countering Missiles with Missiles: U.S. Military Posture After the INF Treaty," War on the Rocks, July 16, 2019, https://warontherocks.com/2019/07/countering-missiles-with-missiles-the-u-s-military-after-the-inf-treaty/.
51. Mahnken et al., *Tightening the Chain*, 6; and Iain Marlow, "To Deter China, Refined 'Porcupine Strategy' May Be More Crucial to Taiwan than High-Profile Arms," *Japan Times*, January 16, 2020, https://www.japantimes.co.jp/news/2020/01/16/asia-pacific/f-16s-trump-taiwan-looks-inward-deter-china-weighs-porcupine-strategy/.
52. Eric Gomez, "The Future of Extended Deterrence: Are New U.S. Nuclear Weapons Necessary?," in America's Nuclear Crossroads; and Roehrig, *Japan, South Korea, and the United States Nuclear Umbrella*, 15.
53. David H. Berger, *Force Design 2030* (Washington, DC: U.S. Marine Corps, March 2020), https://www.hqmc.marines.mil/Portals/142/Docs/CMC38%20Force%20Design%202030%20Report%20Phase%20I%20and%20II.pdf?ver=2020-03-26-121328-460.
54. Matthew Fay and Michael A. Hunzeker, "No Sure Victory: The Marines New Force Design Plan and the Politics of Implementation," War on the Rocks, May 14, 2020, https://warontherocks.com/2020/05/no-sure-victory-the-marines-new-force-design-plan-and-the-politics-of-implementation/; and David Lague, "Special Report: U.S. Rearms to Nullify China's Missile Supremacy," Reuters, May 6, 2020, https://www.reuters.com/article/us-usa-china-missiles-specialreport-us/special-report-u-s-rearms-to-nullify-chinas-missile-supremacy-idUSKBN22I1EQ.

Another advantage of U.S. intermediate-range missiles for sea denial is their appeal for allied countries. As stated earlier, many U.S. allies are already pursuing land-based, anti-ship missiles for sea denial missions. A growing number of U.S. security scholars and defense analysts are encouraging allies to embrace deterrence by denial because it is affordable and makes good use of East Asia's geography.[55] Moreover, using U.S. intermediate-range missiles to hold Chinese warships at risk while avoiding deep targets is advantageous for U.S. allies precisely because doing so does not threaten the Chinese mainland.[56] If allies face significant domestic political challenges to approving U.S. missile deployments, it might still be possible to reap some of the strategic benefits by offering to co-develop new missile capabilities.

In addition to being an easier sell to U.S. allies, the reformer approach would have less dangerous effects on strategic stability due to its limited target set. Using intermediate-range missiles to destroy targets deep in Chinese territory would be more dangerous from an inadvertent escalation perspective than targeting warships at sea or bases closer to the coasts. U.S. missile strikes against four kinds of Chinese targets—nuclear weapons, nuclear delivery systems, conventional forces that protect nuclear forces, and the sensor and communications systems used to marshal a retaliatory strike—are particularly risky.[57] While no conflict between the United States and China would be completely free of inadvertent escalation risks, U.S. intermediate-range missiles would increase the likelihood of inadvertent escalation if they went after the targets that maximizers propose. This is because more of the maximizer's envisioned targets fall under the four categories of risky targets mentioned above.

At its core, the maximizer approach is an evolution of the AirSea Battle operational concept, which places a high priority on destroying Chinese command and control networks, intelligence and surveillance assets, ballistic missile bases, and air defense systems.[58] Such attacks pose a relatively small risk to China's nuclear weapons and nuclear delivery systems. The maximizers do not advocate using intermediate-range missiles to target Chinese nuclear weapons or nuclear-armed missile units on purpose. Accidental destruction of China's nuclear forces is still possible, especially if U.S. intermediate-range missiles target Chinese missile bases or launch sites. However, China appears to keep nuclear and conventional missile launch units stationed at different bases.[59] Retaining this practice of not co-mingling missile units would help reduce the risk of inadvertent escalation, though Beijing may rethink its basing practices if the conventional threat to its nuclear arsenal increases.[60]

While the maximizer approach to intermediate-range missile deployments may not threaten China's second-strike nuclear forces directly, it could pose a serious threat to the conventional forces that

55. Eugene Gholz, Benjamin Friedman, and Enea Gjoza, "Defensive Defense: A Better Way to Protect U.S. Allies in Asia," *Washington Quarterly* 42, no. 4 (2019): 171–189, doi:10.1080/0163660X.2019.1693103; Eric Heginbotham and Richard J. Samuels, "Active Denial: Redesigning Japan's Response to China's Military Challenge," *International Security* 42, no. 4 (Spring 2018): 128–169, https://dspace.mit.edu/handle/1721.1/118651; and Michael A. Hunzeker and Alexander Lanoszka, *A Question of Time: Enhancing Taiwan's Conventional Deterrence Posture* (Fairfax, VA: Schar School of Policy and Government at George Mason University, November 2018), http://csps.gmu.edu/wp-content/uploads/2018/11/A-Question-of-Time.pdf.
56. Mahnken et al., *Tightening the Chain*, 16.
57. Talmadge, "Would China Go Nuclear?," 59–60.
58. Talmadge, 53. Also see Jan van Tol et al., *AirSea Battle: A Point-of-Departure Operational Concept* (Washington: Center for Strategic and Budgetary Assessments, May 18, 2010), https://csbaonline.org/research/publications/airsea-battle-concept.
59. Cunningham and Fravel, "Assuring Assured Retaliation," 42–44.
60. Fiona S. Cunningham and M. Taylor Fravel, "Dangerous Confidence? Chinese Views on Nuclear Escalation," *International Security* 44, no. 2 (Fall 2019): 93–94, https://www.belfercenter.org/publication/dangerous-confidence-chinese-views-nuclear-escalation; and P.W. Singer and Ma Xiu, "China's Ambiguous Missile Strategy Is Risky," *Popular Science*, May 11, 2020, https://www.popsci.com/story/blog-network/eastern-arsenal/china-nuclear-conventional-missiles/.

protect China's nuclear forces and the enabling capabilities that would marshal a retaliatory strike. Attacks against Chinese air defense networks, command and control nodes, and long-range sensor capabilities are important features of the maximizer approach because these systems enable other parts of China's military strategy. If Beijing can be deprived of these and similar capabilities, then the United States stands a better chance of achieving military overmatch in a conflict. However, the destruction of these capabilities would also make China's nuclear forces more vulnerable to attack.[61] Under such circumstances the destruction of a relatively small part of China's nuclear arsenal would be much more dangerous from Beijing's perspective because it would be harder to guarantee the survivability of the remaining nuclear weapons.

The reformer approach would not remove inadvertent escalation risks, but it could reduce their impact. China's surface warships and coastal bases do contribute somewhat to the defense of its nuclear forces, but most of China's nuclear arsenal is stationed far away from the coasts. The major exception is the Yulin naval base on Hainan Island, which hosts China's ballistic missile submarines in addition to many surface warships. Attacking that base with intermediate-range missiles could carry higher inadvertent escalation risks compared to attacks on other coastal base facilities. The overarching strategic purpose of U.S. intermediate-range missiles in the reformer model is offsetting China's ability to easily project naval power into East Asia. While intermediate-range missiles could be used to target enabling capabilities inside the Chinese mainland, disrupting naval movements would be a higher priority.

CONCLUSION

Under what circumstances can intermediate-range missiles contribute positively to conventional deterrence without straining strategic stability in the U.S.-China relationship? Moving more U.S. offensive strike options ashore could reduce incentives for both countries to conduct preemptive attacks in crises while improving U.S. operational flexibility. However, not all deployment models are created equal.

Using intermediate-range missiles to achieve U.S. overmatch—the maximizer approach—is likely to cause friction with allies and increase the risks of inadvertent escalation in conventional conflict. Conversely, deploying intermediate-range missiles to deny China's ability to establish sea control in East Asia—the reformer approach—would complement existing allied military strategies and have less dangerous, though still not risk-free, implications for inadvertent escalation.

As Washington contemplates how to incorporate intermediate-range missile capabilities into its military strategy vis-à-vis China, it ought to weigh costs and benefits. Pursuing maximum U.S. flexibility and trying to deploy a wide variety of missile systems that can hold a large target set at risk is tempting. Yet going down this path would likely cause new problems for strategic stability and face greater resistance from U.S. allies. A reformer-oriented missile strategy may not improve U.S.-China strategic stability, which is being challenged by many sources of friction in the relationship, but it would not purposely erode strategic stability as the maximizer-oriented approach would do.

A more modest operational deployment model focused on a narrow target set would improve conventional deterrence against Chinese aggression without increasing the risks of inadvertent escalation. Washington might be able to have intermediate-range missiles as well as stability, but this will require a conscious effort to avoid the temptations of overmatch.

61. Talmadge, "Would China Go Nuclear?," 77–79.

Strategic Arms Control, Presidents, and Politics

Why MIRVs Fell Off the Agenda

Garrett Hinck[1]

INTRODUCTION

Missiles equipped with multiple, independently targetable re-entry vehicles (MIRVs) "encapsulate[d] the technology and terror of the Nuclear Age," but despite the end of the Cold War, the United States and Russia failed to significantly limit these weapons in arms control agreements.[2] Their attempt to do so, the second Strategic Arms Reduction Treaty (START II), signed just after the fall of the Soviet Union, would have banned all MIRV'd intercontinental ballistic missiles (ICBMs), but it never took effect. Why did a treaty which President Yeltsin of Russia hailed as going "further than all other treaties ever signed in the field of disarmament" fail?[3]

Since the failure of START II, binding limits on MIRV'd ICBMs have not been pursued in any subsequent strategic arms control negotiation between the United States and Russia. From a U.S.-based perspective, this raises serious questions about the process for deciding arms control priorities, especially considering that Russia has invested in an extensive modernization program to replace its MIRV'd ICBMs. What explains this evident shift in the United States' approach to MIRV'd ICBMs, and what can this tell us about the evolution of arms control priorities?

Despite significant study devoted to U.S. arms control initiatives with the Soviet Union and domestic debates about the threats posed by MIRV'd ICBMs during the Cold War, there has been no comprehensive analysis of why the United States essentially abandoned its long-standing goal

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2. Editorial Board, "The Rise and Fall of MIRV," *New York Times*, January 27, 1992, https://www.nytimes.com/1992/01/27/opinion/the-rise-and-fall-of-mirv.html.
3. "US and Russia Sign START II Treaty," U.S. Department of State, State Department Dispatch, January 11, 1993.

of strictly limiting, if not completely banning, Soviet (and later, Russian) MIRV'd ICBMs.[4] This has (1) theoretical relevance, as understanding this decisionmaking can posit why arms control preferences shift over time, and (2) policy relevance, as the potential expiration of the New Strategic Arms Reduction Treaty in 2021 marks a new phase of arms control in which MIRVs may once again be on the agenda.

This analysis reveals that the end of the Cold War is not the critical turning point for strategic arms control. Indeed, the Clinton administration pursued the ratification of START II for its entire term and even negotiated a protocol extending the treaty's applicability as the ratification dragged on. Thus, explanations that primarily focus on the adversary's (Russia's) capabilities and link U.S. arms control choices to changes in the strategic balance fall short. U.S. arms control choices result from a complex foreign policy process in which different actors lead in each stage, and different rationales provide the primary motivation for each actor as well as constrain their choices. However, the dominant actor in this process is the president, whose key priority with respect to arms control is how it fits in their broader agenda.

This paper develops this model and applies it to explain U.S. arms control choices with respect to MIRVs from 1990 to 2011. It begins with a brief background on MIRVs and U.S.-Soviet arms control, then proceeds into a theory of U.S. arms control choices. The paper then applies this model, using the MIRV as an extended case study. It finds that, indeed, while presidents were constrained in their choices, ultimately an administration's foreign policy priorities determined its approach to MIRVs in arms control. Lastly, the paper closes with implications for future U.S. arms control policy.

BACKGROUND: MIRVS AND ARMS CONTROL DURING THE COLD WAR

The arms race produced MIRVs, and in turn, MIRVs fueled the arms race. These weapons permitted a single missile to deliver several nuclear warheads to different targets, with the benefit of negating anti-missile systems designed to intercept single-warhead missiles. In the 1960s, the United States began to explore the technology for equipping ICBMs with multiple warheads and delivering them to separate targets and had MIRV'd its first ICBM by 1970.[5] By the 1970s, the Soviet Union followed with a major production boost to its delivery systems, for the first time matching and even surpassing the United States in some categories.[6]

Because Soviet ICBMs had greater capacity to deliver heavier (and therefore more powerful) warheads in greater numbers than their U.S. analogs, many U.S. defense analysts and officials became concerned about potential Soviet first strikes on U.S. land-based forces. This led to a so-called "window of vulnerability" projected for the early-1980s in which Soviet forces could potentially destroy "about 90 percent of the U.S. ICBM forces . . . and the Soviets could do this by firing as few as 210 of their 1400 ICBMs."[7] Making this possible were several new Soviet MIRV'd ICBMs, the SS-

4. See Pavel Podvig, "The Window of Vulnerability That Wasn't: Soviet Military Build-up in the 1970s – A Research Note," *International Security* 33, no. 1 (2008), https://cisac.fsi.stanford.edu/publications/the_window_of_vulnerability_that_wasnt_soviet_military_buildup_in_the_1970sa_research_note; and Michael Krepon, "Looking Ahead," in *The Lure and Pitfalls of MIRVs*, eds. Michael Krepon, Travis Wheeler, and Shane Mason (Washington, DC: Stimson Center, 2016), https://www.stimson.org/2016/lure-and-pitfalls-mirvs-first-second-nuclear-age/.
5. Milton Leitenberg, "The Origin of MIRV," in *Studies of Military R&D and Weapons Development* (College Park, MA: Center for International and Security Studies, University of Maryland, 1984), https://fas.org/man/eprint/leitenberg/index.html.
6. Warner R. Schilling, "U.S. Strategic Nuclear Concepts in the 1970s: The Search for Sufficiently Equivalent Countervailing Parity," *International Security* 6, no. 2 (1981): 69–70, doi:10.2307/2538646.
7. Ibid., 69.

17 (MR UR-100), SS-19 (UR-100N), and SS-18 (R-36M)—the last one having the greatest warhead capacity (10) and prompting significant U.S. concerns.[8]

MIRVs became a political symbol in the Washington foreign policy debate of the Soviet Union's ostensible race for strategic superiority. This led to arguments that MIRVs were "destabilizing" because they would only be useful in a first strike attack but vulnerable themselves to such an attack.[9] The advantage one side would gain from launching its MIRV'd ICBMs first in an attack against the other's MIRVs would prove doubly advantageous in that taking out one enemy MIRV would destroy several warheads.

In arms control, the two superpowers consistently failed to come to agreement on mutual restraint and limitations for MIRVs. When the United States was leading in MIRV technology during the initial phase of the SALT negotiations in 1969 to 1972, it defied Soviet attempts to ban their deployment.[10] Henry Kissinger later regretted this decision once the Soviets began to outstrip the United States in MIRVs, writing, "I would say in retrospect that I wish I had thought through the implications of a MIRVed world more thoughtfully in 1969 and 1970 than I did."[11] MIRVs would continue to bedevil U.S.-Soviet strategic arms control, being a key issue in the SALT II accord and later during the Reagan administration as well. For instance, in the context of debates about what to do with the United States' heavy MIRV, the MX missile, the influential Scowcroft Commission of 1983 advocated an approach to arms control to prioritize a "more stable balance of forces."[12] Effectively, this meant restrictions on MIRV'd ICBMs. However, it would take until the end of the decade and the end of the Cold War for the United States and Soviet Union to be able to come to agreement on these steps.

THE PROCESS OF U.S. ARMS CONTROL

The end of the Cold War was a pivotal turning point that opened new opportunities with a much more friendly partner willing to make compromises in Mikhail Gorbachev's Soviet Union and later Boris Yeltsin's Russia. The Reagan administration completed the negotiations for the Intermediate Nuclear Forces (INF) treaty, and the Bush administration entered office with the START negotiations still ongoing. While the START treaty was built on years of negotiations started under Reagan and continued a line of effort started with SALT I in 1969, following its ratification the Bush administration had wide latitude to either let the arms control process lie or select specific areas for further negotiation. What explains its choices and the process that any administration undergoes in strategic arms control?

The literature on arms control has focused on rationales for arms control, citing three reasons for states to engage in arms control. The "Bible" of modern U.S. arms control, Thomas Schelling and Morton Halperin's *Strategy and Arms Control*, argued for an approach focused on what has been termed "strategic stability," loosely defined as a situation where neither side would have incentive to attack first during a crisis and where the likelihood of war would be low in general. Schelling and Halperin in particular focused on the "mischievous character of today's strategic weapons," referring

8. Podvig, "The Window of Vulnerability That Wasn't," 123.
9. See the discussion of land-based ICBMs in William C. Potter, "Coping with MIRV in a MAD World," *Journal of Conflict Resolution* 22, no. 4 (1978): 599–626, https://www.jstor.org/stable/173693.
10. Krepon, "Looking Ahead," 179–184.
11. Michael Krepon, "MIRVs and Remorse, Sort of," Arms Control Wonk, October 15, 2009, https://www.armscontrolwonk.com/archive/402503/mirvs-and-remorse-sort-of/.
12. Ronald Reagan, "Remarks to Reporters Announcing New United States Initiatives in Strategic Arms Reduction Talks," October 4, 1983, in *Public Papers of the Presidents of the United States: Ronald Reagan*, 1983, Book II, (Washington, DC: United States Government Printing Office, 1985).

to the idea that whichever side would go first in a nuclear war would be at a great advantage.[13] Since this time, the definition of what constitutes a situation of strategic stability has become highly contested.[14] Nevertheless, there are some clear themes, particularly those focused on first-strike incentives, as described above, and reducing the overall likelihood of war based on technical characteristics of weapons systems.

Yet if strategic stability represents what an idealist might ascribe to be the aims of arms control, other theories center their explanations on more self-interested concepts. John Maurer describes one school of thought as arguing for arms control to enhance and protect U.S. military advantages vis-à-vis an adversary.[15] In this logic, policymakers look to constrain adversaries' military capabilities through arms control limitations while negotiating to leave their own capabilities unconstrained. For instance, the United States historically sought greater restrictions on Soviet ICBMs, where Moscow was perceived to be leading, while avoiding limits on submarine-launched ballistic missiles (SLBMs), of which the United States had more and which were more sophisticated.

Lastly, states may engage in arms control as part of disarmament initiatives. By Maurer's description of this reasoning, states agree to "tame adverse military-industrial complexes and dismantle old attitudes and cultures of war."[16] The primary motivation for arms control, under this logic, is to reduce the influence of militarist influence groups such as defense industrial sectors that would otherwise increase pressures for war.

These logics inform understanding of why states engage in arms control, but they do not explain the specific choices that a state such as the United States might make in the arms control process. In other words, pursuing an agreement for the sake of disarmament does not specify whether one would advocate for greater limits on bombers or submarine-launched missiles, for example. Such inferences could only be made loosely. For instance, if stability were the dominant logic, one might expect weapons on both sides to be deemed stabilizing. But that determination would be inherently subjective, and many relevant actors within both states might differ on what is stabilizing or destabilizing.

Instead, this paper argues that an approach focused on the process of formulating arms control choices is a better way of explaining U.S. policy positions. This theory opens up the "black box" of the state and focuses on the politics between the legislative and executive branches, as well as within the executive branch. It shows how different actors draw on the three logics of arms control to motivate their choices and how those choices are constrained by other actors within the U.S. political system. In doing so, it builds on Elizabeth N. Saunders' recent work on the domestic politics of nuclear choices, which highlights the roles of leaders and whether they expand their circle to allow other actors or constituencies into the policymaking process.[17]

This paper's model is a three-stage process that follows the "life cycle" of an arms control agreement, focusing on which actors are empowered to make key choices and how other actors constrain them. It highlights how each actor draws on a different set of logics to inform their decisionmaking. As such, it shows which actors have the most influence over the process at each stage and cumulatively,

13. Thomas Schelling and Morton Halperin, *Strategy and Arms Control* (New York: Twentieth Century Fund, 1961), 9.
14. See discussions in Elbridge A. Colby and Michael S. Gerson, eds., *Strategic Stability: Contending Interpretations* (Carlisle, PA: U.S. Army War College Press, 2013), https://publications.armywarcollege.edu/pubs/2216.pdf.
15. John Maurer, "The Purposes of Arms Control," *Texas National Security Review* 2m no. 1 (2018): 16, doi:10.26153/tsw/870.
16. Ibid.
17. Elizabeth N. Saunders, "The Domestic Politics of Nuclear Choices – A Review Essay," *International Security* 44, no. 2 (2020): 146–184, doi:10.1162/isec_a_00361.

allowing inferences to be made about the dominant logics that determine U.S. arms control choices. In the first stage, presidents determine whether to engage in arms control and what its scope would be based on their broader foreign policy goals and preferences. Then, during the negotiation stage, executive branch bureaucracies dominate the process, both in setting specific goals for arms limits and in concluding technical agreements with the other side. In the third and final stage, the president is once again the driver but faces powerful constraints from the legislative branch due to the Senate ratification requirement. While presidents ultimately are the key actor in the arms control process, they do not dominate the other actors and in many respects are constrained by their lack of control by actors who have different logics for their arms control choices.

In the first stage, the president is the key driver. Presidents and their foreign policy advisers determine whether the United States will engage in arms control at all and set the terms for the executive branch's policy processes, which formulate specific negotiation objectives. Arms control is a costly endeavor for presidents, who must dedicate significant amounts of time and energy, particularly for strategic arms which require formal treaties. To get these treaties ratified, presidents often pay large costs, especially when the other party controls the Senate.[18] Nevertheless, arms control is often a central component of a president's foreign policy. This is because it is a powerful tool to accomplish all three goals discussed above. Indeed, Maurer recounts how Nixon combined the objectives of stability, military advantage, and disarmament in the negotiations for the Anti-Ballistic Missile (ABM) Treaty in 1972. However, presidents embed these purposes in their broader foreign policy goals. For instance, a president focused on containing or constraining an adversary might engage in arms control to lock in a military advantage, while a president looking to reduce the potential for great power war might use arms control to enhance stability.

The point is that presidents have to ensure consistency across their foreign policies and will only pursue arms control when it fits their broader agendas such that it makes its costs worth bearing. In most cases, the balance of military forces is not the central focus of a president's foreign policy and is not even the critical factor in bilateral dealings with specific countries. As such, presidents have an incentive to dictate that arms control be limited in scope, as more limited agreements are easier to negotiate and less likely to detract from other goals, such as economic cooperation. This translates to instructions to the interagency to provide the "lowest hanging fruit" of negotiation targets.

However, in the second stage, the interagency leads the process, not the president. Officials in the Departments of State and Defense are the ones with deep knowledge of the United States and its adversaries' militaries, and they can provide the president and relevant advisers with choices suiting their interests. Military bureaucrats can be expected to prioritize the goal of enhancing U.S. advantage, while diplomats would tend to emphasize the stability goal. There is likely to be contestation between these two views on approaches, which the president may attempt to solve. Executive branch bureaucrats are the ones who conduct negotiations directly with foreign government officials, determining the pace of progress and how successful the administration is in achieving its negotiation goals. Only presidents are able to intervene intermittently to observe and regulate this process. They are then left with what their bureaucrats negotiated as the basic text of a final agreement, which they must sign and convince the Senate to ratify.

In this last phase, the president again drives the process forward, but they are highly constrained by

18. Sarah E. Kreps, Elizabeth N. Saunders, and Kenneth A. Schultz, "The Ratifications Premium: Hawks, Doves, and Arms Control," *World Politics* 70, no. 4 (2018): 479–514, doi:10.2139/ssrn.3037077.

the legislature. Achieving the three-fourths majority in the Senate for treaty ratification is a high bar, particularly because the motivation of many lawmakers of the opposing party is pure partisanship, which drives them to oppose the president at least to extract concessions.[19] Presidents can choose to make these concessions and may be able in some cases to mobilize informed actors, such as military leaders, to garner support, but these actions must respond to legislators' concerns.[20]

Cumulatively, it is clear that presidents and their foreign policy priorities are key determinants of whether the United States engages in arms control and how broad or narrow its approach will be. While executive branch bureaucrats in large part set the specific types of weapons that the negotiations focus on and legislators require strict verification regimes, presidents have significant latitude to override bureaucrats' specific priorities and can make side payments to gain support from opposing legislators.

This model suggests that while shifts in the military balance are important contextual information, it is a presidential administration's broader foreign policy approach that determines U.S. arms control choices. The following case study applies this framework to MIRVs in U.S. arms control in the post-Cold War era and assesses its validity.

ANALYSIS: MIRVS IN POST-COLD WAR ARMS CONTROL

Since 1990, the United States and Soviet Union (and as its successor, Russia) have concluded four major strategic arms control agreements, the first two of which, START I and II, contained specific limits (START II contained a complete ban on land-based MIRVs). The latter two treaties, the 2002 Strategic Offensive Reductions Treaty (SORT) and the 2011 New START Treaty contained no measures limiting MIRVs. These treaties and their MIRV-related provisions are summarized in Table 1.

Table 1: Strategic Arms Control and MIRV Limits

	START I	*START II*	*SORT*	*New START*
Year Signed	1991	1993	2002	2010
Overall Deployed Strategic Warhead Limit	6,000	3,000–3,500	1,700–2,200	1,550
MIRV-specific Limits	▪ Limit of 154 deployed heavy ICBMs ▪ Aggregate throw weight limit ▪ Banned new heavy ICBMs	▪ Prohibited MIRVs on ICBMs ▪ All SS-18s to have been destroyed	None	None
Entered into Force?	1994	No	2002	2011

Source: Author's own compilation from multiple sources.

19. Carrie A. Lee, "Electoral Politics, Party Polarization, and Arms Control: New START in Historical Perspective," *Orbis* 63, no. 4 (2019): 545–564, https://www.fpri.org/article/2019/11/electoral-politics-party-polarization-and-arms-control-new-start-in-historical-perspective/.
20. Kreps, Saunders, and Shultz, "Ratification Premium," 17.

There is a clear divide between START I and II and post-2000 strategic arms control in that agreements concluded after 2000 lack provisions related to MIRVs. This analysis thus divides U.S. arms control policy into two distinct phases, neatly divisible by the change in presidential administration in January 2001 with the entry into office of George W. Bush. The paper applies the arms control choices framework above to each of the two periods, 1990 to 2000 and 2000 to 2011. Across the four administrations which attempted or did conclude strategic arms control agreements, the evidence strongly supports the dominance of the president and the importance of presidents' foreign policy agendas in arms control choices.

1990–2000: TRYING AND FAILING TO ELIMINATE MIRVS

The administration of George H.W. Bush entered office in 1989 and was quickly confronted with the rapid unraveling of the Soviet Union's Warsaw Pact alliance. For Bush, managing the end of the Cold War was the central thrust of his foreign policy. The START talks, which had begun under Reagan, were a key priority in these efforts. In a meeting with Soviet General Secretary Gorbachev in late 1989, Bush included the START talks as one of his priorities for U.S.-Soviet relations, and internally, National Security Advisor Brent Scowcroft created a dedicated interagency group to coordinate policy on strategic weapons and arms control.[21] In 1990, Bush and Gorbachev signed a joint statement on the future of arms reductions, stating that their negotiations would aim to improve strategic stability by emphasizing "removing incentives for a nuclear first strike, on reducing the concentration of warheads on strategic delivery vehicles, and on giving priority to highly survivable systems."[22]

The role of the president in fixing arms control's place in broader U.S. foreign policy was clear. But the president who most drove the START negotiations was Reagan, who had been deeply involved in the process since the original START proposal of 1982, not Bush, and by the summer of 1988, Reagan's foreign policy team had drafted nearly 500 pages of treaty text.[23] The rapidly shifting international dynamics of the end of the Cold War contributed to a sense in Bush's foreign policy team that the best course would be to keep START I focused on strategic stability issues and quickly wrap up the negotiations.[24]

However, as negotiations continued, the Bush administration had to manage conflicting views among the bureaucracy and struggled to control the process. At one point, Scowcroft developed a new proposal to ban MIRVs, which received significant pushback from the interagency.[25] This also served domestic political purposes given that Congress was still riven by debates about the deployment of the United States' own mobile MIRV, the MX (later named the Peacekeeper). While the Soviets ultimately rejected the proposal based on military opposition, it formed the basis for the START II agreement.

Ultimately, the Bush administration was able to exert strict control over the bureaucracy and wrapped up negotiations, with Bush and Gorbachev signing the treaty in July 1991. In the final text, the treaty lowered overall force levels and specifically imposed a limit on aggregate "throw weight"

21. Bartholomew H. Sparrow, "Realism's Practitioner: Brent Scowcroft and the Making of the New World Order, 1989-1993," *Diplomatic History* 34, no. 1 (2010): 151–152, 155, doi:10.1111/j.1467-7709.2009.00836.x.
22. George H.W. Bush, "Soviet-United States Joint Statement on Future Negotiations on Nuclear and Space Arms and Further Enhancing Strategic Stability," Public Papers of George H.W. Bush, June 1, 1990, https://bush41library.tamu.edu/archives/public-papers/1938.
23. Toby Dalton, "Armed for Arms Control? Presidents, Bureaucrats and the Role of Government Structure in Policymaking," (PhD dissertation, George Washington University, 2015), 307, https://scholarspace.library.gwu.edu/concern/gw_etds/w95050546?locale=de .
24. Ibid., 314.
25. Ibid., 316–319.

(the potential upper bound of an ICBM's payload size, used as a proxy for the number of warheads an ICBM could carry), leading the Soviets to promise to eliminate half of their force of SS-18s (the Soviet Union's most powerful MIRV'd ICBM) to go under this limit.[26] By achieving this reduction in Soviet MIRVs, START I both improved the United States' relative military advantage and increased strategic stability, at least in the eyes of U.S. policymakers.

For ratification, although the dissolution of the Soviet Union in December 1991 complicated matters slightly, the administration was able to quickly secure Senate assent by October 1992. Notably, as the Bush administration faced increasing foreign policy challenges such as the humanitarian crisis in the former Yugoslavia, it saw ratification of START I as an easy "win" that it could add to its campaign efforts for the 1992 election.[27] This was aided by a lack of challenge in the Senate. Despite a firm Democratic majority, ratification was secured, with many Democratic members enthusiastically supporting START because of their party's longstanding support for arms control.[28] This support allowed Bush to secure ratification despite some opposition from arms control skeptics in his own party, such as Senator Jesse Helms.

Yet even before START I was ratified, Bush already looked forward to another round of reductions, this time to finish the job and eliminate MIRV'd ICBMs.[29] After being preoccupied with Saddam Hussein's invasion of Iraq in the fall of 1990 and the Gulf War in early 1991, Bush returned his attention to arms control in 1992, announcing a proposal for the Soviet Union to eliminate all of its land-based MIRV'd ICBMs in exchange for similar cuts in U.S. forces.[30] This announcement was part of his broader initiative with the new Russian president, Boris Yeltsin, that consisted of both reductions through strategic arms control and unilateral reductions, such as in tactical nuclear weapons and cuts in new weapons procurement, including the announcement that the United States would only build 20 B-2 bombers. Again, strategic arms control, and particularly reductions in heavy weapons systems such as MIRVs, was a central component of Bush's foreign policy goals.

Once again, the White House was able to dominate the negotiation phase, quickly concluding a text on the basis of agreements made at Camp David and Washington. The main focus of the agreement was the ban on MIRV'd ICBMs that Scowcroft had unsuccessfully tried to achieve with START I.[31] Notably, this included mobile ICBMs as well as silo-based ICBMs. However, in November 1992, Bush lost his reelection bid, leading his administration to seek a quick wrap-up to the negotiations before the Bill Clinton took office. This led to the signing of START II on January 3, 1993.

This left the Clinton administration with the onus of taking START II through its ratification (as well as pursuing the final ratification of START I, which was caught up in disputes about the status of the former Soviet Union's nuclear weapons among its constituent republics). Thus, the Clinton administration entered into the third stage of the arms control process as the driver for ratification but with its hands tied by the Bush administration's previous choices and the treaty text it had

26. U.S. Congress, Senate, "The START Treaty: Hearings Before the Committee on Foreign Relations: Part 1," Hearing, 102nd Congress, 2nd sess., 1992, 470, https://catalog.hathitrust.org/Record/007608490.
27. Patrick Homan, "The politics of arms control treaty ratification in the post-Cold War era," (PhD dissertation, Northern Illinois University, 2013), 98.
28. Ibid., 107.
29. Office of the Press Secretary, "Joint Understanding on START II," White House, June 17, 1992, https://www.bits.de/NRANEU/START/documents/Ju16-6-92.htm.
30. George H.W. Bush, "State of the Union Address," (speech, Washington, January 28, 1992), https://www.bits.de/NRANEU/START/documents/StateUnion.htm.
31. Senator Jesse Helms, *START II Treaty Report* (Washington, DC: U.S. Senate Foreign Relations Committee, December 1995), https://www.govinfo.gov/content/pkg/CRPT-104erpt10/html/CRPT-104erpt10.htm.

negotiated. The Clinton administration's foreign policy approach differed in important respects from Bush's, in some parts as a response to the shifts in the international environment that had happened since the dissolution of the Soviet Union. Importantly, the key arms control issue had become not the strategic balance between the United States and Russia but the control of nuclear weapons in Russia and in the former Soviet Republics.[32] This required significant effort from top officials in the Clinton administration to negotiate deals to return or destroy nuclear weapons in Ukraine and other parts of the former Soviet Union, a difficult process because each state wanted security guarantees from Russia in return.[33] This issue also became a precondition to ratification of START I since it applied to all of the former Soviet Union's strategic weapons.

The ultimate outcome was that the Clinton administration did not prioritize strategic arms control in the same ways as his predecessor. Strobe Talbott, who lead the administration's Russia policy as special envoy to the former Soviet Union and was later deputy secretary of state, wrote in his memoir that, "Clinton saw strategic arms control as old business – unfinished, worthwhile and necessary to be sure – but nonetheless not high on his agenda," in part because the risk of nuclear war was much lower.[34] Furthermore, during the 1990s, it was believed that Russia's strategic forces would decline in numbers regardless of arms control reductions, as many key ICBMs would reach the end of their service lives in the 2000s and Russia's financial situation would make it difficult to replace them.[35] While START II had been finalized in early 1993, by 1994 it simply appeared as if its reductions would come about with or without the treaty, while many other matters such as non-proliferation concerns were higher on the administration's agenda. A major change in U.S. government bureaucracy also reflected this attitude: the independent Arms Control and Disarmament Agency (ACDA) was incorporated into the State Department in a 1997 reorganization.[36] The effect was to deprive the interagency process of an independent advocate for arms control, allowing other priorities to trump its conclusions.

However, once the administration did start seeking START II's ratification in Congress, it faced an uphill battle. The midterm elections of 1994 had brought Republicans into the majority in both houses of Congress, and Senator Jesse Helms, a long-time skeptic of arms control, became chairman of the Foreign Relations Committee. Helms blocked the treaty for most of 1995 until the Clinton administration promised to move forward with legislation Helms favored to reorganize the State Department.[37] While Clinton was willing to make this concession to achieve Senate ratification, persuading Russia to do the same proved a more difficult task.

Russian objections to the treaty were numerous. START II's MIRV ban would have required major shifts in Russia's strategic force structure away from silo ICBMs and toward mobile ICBMs and SSBNs. The cuts that de-MIRVing implied, without the addition of more of mobile missiles and SSBNs, would have brought Russia's force numbers far below START II's limit of 3,500 deployed strategic

32. "Bill Clinton, Boris Yeltsin, and U.S.-Russian Relations," U.S. Department of State, https://history.state.gov/milestones/1993-2000/clinton-yeltsin.
33. Strobe Talbott, *The Russia Hand: A Memoir of Presidential Diplomacy* (New York: Random House, 2003), "Chapter 2: The Main Chance", 77–80.
34. Ibid., 46.
35. "Russian Nuclear Weapons," in *Nuclear Status Report*, eds. Jon Brook Wolfsthal, Cristina Chuen, and Emily Ewell Daughtry (Monterey, CA and Washington, DC: Monterey Institute of International Studies and Carnegie Endowment for International Peace, June 2001), https://www.nonproliferation.org/wp-content/uploads/2016/06/nuclear_security_report.pdf.
36. "Reinventing State, ACDA, USIA, and AID," White House, Press Release, April 18, 1997, https://1997-2001.state.gov/global/general_foreign_policy/reinvent.html.
37. "Senate Takes Up START II Treaty," UPI, December 22, 1995, https://www.upi.com/Archives/1995/12/22/Senate-takes-up-START-II-treaty/5851819608400/.

warheads. As a consequence, to maintain parity, Russia would have to invest in new nuclear arms. One retrospective on the treaty said, "for Russia, it was not a disarmament, but a rearmament agreement."[38] As a consequence, Russia dithered in ratifying START II. Boris Yeltsin's administration did not start making serious efforts to ratify the treaty until 1996, and in the following years, in part to overcome resistance from opposition parties in the Duma, Russia increasingly linked START II ratification with efforts to reach an understanding on desired U.S. changes to the ABM Treaty.[39]

The Clinton administration, in part to satisfy increasingly strident Republican demands for a national missile defense (NMD), was pushing for a limited missile defense capability in Alaska.[40] In 1997, the Russian and U.S. foreign affairs ministers reached a series of agreements extending the proposed implementation time of START II (to compensate for delayed ratification), setting out demarcation agreements for the ABM Treaty that would have permitted the planned Alaska site and agreeing to negotiate a START III that would cut forces further (addressing a key Russian concern about START II).[41] But key Republican senators said they would never ratify any proposed ABM treaty modifications, and the Clinton administration never submitted the 1997 agreements for Senate ratification.

This was the crucial juncture at which legislative constraints, combined with the divergence in broader foreign policy goals, definitively shifted U.S. arms control choices away from pursuing MIRV limits. The Republican-led Senate would never ratify the ABM agreement, but without it, the Russian Duma would not ratify the treaty. The Clinton administration effectively threw up its hands and moved on to more productive avenues of diplomacy. Talbott recounts in his memoir how despite the United States previously linking Russian ratification of START II to the United States agreeing to a presidential visit to Moscow in 1998, he advocated for "de-linking" the visit as a way to continue positive Moscow-Washington relations.[42]

As U.S.-Russian relations become more tense following North Atlantic Treaty Organization (NATO) enlargement, the bombing of Iraq in 1998, and NATO action in Yugoslavia in 1999, prospects for ratification further dimmed. Although the Duma under Russia's new president, Vladimir Putin, did finally ratify START II in 2000, it conditioned its final approval on U.S. ratification of the 1997 ABM agreements, which never occurred.[43] Thus, START II was never implemented.

The most important factor in all of this was the increasing irrelevance of strategic arms control to presidents' foreign policy agendas. Clinton's approach to strategic arms control was a product of compromise between competing policy objectives, aiming less at achieving success with Russia and more at preventing arms control's collapse. It was unable to bridge the divide on the ABM Treaty between Moscow and its Republican congressional opposition. In this mix, it was never able to find the time to prioritize finding a compromise on START II. This was a difficult endeavor, as arms control became a more partisan issue in the Senate and bipartisan groups such as the Senate Arms Control Observer Group lost their relevance in the institution.[44] With presidents increasingly aware

38. Alexander A. Pikayev, "The Rise and Fall of START II: The Russian View," Carnegie Endowment for International Peace, Working Paper No. 6, September 1999, 8, https://carnegieendowment.org/files/Rise_Fall_StartII.pdf.
39. Ibid., 19.
40. Amy F. Woolf, *Arms Control After START II: Next Steps on the U.S.-Russian Agenda*, CRS Report No. RL30660 (Washington, DC: Congressional Research Service, Updated June 2001), 5, https://www.everycrsreport.com/files/20010622_RL30660_fcfc-65576989b435c417b5ea37b34862579a520b.pdf.
41. Pikayev, "Rise and Fall," 21.
42. Talbott, *The Russia Hand*, "Chapter 10: Bad Business."
43. Amy F. Woolf, "Nuclear Arms Control: The U.S.-Russian Agenda," Congressional Research Service, Updated January 3, 2006, 6, https://fas.org/sgp/crs/nuke/IB98030.pdf.
44. Nickolas Roth, "The Evolution of the Senate Arms Control Observer Group," *Public Interest Report* 67, no. 2 (Spring 2014),

of the significant costs of arms control in terms of political capital and viewing concessions to the other party and the strategic situation as favorable, specific limits on heavy weapons systems such as MIRVs became unachievable albatrosses around the necks of their State Departments. One may wonder whether the Clinton administration would have fared better in its efforts if START II had approached reductions similarly to START I and was not so lopsided in the United States' favor. But as the process favored a strict limit in 1993, it disfavored it in 1997.

2000–2010: WHITHER STRATEGIC ARMS CONTROL?

If the Clinton administration failed to get START II over the finish line, George W. Bush's administration canceled the race. Bush brought an entirely different foreign policy agenda to the presidency, shifting decisively away from strategic arms control and in general eschewing international agreements of any kind. Bush campaigned on leaving behind "outdated" treaties, such as the ABM Treaty, and pledged to deploy national missile defense at the "earliest possible date."[45] In the fall of 2001, the Bush administration completed a nuclear posture review (NPR) heralding a new security environment, one in which nuclear force planning did not have to be based on specific adversaries' forces. At a joint press conference with Russian President Vladimir Putin, Bush announced one of the major policy recommendations of the NPR: the United States would unilaterally reduce its "operationally deployed strategic warheads" to between 2,200 and 1,700 by 2012.[46] One month later, Bush announced that the United States would be withdrawing from the ABM Treaty. Both moves were motivated by the desire to deemphasize nuclear weapons in U.S. foreign policy.

However, Bush's foreign policy also emphasized at least the appearance of positive relations with Russia, which was especially vital as a partner in the burgeoning war on terror. To do that, he needed to show some cooperation with Russia on strategic matters. The administration sought to underscore that withdrawal from the ABM Treaty did not adversely affect the strategic relationship with Russia. Bush asserted during the announcement that he agreed with Putin that withdrawal, "will not, in any way, undermine our new relationship or Russian security."[47] In the words of then-Secretary of State Colin Powell, "[o]ur withdrawal has not spurred an arms race or undermined strategic stability."[48] To make this assertation, the administration had to present a picture of a cooperative, friendly relationship with Russia. Putin had rebuffed attempts to negotiate a joint exit from the ABM Treaty, and thus, by March of 2002, Bush announced that he would negotiate a formal arms control agreement to commit to the reductions he earlier said would be made unilaterally.[49] This agreement, the Strategic Offensive Reductions Treaty (SORT), signed in May 2002, essentially committed both sides only to reduce their forces to the prescribed 1,700 to 2,200 warheads, without invasive verification measures.

Again, the president shaped how the United States pursued arms control and how it fit in the broader foreign policy agenda. In this case, these broader goals actually demanded the president act contrary

https://fas.org/wp-content/uploads/2014/06/ACOG-Spring-2014.pdf.
45. George W. Bush, "Acceptance Speech at the Republican National Convention," (speech, Philadelphia, PA, August 4, 2000), http://movies2.nytimes.com/library/politics/camp/080400wh-bush-speech.html.
46. George W. Bush, "Joint Press Conference with Russian President Vladimir Putin," Kremlin, November 13, 2001, http://en.kremlin.ru/events/president/transcripts/21397.
47. U.S. Department of State, "U.S. Withdrawal from the ABM Treaty: President Bush's Remarks and Diplomatic Notes," *Arms Control Today*, January 2002, https://www.armscontrol.org/act/2002-01/us-withdrawal-abm-treaty-president-bush%E2%80%99s-remarks-us-diplomatic-notes.
48. U.S. Congress, Senate, "Treaty on Strategic Offensive Reduction: The Moscow Treaty," Hearing, Committee on Foreign Relations, 107th Cong., 2nd sess., 2002, 15, https://www.govinfo.gov/content/pkg/CHRG-107shrg81339/html/CHRG-107shrg81339.htm.
49. Woolf, "Nuclear Arms Control," 9.

to his unilateralist principles and conclude a formal treaty to satisfy Russian concerns. Yet SORT was the ultimate example of presidential dominance over arms control agreements and the sidelining of the bureaucracy. It was merely a formalization of the commitment to reduce strategic forces that Bush had already stated, providing essentially no role for interagency groups to propose limits on specific weapons such as MIRVs.

On this point, Powell testified during SORT's ratification hearing that, "[s]ince neither the United States nor Russia has any incentive to launch nuclear weapons at each other, we no longer view Russian deployment of MIRVed ICBMs as destabilizing to our strategic relationship."[50] Then Secretary of Defense Donald Rumsfeld testified that, "Russia's deployment of MIRVs has little impact on U.S. national security under current conditions" because "neither the United States and its allies nor Russia view our strategic relationship as adversarial."[51] Rumsfeld added that the United States believed that Russia would not retain its MIRV'd ICBMs as they reached the end of their service lives in approximately a decades' time. Admiral James Ellis, the head of U.S. Strategic Command, further supported this approach in saying, "[a]s the friendship between the United States and Russia continues to grow, the exact composition of the Russian force structure will diminish even further in importance."[52] With these beliefs dominating thinking in the Bush administration, it made sense for it to pursue a vague, limited approach to strategic arms control.

When it came to ratification, the Bush administration benefited from the new Republican majority in the Senate elected in November 2002. This ensured that the treaty received minimal scrutiny and unanimous ratification in March 2003.[53] Again, Republican control of the legislature with a Republican president permitted even more latitude for the president to direct arms control.

The rest of the Bush administration was a stagnant one for arms control. However, once Barack Obama took office in 2009, he was determined to reorient U.S. foreign policy. Obama's administration embraced liberal internationalism, seeking to restore perceived lost credibility with allies abroad and to restore relations that had soured as a result of Bush's unilateralism.[54] With respect to Russia, the administration notably pursued a "reset" policy that attempted to find new grounds for cooperation.[55] Here, nuclear arms control clearly had a role to play, especially because the Obama administration sought Russia's cooperation on other non-proliferation issues, such as addressing the Iranian nuclear program.

Further, as Obama took office, his administration faced a deadline: the expiration of START I on December 5, 2009. While SORT's limits would persist until 2012, that treaty made use of START I's verification provisions. Thus, the administration ran the risk of all measures for ensuring compliance with nuclear reductions being eliminated in its first year of office. Faced with this prospect, the administration had to make an arms control choice quickly. Notably, potential options were varied in scope, from simply extending START I to negotiating a new treaty to either simply preserve the

50. U.S. Congress, Senate, "Treaty on Strategic Offensive Reduction: Moscow Treaty," 18.
51. U.S. Congress, Senate, "The National Security Implications of the Strategic Offensive Reductions Treaty," Hearing, Armed Services Committee, 107th Cong., 2nd sess., 2002, 48–49, https://www.govinfo.gov/content/pkg/CHRG-107shrg83759/html/CHRG-107shrg83759.htm.
52. Ibid., 106.
53. "Strategic Offensive Reductions Treaty (SORT)," Nuclear Threat Initiative, last updated October 26, 2011, https://www.nti.org/learn/treaties-and-regimes/strategic-offensive-reductions-treaty-sort/.
54. James M. McCormick, "The Obama Presidency: A Foreign Policy of Change?," in Steven Schier, ed. *Transforming America: Barack Obama in the White House* (Lanham, MD: Rowman & Littlefield Publishers, Inc., 2011), 235–266, https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1018&context=pols_pubs.
55. "U.S.-Russia Relations: 'Reset' Fact Sheet," White House, Press Release, June 24, 2010, https://obamawhitehouse.archives.gov/the-press-office/us-russia-relations-reset-fact-sheet.

verification regime or pursue further reductions in strategic forces. The administration also would have had the option of pursuing more specific limits on Russian weapons of concern, such as its MIRV'd ICBMs. In all of this, there was also a timing choice–either to pursue an agreement before START I's expiration in less than a year (meaning it would be necessarily less ambitious and more limited in scope) or pursue a more comprehensive new agreement in a longer negotiation.

Once again, broader foreign policy goals drove the White House in the critical first stage. With arms control not the overriding priority in U.S.-Russia relations, the administration chose to pursue a limited replacement mainly focused on preserving the START verification regime and slightly reducing further deployed strategic warheads. This did require more effort than a simple extension would have, but Russia opposed the extension because it did not want to continue involving Ukraine, Belarus, and Kazakhstan in the arms control framework (they had been parties to START 1 due to their former Soviet Union's nuclear weapons) and because the Obama administration had publicly articulated a goal of reducing nuclear arsenals.[56] While the adversary was able to impose some constraint, the primary driver was the president's foreign policy agenda, particularly the goal of showing progress in the Russia "reset" and avoiding a lapse in the arms control verification regime.

According to Toby Dalton's characterization of the negotiations for what eventually became called the New START Treaty, the White House once again dominated the process and minimized opportunities for the bureaucracy to pursue limits based on its own reasoning.

[57] The final treaty text brought down overall deployed warheads and launchers to 1,550 for both sides and contained no specific limits on MIRVs. Indeed, then-Under Secretary of State for Arms Control and International Security Rose Gottemoeller, who was the chief U.S. negotiator for New START, stated during Senate testimony that, "Limiting MIRVed ICBMs was not an objective in the New START treaty negotiations . . . [Russia's MIRV'd ICBMs'] age and smaller size led the United States to determine that it was less important to prioritize discouraging the deployment of such systems."[58] Rather than seeking to shape the other side's forces, each party had "freedom to mix" and decide the composition of their strategic forces among SSBNs, ICBMs, and bombers. This approach, which required less effort to negotiate than weapon-specific limits would have needed, fitted the administration's broader goal of a limited agreement.

When it came to ratification, even the Obama administration's limited approach ran in to difficulties because of partisan opposition. Many Republican senators cited long lists of concerns, only some related to the substance of the treaty, as the basis of their opposition. Only by engaging in a series of trades where it promised funding for modernization of the U.S. nuclear arsenal was the administration able to secure support from critical Republicans that just put it over the three-fourths threshold.[59] New START was evidently sufficiently important as a part of Obama's foreign policy agenda to merit these payments.

In sum, the Obama administration's approach to New START fit the paradigm nearly exactly. Since the treaty did serve broader goals, the administration was willing to pursue it, but only in a limited form

56. Dalton, "Armed for Arms Control," 346–347; and Wade Boese, "START Decision Put Off to 2009," Arms Control Today, December 2008, https://www.armscontrol.org/act/2008-12/start-decision-put-2009.
57. Ibid., 394.
58. U.S. Congress, Senate, "The New START and Implications for National Security," Hearing, Armed Services Committee, 111th. Cong., 2nd sess., 2010, 399, https://fas.org/irp/congress/2010_hr/newstart.pdf.
59. Kreps, Saunders, and Shultz, "Ratification Premium," 36–41.

and eschewing the focus on MIRVs that previously preoccupied U.S. arms controllers. The Obama administration, while professing to care about strategic stability issues, in fact shared most of its arms control thinking with the Bush administration. The difference was in how arms control lined up with the administrations' respective foreign policy approaches. When it came to ratification, once again, the dove suffered while the hawk benefited from an increasingly partisan approach to arms control by the Republican party.

ASSESSMENT AND IMPLICATIONS

In all four cases, the key variable was the president's foreign policy agenda, not specific issue-based concerns emanating from experts in the bureaucracy or outside the government. The post-Cold War experience has cemented the presidency's dominance over the arms control process, indicating that the model is possibly too conservative in discussing the ways that bureaucrats can pursue their own priorities during negotiations. Since all four negotiations took place over short time periods, the White House could closely monitor the process and reduce the ways that negotiators could pursue limits of interest to their constituencies. In the third stage, the possibility for constraint was limited to cases with a Democratic president and Republican-controlled Senate. In the reverse situation for START I, Bush was able to mobilize pro-arms control Democrats to overcome any potential partisan opposition. Democratic presidents lack such allies in the other party and thus have faced greater constraints. These constraints even motivated Clinton to abandon START II ratification by not pressing to have the Senate ratify the agreement on missile defense in 1997.

This of course leads directly to the topic of MIRVs and why they fell off the arms control agenda. Simply put, MIRVs ceased to matter because strategic arms control itself stopped mattering to presidents' foreign policies. As an arms control choice, limits on MIRVs especially diverged from what presidents wanted from arms control. Negotiating with the Russians about MIRVs would have required addressing the relationship between offense and defense and the Russians' desires for constraints on U.S. missile defenses. This would have been a constraint on presidents' chances of a foreign policy success and would have run into serious domestic constraints in the Senate. H.W. Bush's success at banning MIRVs in START II was the product of a unique moment where Russia dropped its constraints in the immediate wake of the Soviet Union's dissolution. That moment is not likely to reappear.

These findings imply that arms control experts should consider deemphasizing certain themes in their attempts to persuade presidents to make arms control choices. Rhetoric about the importance of arms control for enhancing stability, gaining military advantage, or pursuing disarmament will fall flat if it is not framed in a president's broader foreign policy agenda with respect to Russia and beyond. Administrations which decry multilateral treaties and cooperation with adversaries will not prove receptive audiences. Furthermore, analysts should pay attention to the costs of arms control choices for the president, both in terms of their broader agendas and the costs they will be forced to pay to secure ratification. This implies that ambitious proposals, such as those calling for a return to the MIRV ban of START II, need to justify in political terms why presidents should be prepared to pay costs in terms of time, agenda space, and political capital to secure them.[60]

Looking ahead, as the next presidential term begins, New START will expire. President Trump has made including China in a new strategic arms agreement an important part of his China policy,

60. Dakota S. Rudesill, "MIRVs Matter: Banning Hydra-Headed Missiles in a New START II Treaty," *Stanford Journal of International Law* 54, no. 1 (2018): 83–115, https://papers.ssrn.com/sol3/papers.cfm.

which has emphasized competing with Beijing. A Biden administration would likely adopt a different approach premised on first extending New START, but what may come after that is unclear and may depend on global dynamics in 2021. With new MIRV'd ICBMs and several new "exotic" strategic delivery systems now a part of Russia's arsenal, there may be more and more arguments for arms control measures to constrain these systems.[61] Moreover, China itself has recently introduced several MIRV'd ICBMs, which may provide fodder for further proposals along these lines. [62] In all of this, analysts will need to ensure that they frame any capabilities-based assessments in their broader political context and take the political costs of arms control into account.

In sum, this article has put forward a framework for assessing arms control choices in terms of a process dominated by the president and his foreign policy agenda. Presidents may draw from different logics to engage in arms control, but their primary driver is their broader foreign policy agenda. Other actors, such as the relevant adversary and partisan opponents in Congress, can impose constraints on presidents' choices at certain moments in the process. This model explains the shift away from limited MIRV'd ICBMs, which so dominated U.S. arms control thinking during the late-1980s during the post-Cold War period, when presidents turned away from strategic arms control as a central item on the foreign policy agendas. Future research could consider whether this model applies to other states that engage in arms control, principally Russia, and ascertain under what conditions arms control cooperation is more likely.

61. Vladimir Putin, "Presidential Address to the Federal Assembly," (speech, Moscow, March 1, 2018), http://en.kremlin.ru/events/president/news/56957; and Pranay Vaddi, "Bringing Russia's New Nuclear Weapons Into New START," Lawfare, August 13, 2019, https://carnegieendowment.org/2019/08/13/bringing-russia-s-new-nuclear-weapons-into-new-start-pub-79672.
62. Travis Wheeler, "China's MIRVs: Separating Fact From Fiction," *The Diplomat*, May 18, 2016, https://thediplomat.com/2016/05/chinas-mirvs-separating-fact-from-fiction/.

The Future of Nuclear Energy in the United States

Phoebe M. Kotlikoff[1]

INTRODUCTION

In the mid-twentieth century, the United States invested heavily in nuclear power for energy, building over 100 reactors over the course of 50 years. Today, there are 95 commercially operating nuclear power reactors[2] in the United States providing 20 percent of total U.S. energy production, a number that has steadily risen since the 1980s.[3]

Those reactors and that power are the product of previous strategic investment, licensing, and infrastructure over the course of 40 years (see Figure 1).[4] Despite the significant market share of production that nuclear power holds, federal policies and geopolitical strategies have ensured the availability of other sources of energy at lower cost, resulting in economic conditions that eliminated new investments in nuclear power plant construction between 1977 and 2013.[5] Today, the United States nears a turning point—as nuclear reactors reach the end of their lifecycles and are retired from service, the share of energy production from nuclear power is set to decline markedly without intervention.

This paper is not intended to advocate for increased investment in nuclear power in the United States. Rather, it examines the history of the industry and challenges presented by the decline of domestic nuclear energy production. It is important, however, to note the factors that play into the current state of the nuclear power industry. First, the economic incentives that once made nuclear

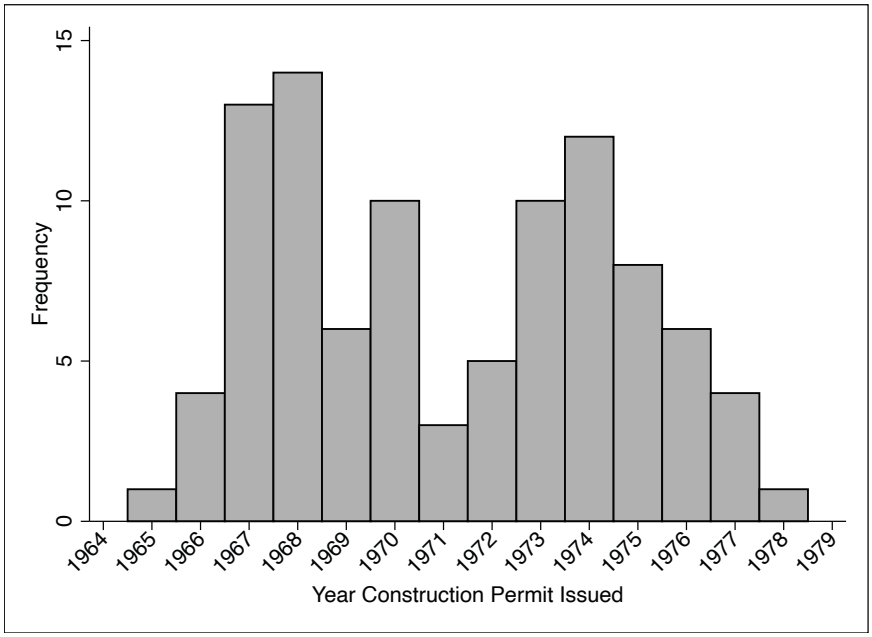
1. Phoebe Kotlikoff is a submarine officer in the U.S. Navy. Views presented are her own and do not represent the views of DoD or its components.
2. "Operating Nuclear Power Reactors (by Location or Name)," U.S. Nuclear Regulatory Commission, https://www.nrc.gov/info-finder/reactors/index.html. Retrieved 29 December 2020.
3. "What is U.S. electricity generation by energy source?" U.S. Energy Information Administration, https://www.eia.gov/tools/faqs/faq.php?id=427&t=3. Updated 2 November 2020.
4. Figure 1 generated using dataset "Commercial Nuclear Power Reactors – Operating Reactors," U.S. Nuclear Regulatory Commission, NRC High-Value Datasets, https://www.nrc.gov/data/.
5. "Nuclear Power in the USA," World Nuclear Association. https://www.world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-power.aspx. Retrieved 29 December 2020.

power a rational investment have since declined in the face of overwhelming oil and gas supply. Additionally, with high upfront capital costs and delays associated with federal and local regulatory oversight, nuclear power plants only become profitable in the longer term. Without external investment through government intervention, nuclear power is unlikely to see a resurgence. Second, the United States does not appear to have a strategy in place to replace energy from nuclear power, placing the country in a less energy secure position, vulnerable to shifts in the cost of, and access to, oil. Third, the market share of energy produced by nuclear power is likely to be replaced with a fossil fuel that will contribute to climate change. Taken together, these factors explain why government investment in nuclear power should be considered, and thus why it is important to understand the status of existing U.S. infrastructure.

THE COMPLEX HISTORY OF U.S. NUCLEAR POWER

In the 1960s and early 1970s, many utility companies saw nuclear as the future of electrical power. With demand for electricity predicted to rise at a steady rate, the cost of oil also increasing, and the compelling need for reliable domestic energy sources, the high initial cost and lead time required for nuclear power plant construction appeared justified. Moreover, the early success of the Navy Nuclear Propulsion Program led by Admiral Hyman Rickover provided proof of concept for nuclear power production and helped launch the industry into existence. However, initial research, development, and investment petered out during the 1970s and 1980s. From 1979 through 1988, 67 planned builds of nuclear reactors were canceled, and no nuclear plants were opened between 1977 and 2013.[6]

Figure 1: Issue Year for Construction Permits of Currently Operating U.S. Reactors



Source: Figure 1 generated using dataset "Commercial Nuclear Power Reactors – Operating Reactors," U.S. Nuclear Regulatory Commission, NRC High-Value Datasets, https://www.nrc.gov/data/.

6. "Most U.S. nuclear power plants were built between 1970 and 1990," Today in Energy, U.S. Energy Information Administration, April 27, 2017, https://www.eia.gov/todayinenergy/detail.php?id=30972#tab2.

Several factors contributed to a dramatic halt in nuclear industry expansion. First, construction delays and rising production costs led to significant budget overruns.[7] Second, the Three Mile Island accident in 1979 shook the nation and led to significant increase in regulation within the industry.[8] Finally, the catastrophic effects of the 1986 Chernobyl disaster resulted in a distinct shift in public opinion away from nuclear power.[9] Large power companies faced enormous investments in the construction of nuclear reactors, where operation was repeatedly delayed by increased regulation and local and regional opposition. Meanwhile, electricity demand flattened. Companies were wary of large plants, where construction timing was uncertain, operation heavily regulated, and ultimate profitability questionable. This had a dramatic chilling effect on new applications for nuclear plant licenses through the Nuclear Regulatory Commission (NRC) and nudged utilities away from nuclear toward other energy production capabilities.

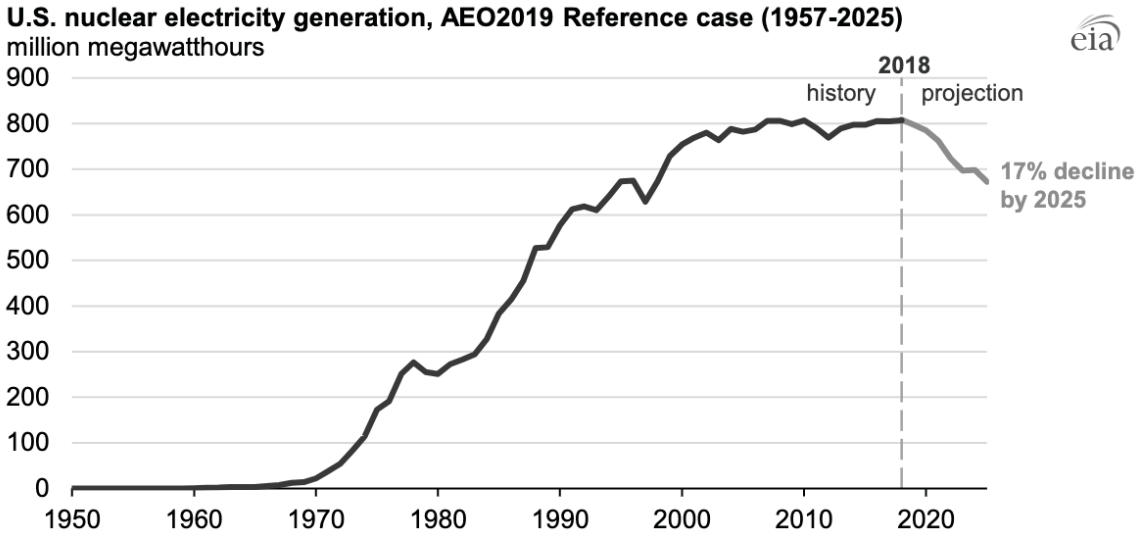
By the late 1970s, nuclear supply levelled off at a capacity to generate 20 percent of the U.S. economic supply, which it has done consistently since.[10] The nuclear infrastructure in operation today is largely the same infrastructure that was permitted over 40 years ago. The United States is able to rely on the baseload supply of consistent electrical supply because nuclear infrastructure is built to last—licensed for 40 years by the NRC with opportunities to extend. However, the United States is now at a turning point. The U.S. supply of electricity from nuclear power will soon begin to decline as a result of decommissioning plants that have been providing power for over 50 years (see Figure 2).[11]

The Energy Information Administration (EIA) has conducted sensitivity analysis on the stability of existing nuclear infrastructure that suggests either low natural gas prices or heightened operating costs for nuclear plants could drive unplanned early retirement of nuclear power plants and a decrease in nuclear capacity for electricity generation. This study found that under experimental circumstances of lowered natural gas and raised nuclear operating costs, nuclear energy production could fall to 18 percent of existing nuclear capacity by 2050.[12]

In the late 2000s, many energy economists predicted a second nuclear heyday.[13] Nuclear energy is carbon free and represents a reliable and clean way to ensure continuous electricity supply without the need for consistent weather (sun or wind) or significant storage capacity. However, the Fukushima disaster in 2011 (in which an earthquake and tsunami interrupted emergency cooling water supply) prompted renewed speculation over nuclear safety.[14]

7. Federal Energy Regulatory Commission, "Promoting Wholesale Competition Through Open Access Non- Discriminatory Transmission Services by Public Utilities (RM95-8-000) and Recovery of Stranded Costs by Public Utilities and Transmitting Utilities (RM94-7-001): Final Environmental Impact Statement," Department of Energy, February 1, 1996, J-66, https://www.govinfo.gov/content/pkg/FR-1996-05-10/pdf/96-10694.pdf.
8. George Frampton and Mitchell Rogovin, *Three Mile Island*; *A Report to the Commissioners and to the Public*, NUREG/CR-1250 (Washington, DC: Nuclear Regulatory Commission, 1980), https://www.osti.gov/servlets/purl/5395798.
9. Carol Glover and Michael Ratner, *U.S. Energy: Overview and Key Statistics*, CRS Report No. R40187 (Washington, DC: Congressional Research Service, June 2014), https://fas.org/sgp/crs/misc/R40187.pdf/.
10. "Monthly Energy Review May 2020," U. S. Energy Information Administration, May 2020, https://www.eia.gov/totalenergy/data/monthly/pdf/sec1.pdf.
11. "Despite closures, U.S. nuclear electricity generation in 2018 surpassed its previous peak," U.S. Energy Information Administration, March 21, 2019, https://www.eia.gov/todayinenergy/detail.php?id=38792#.
12. Michael Scott, "Future of U.S. nuclear power fleet depends mostly on natural gas prices, carbon policies," U.S. Energy Information Administration, May 18, 2018, https://www.eia.gov/todayinenergy/detail.php?id=36112.
13. David Biello, "Is a U.S. Nuclear Revival Finally Underway?," *Scientific American*, February 16, 2011, https://www.scientificamerican.com/article/us-nuclear-revival-starting/.
14. "The Fukushima Daiichi Accident, Report by the Director General," IAEA Library Cataloguing in Publication Data, 2015, https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1710-ReportByTheDG-Web.pdf.

Figure 2: U.S. Nuclear Electricity Generation (1957-2025)



Source: "Despite closures, U.S. nuclear electricity generation in 2018 surpassed its previous peak," U.S. Energy Information Administration, March 21, 2019, https://www.eia.gov/todayinenergy/detail.php?id=38792#.

According to 2019 Gallup polling, 49 percent of Americans oppose use of nuclear power and 49 percent view nuclear powerplants as unsafe. This represents a dramatic shift since 2010, when high oil prices and a tenuous supply of natural gas in the pre-Fukushima era led 62 percent of Americans to say they favored the use of nuclear power.[15]

In addition to a decline in public support, the low cost of natural gas has driven down energy prices over the last five years, making the significant startup costs of nuclear even less attractive to industry. However, there have been many changes to the systems under which U.S. nuclear infrastructure was built, and advances in technology compliment the changes to policy in a way that suggests a potential future for nuclear resurgence in the United States.

THE U.S. ENERGY ECONOMY

The energy economy is a complex web of interconnected supply and demand functions. In electricity markets, demand has low price elasticity, meaning demand stays fairly constant regardless of changes in price. Supply is also fairly price inelastic due to fixed capacity and limited storage ability. To further complicate the energy economy, electricity is typically bought from suppliers at a fixed price, regardless of the method or cost of that unit of production.[16]

Nuclear power contributes to the supply side of electricity production. Over the last decade, expansion in natural gas production through fracking technology and a dramatic increase in electricity generation from renewable power sources has created a competitive energy supply economy with low energy costs to consumers. The market for electricity yields natural monopolies as a result of high infrastructure costs and the ability to efficiently share distribution infrastructure.

15. RJ Reinhart, "40 Years After Three Mile Island, Americans Split on Nuclear Power," Gallup, March 27, 2019. https://news.gallup.com/poll/248048/years-three-mile-island-americans-split-nuclear-power.aspx.
16. Severin Bornstein, "The Trouble With Electricity Markets: Understanding California's Restructuring Disaster," *Journal of Economic Perspectives* 16, no.1 (Winter 2002): 191–211, http://faculty.haas.berkeley.edu/borenste/download/JEP02ElecTrbl.pdf.

Many large, vertically integrated utilities own and operate multiple generation systems and sell electricity generated directly to consumers.[17]

The Federal Energy Regulatory Commission (FERC), recognizing the economic disincentives at play, provided a mechanism to regulate the natural monopolies of the domestic energy economy while simultaneously incentivizing investment in new technology, Orders 888 and 889, which passed together in 1996.[18] Orders 888 and 889 also sought to nationalize the market for energy, creating a wholesale electricity economy and preventing massive variance in electricity pricing based on proximity to power plants. Under these orders, public utilities that produce electricity in a vertically integrated system must provide for the sale of their electricity to competitors at the same rate they apply to themselves and their own distribution systems. This system had significant impacts on limiting monopolies in micro-economies based on geographic location and energy transmission capability (ownership of the cabling connecting power stations to consumers). It also improved overall grid reliability and efficiency.[19]

Orders 888 and 889 also implemented a sunk-cost protection for industries to recoup lost investment in a utility rendered financially inviable due to lower-than-expected electricity prices. In other words, the orders protect utility companies that would otherwise be forced to sell electricity at a net loss. The arguments for and against stranded investment protection help to draw out the competing factors in energy generation technology development. At the time, many low-cost utilities argued that sunk-cost protections were tantamount to bailouts for a competitor's bad investment.[20] However, without the ability to recoup costs for higher electricity prices, the electricity economy would become entirely dependent on the cheapest existing technology without regard for environmental impact, dulling innovation and encouraging a tragedy of the commons for the environment. The ability to recoup stranded costs locked in development of new infrastructure or in failed projects through raising electricity prices and passing sunk costs on to consumers proved a boon for industries struggling to pay the high startup costs associated with the development of nuclear power.[21]

The wholesale electricity economy is entirely transparent to the demand-side consumer except for the price metric. Despite national efforts to regulate electricity pricing, many factors contribute to a wide range of cent/kilowatt-hour (kWh) prices from state to state and even county to county. Moreover, due to the highly vertically integrated production networks in place, utilities are able to maximize profit-making through clever management of available resources. Nuclear power plants, with high capacity factors and relatively low operating costs, typically run continuously. It is difficult to estimate the cost to produce a unit of electricity from a nuclear power plant, and equally as difficult to estimate the price to consumers of a single unit of nuclear-produced electricity as compared to a unit of coal-produced electricity based on the complex set of variables involved: startup costs, production costs, transmission costs, and effect of market value on unit price. Moreover, companies do not sell electricity in units based on the method of production. Table 1 shows the consistency in electricity prices to consumers over the last decade.

17. "Electricity explained - How electricity is delivered to consumers," U.S. Nuclear Regulatory Commission, https://www.eia.gov/energyexplained/electricity/delivery-to-consumers.php. Updated 22 October 2020.
18. R. Burns, K. Rose, and R.J. Graniere, *Research report: Summary of key state issues of FERC orders 888 and 889* (Columbus, OH: National Regulatory Research Institute, January 1, 1997), https://digital.library.unt.edu/ark:/67531/metadc681501/.
19. Wilbur C. Earley, "The Federal Energy Regulatory Commission's Open Access Rule," in Federal Facilities Council, *Competition in the Electric Industry: Emerging Issues, Opportunities, and Risks for Facility Operators* (Washington, DC: The National Academies Press, 1996), https://www.nap.edu/catalog/5482/competition-in-the-electric-industry-emerging-issues-opportunities-and-risks.
20. Ibid.
21. John Hanger, "Electric Power Competition: Perspective of a Regulator," in *Competition in the Electric Industry*.

Table 1: Average Electricity Price (cent/kWh) to Consumer by End-Use Sector

YEAR	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	TRANSPORTATION	TOTAL
2010	11.54	10.19	6.77	10.56	9.83
2011	11.72	10.24	6.82	10.46	9.9
2012	11.88	10.09	6.67	10.21	9.84
2013	12.13	10.26	6.89	10.55	10.07
2014	12.52	10.74	7.1	10.45	10.44
2015	12.65	10.64	6.91	10.09	10.41
2016	12.55	10.43	6.76	9.63	10.27
2017	12.89	10.66	6.88	9.68	10.48
2018	12.87	10.67	6.92	9.7	10.53
2019	13.01	10.68	6.81	9.66	10.54

Source: "Electric Power Monthly, Table 5.3. Average Price of Electricity to Ultimate Consumers," U.S. Energy Information Administration, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_3. Retrieved 29 December 2020.

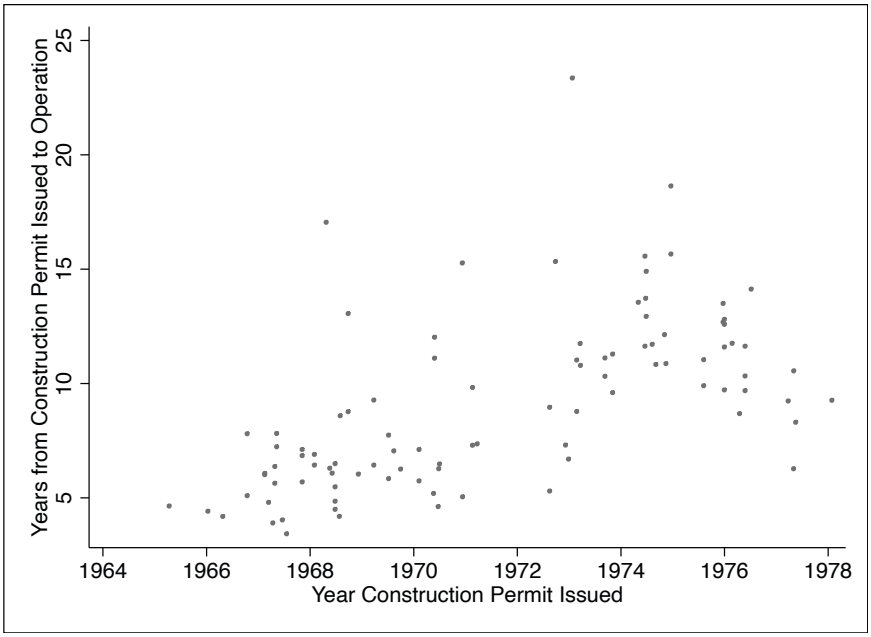
REGULATION AND EXISTING INFRASTRUCTURE

In order to understand the status of U.S. nuclear infrastructure today, it is essential to understand the historical licensing requirements as well as the current licensing process. The 1946 Atomic Energy Act established the Atomic Energy Commission (AEC) as responsible for nuclear regulation, to include the regulation of commercial nuclear energy development legalized in 1954. During the first 15 years of its existence, the AEC developed vocal critics of regulatory processes, particularly since the AEC was also responsible for encouraging development of commercial nuclear power. As a result, the NRC was formed in 1975 to oversee construction and operation of nuclear reactors in the United States only, without a mandate to encourage development.[22] Figure 3 illustrates a trend in the relationship between regulation authority and the length of construction time.[23]

Historically, the NRC has required applicants to submit separate applications for permission to build and license to operate a nuclear power plant.[24] An updated licensing process, first released in 1989, sought to reduce administrative burden on companies desiring to build and operate a nuclear power plant (perceived as contributing to the lack of licensing applications sought during the 1980s). Under the new process, there exist standardized designs for nuclear power reactors that are pre-approved for use. A company can apply for a combined license application to both build and operate a nuclear plant. The applicant undergoes a series of parallel review processes for safety, environmental impact, and public opinion before the NRC makes a final decision to grant or deny the application. In another simplification of the licensing process, the NRC now grants early site permits allowing an applicant to have a potential plant site approved for future use without the investment of a full license application.[25]

22. "History," U.S. Nuclear Regulatory Commission, https://www.nrc.gov/about-nrc/history.html.
23. "Commercial Nuclear Power Reactors – Operating Reactors," U.S. Nuclear Regulatory Commission, NRC High-Value Datasets, https://www.nrc.gov/data/.
24. "Nuclear Power Plant Licensing Process (NUREG/BR-0298, Revision 2)," Office of Public Affairs, U.S. Nuclear Regulatory Commission, July 2009, https://www.nrc.gov/reading-rm/doc-collections/nuregs/brochures/br0298/index.html.
25. Ibid.

Figure 3: Construction Duration Over Time



Source: "Commercial Nuclear Power Reactors – Operating Reactors," U.S. Nuclear Regulatory Commission, NRC High-Value Datasets, https://www.nrc.gov/data/.

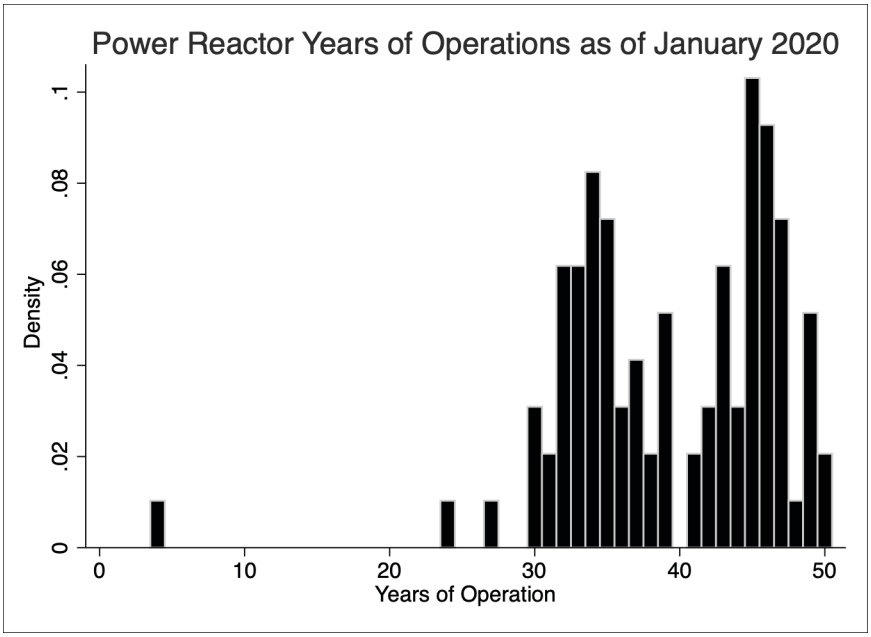
Currently, 95 operating nuclear reactors produce 99 gigawatts (GW) of power or 807.1 million megawatt hours (MWh) per year. This translates to 20 percent of the total energy produced in the United States.[26] Eight plants have shut down since 2013, with four more permanent shutdowns planned by the end of 2025, a loss of 5 percent of total generating capacity. The EIA predicts the potential for additional unplanned plant shutdowns reducing nuclear generating capacity to 79 GW by 2050.[27] The most recently constructed nuclear reactor in the United States was opened in 2016 in Tennessee, nearly 50 years after it was originally permitted. Active reactors have an average age of 39 years in operation (Figure 4).[28]

The existing nuclear power reactors in the United States are owned by 23 parent companies.[29] These parent companies often also own electricity production capacity in other sectors, including renewables, natural gas, coal, and others. These companies generate power and distribute electricity across the country through a complex energy delivery network. In the last two years alone, six plants at three locations have had their licenses terminated—the Virgil C. Summer Nuclear Station, the South Texas Project, and the Levy Nuclear Plant—after significant cost overruns rendered projects inviable.[30] Westinghouse declared bankruptcy Chapter 11 largely due to

26. "Nuclear Explained: U.S. nuclear industry," U.S. Energy Information Administration, April 15, 2020, https://www.eia.gov/energyexplained/nuclear/us-nuclear-industry.php.
27. "U.S. nuclear capacity and generation expected to decline as existing generators retire," U.S. Energy Information Administration, May 12, 2017, https://www.eia.gov/todayinenergy/detail.php?id=31192.
28. "Commercial Nuclear Power Reactors – Operating Reactors," U.S. Nuclear Regulatory Commission, NRC High-Value Datasets, https://www.nrc.gov/data/.
29. "Canceled U.S. Commercial Nuclear Power Reactors," NRC High-Value Datasets, https://www.nrc.gov/data/.
30. "Commercial Nuclear Power Reactors – Operating Reactors," U.S. Nuclear Regulatory Commission, NRC High-Value Datasets, https://www.nrc.gov/data/.

costs.[31] In addition, 12 companies withdrew or had their combined operating license applications suspended over the last decade.[32]

Figure 4: Age of Existing Nuclear Infrastructure: Power Reactor Years of Operations as of January 2020

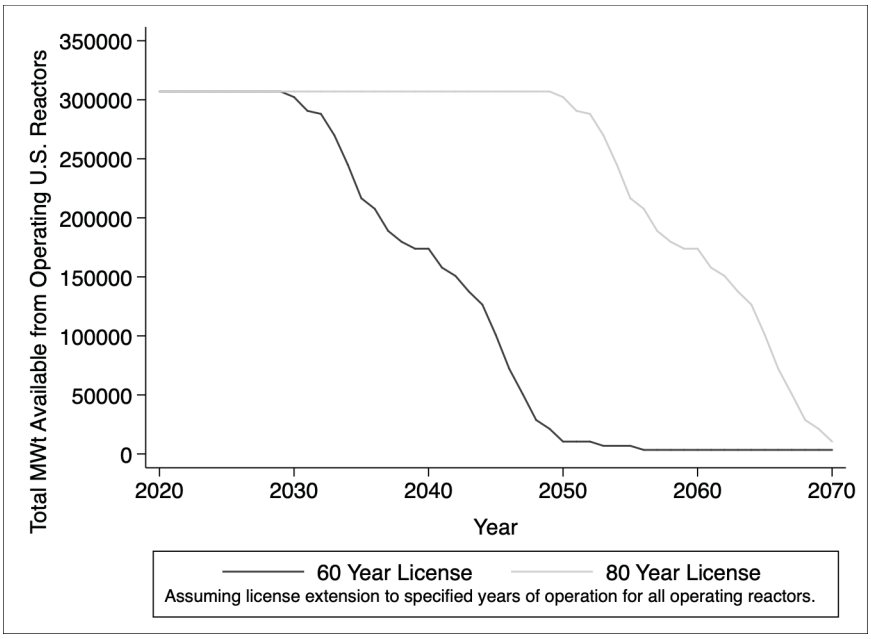


Source: "Commercial Nuclear Power Reactors – Operating Reactors," U.S. Nuclear Regulatory Commission, NRC High-Value Datasets, https://www.nrc.gov/data/.

The NRC licenses nuclear reactors for an initial operating lifetime of 40 years, with option to extend operating time up to 20 years at a time. Of operating reactors, 90 have received license extensions past their original 40-year operating lifetime.[33] In late 2019, the NRC approved the first license renewal requesting a second extension of lifetime from 60 years to 80 years of operation.[34] With lifetime extensions out to 60 years for all operating reactors, existing energy generation will plummet between now and 2050. With lifetime extension out to 80 years, existing infrastructure will continue providing energy through 2070 (Figure 5).[35]

31. "South Carolina Electric & Gas Company To Cease Construction And Will File Plan Of Abandonment Of The New Nuclear Project," PR Newswire, July 31, 2017, https://seekingalpha.com/pr/16901340-south-carolina-electric-gas-company-to-cease-construction-and-will-file-plan-of-abandonment.
32. "Combined License Applications for New Reactors." U.S. Nuclear Regulatory Commission, https://www.nrc.gov/reactors/new-reactors/col.html.
33. "Commercial Nuclear Power Reactor Operating Licenses— Issued by Year," U.S. Nuclear Regulatory Commission, NRC High-Value Datasets, https://www.nrc.gov/data/.
34. "Issuance of Subsequent Renewed Facility Operating License Nos. DPR-31 and DPR-41 for Turkey Point Nuclear Generating Unit Nos. 3 and 4 (EPID l-2018-RNW-0002)," U.S. Nuclear Regulatory Commission, December 4, 2019, https://www.nrc.gov/docs/ML1930/ML19305C879.pdf.
35. "Commercial Nuclear Power Reactors – Operating Reactors," U.S. Nuclear Regulatory Commission, NRC High-Value Datasets, https://www.nrc.gov/data/.

Figure 5: Future MWt Available from Existing Nuclear Infrastructure



Source: "Commercial Nuclear Power Reactors – Operating Reactors," U.S. Nuclear Regulatory Commission, NRC High-Value Datasets, https://www.nrc.gov/data/.

COMPETING FACTORS: ENVIRONMENTAL TRAGEDY OF THE COMMONS

As described above, there is inherent conflict between the energy economy and emissions control. On a microeconomic level, consumers are affected most by the price of energy required to heat their homes, cool their food, and turn on their lights. The source of this electricity is not obvious to the consumer, and neither are the effects of the potential carbon emissions released as a result of that electricity use. Moreover, the consumer is effectively rendered powerless in deciding from where their electricity will be supplied. Some companies offer plans under which consumers pay specifically for electricity from renewable sources, but this process is sometimes administratively burdensome and often does not exist.

On a macroeconomic level, reducing nuclear power production is likely to result in increased carbon emissions. Although there are plans to dramatically increase the renewable energy capacity in the United States, in the short term the cheap availability of natural gas suggests fossil fuels will fill the gap left by a reduction in nuclear energy production capability.

Without government intervention (e.g. tax cuts, subsidies, and public-private partnerships) to encourage new nuclear investment or to make fossil fuels comparatively more expensive for producers, supply and demand economics dictate that consumers will purchase the cheapest energy sources available to power their homes, and producers will seek to maximize profits through producing the cheapest energy from the cheapest sources. New nuclear development will not emerge in an environment in which it is fiscally inviable.

THE NEXT ERA OF NUCLEAR

THE ENDURING PROBLEM OF WASTE

One consideration that bears recognition and study is the issue of nuclear waste. Nuclear waste disposal remains an unsolved problem despite the industry's decades-long efforts to develop a solution. During the mid-2000s, Yucca Mountain in Nevada was approved as a storage facility for aggregated spent nuclear fuel. However, after nearly a decade of federal funding, the project ended due to public resistance and political retrenchment.[36] The elimination of a federal solution to waste disposal resulted in many nuclear power plants storing spent fuel on-site, in dry cask storage or spent-fuel pools.[37] However, these waste disposal sites are constrained by size and comprise a stop gap solution at best. A 2011 MIT study advocates continued research and development on integrating waste management into fuel-cycle considerations and new disposal concepts, including deep borehole storage.[38] While there was initial investment and a pilot program through the Department of Energy, this was also terminated after public outcry. Without significant investment in methods to safely store and dispose of spent nuclear fuel (and communication of the long-term benefit), any planned increase in nuclear power capability in the United States will face the technical challenge of storage solutions and unrelenting political opposition.

INNOVATION

The 2018 Nuclear Energy Innovation Capabilities Act reassesses the NRC's license streamlining process and encourages innovation in new technologies through partnerships between government and private industry. The act seeks to split licensing fees between industry and government through a grant program designed to spur innovative design.[39] It also created the National Reactor Innovation Center (NRIC) housed at Idaho National Lab, where new technologies can be tested and companies can demonstrate proof of concept for new designs.[40]

PLANNED REACTORS

Ten reactors are under construction and eight have active operating licenses. Two, the Bellefonte Nuclear Power Station Units 1 and 2, had their construction permit issued in 1974 but have been on hold since 1988 pending sale of the site and significant federal legal battles over ownership, sale, and responsibility.[41] The remaining eight projects represent an important test for the future of nuclear power and the NRC's new streamlined license process. Construction permits were issued for two new plants at the Vogtle Power Station in Waynesboro, Georgia in 2012, and the plants are expected to come online in late 2021, suggesting that a 10-year construction period is possible for a new plant.[42] Additional combined operating licenses have been issued for seven new plants, three

36. Hannah Northey, "GAO: Death of Yucca Mountain Caused by Political Maneuvering," *New York Times*, May 10, 2011, https://archive.nytimes.com/www.nytimes.com/gwire/2011/05/10/10greenwire-gao-death-of-yucca-mountain-caused-by-politica-36298.html?pagewanted=all.
37. "Storage of Spent Nuclear Fuel," U.S. Nuclear Regulatory Commission, October 27, 2020, https://www.nrc.gov/waste/spent-fuel-storage.html.
38. Massachusetts Institute of Technology, *The Future of the Nuclear Fuel Cycle, An Interdisciplinary Study* (Cambridge, MA: 2011), 5–9 https://energy.mit.edu/wp-content/uploads/2011/04/MITEI-The-Future-of-the-Nuclear-Fuel-Cycle.pdf.
39. "President Trump Signs Bill to Boost Advanced Nuclear in America," Department of Energy, September 28, 2018, https://www.energy.gov/articles/president-trump-signs-bill-boost-advanced-nuclear-america.
40. Office of Nuclear Energy, "National Reactor Innovation Center," U.S. Department of Energy, August 2019, https://www.energy.gov/sites/prod/files/2019/08/f65/NRIC_Fact_Sheet.pdf.
41. "Commercial Nuclear Power Reactors – Operating Reactors," U.S. Nuclear Regulatory Commission, NRC High-Value Datasets, https://www.nrc.gov/data/.
42. "Southern CEO: Early start-up of Vogtle units possible," World Nuclear News, February 21, 2020, https://www.world-nuclear-news.org/Articles/Early-start-up-of-Vogtle-units-possible-says-South.

companies are in the process of having their designs certified, and one is in the process of securing an early site permit.[43]

CONCLUSIONS

Due to the rapid development of renewable energy technology and historically inexpensive natural gas, confronting the reality of aging U.S. nuclear infrastructure has not been a priority for industry or government. Despite tremendous progress in technology and an increased priority within the NRC to encourage innovation, the cost of building new plants has prohibited significant investment in the replacement of nuclear plants scheduled to decommission. Without policy interventions, the ability to generate nuclear electricity will slowly disappear and be replaced by either coal, natural gas, or renewables such as solar, wind, or hydropower.

Regardless of the future of natural gas prices, availability and reliability of renewable electricity, and the capacity of electricity storage technology, the United States is potentially facing a serious supply reduction in baseline energy over the next few decades.

There is potential to recover the U.S. nuclear infrastructure through rapid investment and efficient rollout. However, history suggests that cheap alternative energy sources, cost-overruns, and complex licensing processes will impede new development. Assuming an (unlikely) average 10-year construction period for a new reactor, the NRC would have to start approving multiple license applications every year in order to check the fall in nuclear energy supply. This in turn would require companies to be submitting applications during an era in which nuclear is economically less attractive than ever.

Moreover, a nuclear resurgence would likely require significant marketing and education campaigns to mobilize public sentiment in the face of almost certain opposition. The specter of the well-known nuclear incidents at Three Mile Island, Chernobyl, and Fukushima loom large over the industry, despite a poor understanding of their relevance to the safety of nuclear power in the United States. Without Americans who are able to recognize the relative risks and benefits of nuclear power as compared to those of fossil fuels, there is little hope that the country will mobilize the political will to advance the industry.

43. "New Reactors," U.S. Nuclear Regulatory Commission, May 18, 2020, https://www.nrc.gov/reactors/new-reactors.html.

Millennials and Nuclear Weapons

Concerned or Complacent?

Amelia Morgan[1]

INTRODUCTION

In January 2020, the International Committee of the Red Cross (ICRC) released findings of a global survey capturing millennial views on various aspects of conflict, including the future of warfare, international humanitarian law, and the methods of war.[2] In their summary report, the ICRC revealed a puzzling finding: while 54 percent of millennials considered a nuclear attack to be likely within the next decade, nuclear weapons were ranked as the least important of 12 global issues. What explains these seemingly confusing, if not contradictory, results?

Drawing on responses across five nuclear weapons states—the United Kingdom, the United States, France, Russia, and Israel—and utilizing previous polling on nuclear issues, this paper explores three interrelated explanations. First, the public has rarely, if ever, ranked nuclear weapons atop their list of concerns. Short of crisis or war, domestic issues supersede international concerns, which rarely punctuate the everyday lives of mass publics. Second, inadequate question phrasing often obscures important nuances in public sentiments on nuclear issues, which serves to exaggerate or downplay important distinctions. Most importantly, however, millennials among nuclear weapons states hold complex views on nuclear weapons. While they harbor deep concerns about the potential effects of nuclear weapons, they are also divided over their perceived utility. This generates a latent concern about nuclear weapons, perhaps even a latent dissatisfaction, but not an overwhelming rejection of the status quo. Millennials would thus be best characterized as ambivalent—both concerned and complacent—about nuclear weapons. Three findings in particular have relevance for policy:

1. Amelia Morgan is a doctoral candidate at King's College London and a research associate at the Centre for Science and Security Studies.

2. "Majority of millennials see catastrophic war as real possibility, and believe there should be limits," International Committee of the Red Cross, January 16, 2020, https://www.icrc.org/en/document/majority-millennials-see-catastrophic-war-real-possibility.

1. Millennial opinions on nuclear weapons are far less consensual than is often portrayed. While cognizant of the risks accompanying nuclear weapons, they are divided over the inherent value of possession. For those in government, this is both a risk and an opportunity. Those interested in maintaining legitimate nuclear arsenals should harness the tacit support that currently exists for nuclear possession through engagement and outreach efforts, or risk ceding the nuclear narrative entirely to those who seek to undermine it.
2. Millennial support for the broad concept of disarmament is consistent with previous polling: it is supported by large majorities across nuclear weapons states. However, support for the Treaty on the Prohibition of Nuclear Weapons (TPNW) receives *less* support among this generation than the abstract concept of nuclear disarmament. This might change over time as awareness of the treaty grows and if public perceptions about the utility of nuclear weapons diminish.
3. Existing public opinion data on nuclear weapons is inadequate, both within and across states. Vague hypothetical questions and individual polls are often taken as reliable indicators of public opinion when they are limited in providing meaningful insights. Without more adequate data, policymakers risk drawing the wrong conclusions about what moves and shapes support for specific policy proposals and miscalculating how public opinion will evolve in response to changing strategic realities.

THE SURVEY: WHAT IT CAN TELL US AND WHY WE SHOULD CARE

The ICRC survey was conducted between October 1–7, 2019, polling 16,288 millennials from 16 countries, including 11 non-nuclear weapons states (Afghanistan, Colombia, Indonesia, Malaysia, Mexico, Nigeria, Palestine, South Africa, Switzerland, Syria, and Ukraine) and five nuclear weapons states (France, Russia, the United Kingdom, the United States, and Israel).[3] Given Israel's policy of deliberate ambiguity, it was surveyed as a non-nuclear weapons state. While there is no universally accepted boundary delineating generational divides, the survey defined millennials as those aged between 20 and 35 and employed a mixed-method design of online panels, face-to-face interviews, and telephone interviews. Under ideal circumstances, data collection methodologies would be consistent across countries, but this can be particularly challenging across diverse states due to a combination of cost, time, security, and logistical constraints.[4]

Any conclusions drawn have obvious limitations: four nuclear weapons states (China, India, Pakistan, and North Korea) were not included in the survey, nor were beneficiaries of extended nuclear deterrence. Nonetheless, cross-country studies polling attitudes on nuclear issues are sporadic, infrequent, and rarely ever include all nuclear possessors or those with extended deterrence arrangements. The regularity and consistency of country-specific surveys also vary significantly across countries. Polling data in the United States, for example, dwarfs that of all nuclear weapons states, making temporal analyses and cross-country comparisons difficult if not impossible to achieve without significant caveats and qualifications. The ICRC survey thus offers a rare opportunity to

3. Sample size by country: Afghanistan: 1,056; Ukraine: 1,001; Colombia: 1,004; Nigeria: 1,053; Israel: 1,000; Palestine: 1,000; Syria: 1,004; Indonesia: 1,099; Malaysia: 1,000; France: 1,001; Russia: 1,000; Switzerland: 1,000; United Kingdom: 1,043; United States: 1,000; Mexico: 1,027; and South Africa: 1,000.
4. More details on the methodology can be found in International Committee of the Red Cross, *Millennials on War* (Geneva: January 2020), 30, https://www.icrc.org/sites/default/files/wysiwyg/campaign/millennials-on-war/icrc-millennials-on-war_full-report.pdf.

explore prevailing sentiments across several nuclear weapons states, identify trends and variations between them, and place the results within broader polling context.[5]

The importance of understanding public opinion on nuclear weapons should not be underestimated. Maintaining popular support for defense policies is a domestic imperative—an essential element of government legitimacy and accountability. Governments can face significant constraints in implementing policy or electoral consequences if policies are not aligned with broad-based public acceptability.[6] There are also clear strategic incentives. Public support underpins the effectiveness and sustainability of defense postures in that it shapes how both adversaries and allies interpret the credibility of threats and commitments, as well as the limits of resolve.[7]

Some may counter that the public is unknowledgeable about nuclear affairs and therefore incapable of enlightened or reasoned judgement on these issues.[8] While opinions based on limited knowledge might be of negligible utility in determining policy, they nonetheless provide valuable insights into how policy should be packaged and sold. This might be particularly important on issues relating to nuclear weapons, where potent narratives can undermine, discredit, and simplify complex strategic choices that often entail competing benefits and trade-offs. It is even more important today, when publics are not simply passive observers of international affairs but exploitable actors. Various efforts to manipulate the social, cultural, and political seams of domestic fabrics should underscore the importance of understanding, anticipating, and responding to public opinion, however uninformed and ill-conceived one believes these opinions to be.

Furthermore, as the largest adult generation globally, millennial views on nuclear issues will assume greater importance in the coming years. Advancing into prominent positions within government, diplomacy, the military, industry, and academia, millennials will inherit the legacy of prior decisions and will be uniquely positioned to chart the direction of the nuclear landscape. With distinct formative experiences, priorities, and values, intergenerational opinion differences are already apparent in areas as diverse as foreign policy, climate change, and economic policy.[9] Understanding how this generation characterizes the utility of nuclear weapons and their role in national security policy is therefore crucial for anticipating and shaping the future trajectory of the global nuclear order. In an age characterized by growing public skepticism on the legitimacy of elite behavior, a better understanding of these sentiments may be more important than ever.

A PERPLEXING PUZZLE?

To recap the puzzle: while 54 percent of respondents thought a nuclear attack was likely within the next decade, nuclear weapons were ranked as the least important of 12 global issues (Tables 1 and 2). The issue was rated as marginally more pressing among respondents from nuclear weapons states than non-nuclear weapons states (30 percent vs. 24 percent), but on aggregate terrorism (54 percent) and global warming (53 percent) trumped their list of concerns. Nuclear weapons states were also marginally less pessimistic about the likelihood of nuclear use than non-nuclear weapons states (50 percent vs. 56

5. One additional point of caution should also be noted at the outset. The ICRC is not an impartial observer on nuclear weapons but advocates for nuclear disarmament, rejects the legality of deterrence, and actively promotes the TPNW. This does not disqualify the survey nor necessarily undermine the results, but it should encourage sensitivity to the objectivity of its questions. This is a cardinal principle of public opinion analysis.
6. Thomas Risse-Kappen, "Public Opinion, Domestic Structure, and Foreign Policy in Liberal Democracies," *World Politics* 43, No.4 (1991): 482–483, doi:10.2307/2010534.
7. Lawrence Freedman, "NATO Myths," *Foreign Policy*, no. 45 (Winter 1981-1982): 48–68, https://www.jstor.org/stable/1148309.
8. Graham Almond, *The American People and Foreign Policy* (New York: Praeger, 1950), 5.
9. "The Generation Gap in American Politics," Pew Research Center, March 1, 2018, https://www.people-press.org/2018/03/01/3-u-s-foreign-policy-and-americas-global-standing-islam-and-violence-nafta/.

percent), but all nuclear possessors apart from France and Israel considered it more likely than unlikely.[10] Three interrelated factors may help to explain these results: (1) the public's prioritization of domestic issues, (2) inadequate question framing, and (3) millennial ambivalence about nuclear weapons.

THE PUBLIC PRIORITIZES DOMESTIC ISSUES

For the early intellectual authorities of public opinion research, these results would not be surprising. While the public are closely attuned to issues that touch their everyday lives, this does not extend to matters of foreign policy, which are typically far removed from the public's experience.[11] Lacking the knowledge and proximity to foreign affairs, so the argument goes, the public is uninformed and indifferent to developments beyond their borders and will therefore naturally opt for issues more tangibly and immediately related to them. This dynamic might be expected to be particularly acute on nuclear weapons issues, where public engagement is either discouraged by elites or inhibited by the technical jargon of weapons systems and strategy.

The distribution of results across nuclear weapons states suggests there is some evidence of this dynamic (Table 3). In the United States, for example, "poor health care" was rated as the most important global issue (56 percent); in Russia, corruption (68 percent); in Israel, terrorism (60 percent); and in the United Kingdom and France, global warming (69 percent and 72 percent, respectively, which might be explained by the climate change protests held across Europe at the time the survey was conducted). While the question refers to *global* issues, respondents on the whole answered through a domestic frame, prioritizing issues affecting their everyday lives or those which are domestically salient.

Table 1: Most Important Global Issues

Q: "Now, thinking about some issues around the world . . . Which of the following do you see as the most important issues affecting people around the world today? Please select all that apply."

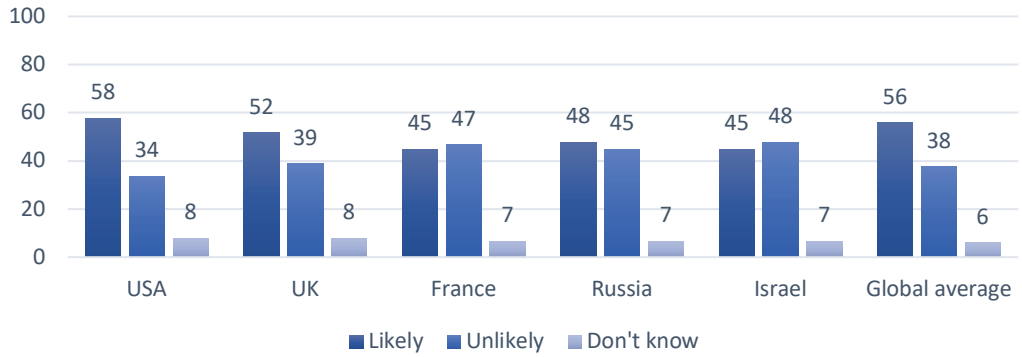
	GLOBAL AVERAGE	*%*	*NWS AVERAGE*	*%*
1.	Corruption	54	Terrorism	54
2.	Unemployment	52	Global warming	53
3.	Increasing poverty	47	Increasing poverty	51
4.	Terrorism	47	Poor health care	50
5.	Wars and armed conflicts	45	Wars and armed conflicts	48
6.	Poor health care	41	Corruption	46
7.	Weak economy	41	Unemployment	41
8.	Global warming	40	Natural disasters	41
9.	Natural disasters	33	Weak economy	36
10.	Poor access to education	32	Poor access to education	35
11.	Increasing migration	27	Nuclear weapons	30
12.	Nuclear weapons	24	Increasing migration	29

Source: International Committee of the Red Cross, *Millennials on War* (Geneva: January 2020), 30, https://www.icrc.org/sites/default/files/wysiwyg/campaign/millennials-on-war/icrc-millennials-on-war_full-report.pdf.

10. All figures are percentages rounded to the nearest 1 percent. Unless otherwise stated, questions with "don't know" or "prefer not to answer" yielding less than 5 percent are not detailed within the results. Instances in which respondents were asked whether they supported or opposed a proposition "somewhat" or "completely" are aggregated.
11. Walter Lippmann, *Public Opinion* (New York: Macmillan, 1992).

Table 2: Likelihood of Nuclear Use in Next 10 Years

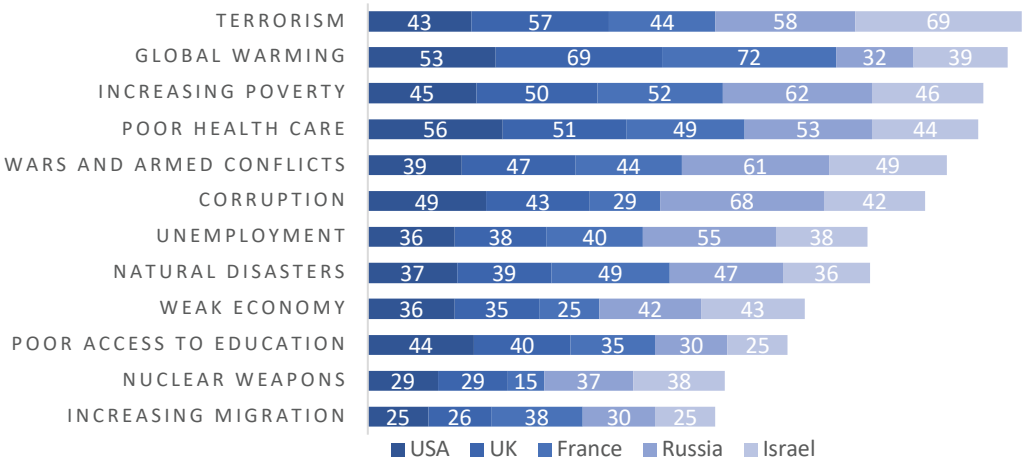
Q: "In your opinion, how likely or unlikely is it that nuclear weapons will be used in wars or armed conflicts anywhere in the world within the next 10 years?"



Source: International Committee of the Red Cross, *Millennials on War*.

Table 3: Most Important Global Issue Among Nuclear Weapons States

Q: "Now, thinking about some issues around the world . . . Which of the following do you see as the most important issues affecting people around the world today? Please select all that apply."



Source: International Committee of the Red Cross, *Millennials on War*.

INADEQUATE QUESTION FRAMING OBSCURES MORE THAN IT CLARIFIES

Another explanation might also be at play. How did respondents characterize the "nuclear weapons" issue? Did they take it to mean nuclear use, nuclear proliferation, the safety and security of nuclear weapons and materials, or perhaps something entirely different? How can one be sure? Each country has its own unique set of threat perceptions, values, priorities, and a host of other factors that will ultimately determine the shape of public sentiments on nuclear weapons. This distinction might have been a crucial determinant in voting patterns.

While this cannot be determined from the survey, one might, for example, presume that Israel's relatively high prioritization of "nuclear weapons" (38 percent) relates to proliferation in the Middle East. This is consistent with national surveys conducted in the country over the years; the Iranian nuclear threat has consistently polled as a serious national security issue, though this declined following the conclusion of the Joint Comprehensive Plan of Action (JCPOA) in 2015.[12] Even at its peak in 2012, however, Israeli concern did not stem from a belief that Iran would attack Israel with nuclear weapons but that Iran would behave more aggressively in the Middle East. Indeed, Israelis exhibited a high degree of confidence in *nuclear* deterrence.[13]

Russia's relatively high prioritization (37 percent), meanwhile, might be related to something else. A July 2019 poll by Russia's state-owned polling organization is suggestive. When asked which countries or organizations "pose a threat for Russia connected with the use of nuclear weapons," 60 percent selected the United States, 13 percent selected China, 6 percent selected "Great Britain," and 6 percent selected "Korea."[14] Concern about the *prospects* of "nuclear war," however, was relatively low, particularly among younger generations: 59 percent of 18- to 34-year-olds were "not personally concerned" about nuclear war, compared to 42 percent aged 35 and above. As such, the ICRC survey result may simply be a methodological artifact: the question is too vague to elicit any meaningful understanding of how respondents understood the "nuclear weapons" issue and is therefore a poor indicator of how they prioritized the problem.

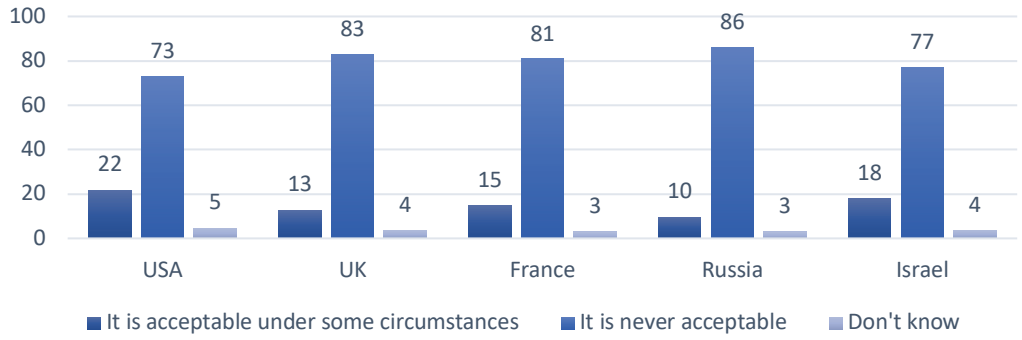
Another example of inadequate question framing can be found in the question relating to nuclear use (Table 4). Asking respondents whether the use of nuclear weapons in wars or armed conflict is acceptable under some circumstances or whether it is never acceptable, the survey question was followed by a problematic lead-in: "*A single nuclear bomb can destroy an entire city*." While factually accurate, outlining one of the associated costs of nuclear use without mentioning the underlying rationale or supposed benefits—such as shortening war and minimizing casualties—primes an unfavorable response. Indeed, other surveys have demonstrated that when presented with more nuanced scenarios and when asked to weigh competing priorities and risks, tolerance for use often increases.[15] Polling data has frequently also demonstrated this, but it is often overlooked. In the United Kingdom, for example, the public has historically demonstrated support for nuclear use in retaliation to a nuclear attack but has generally rejected the first use of nuclear weapons in most cases.[16] Support is also very sensitive to question framing. Take two independent YouGov polls, the first conducted one month after the ICRC survey. 43 percent of respondents thought that "the British Prime Minister should be prepared to authorize the use of nuclear weapons in some circumstances," compared to 38 percent who thought they should not (Table 5A). A second poll, in 2016, which

12. Zipi Israeli, "Survey: Israelis worry most about threats internally and from the north," *Jerusalem Post*, January 27, 2018, https://www.inss.org.il/wp-content/uploads/2018/01/Survey-Israelis-worry-most-about-threats-internally-and-from-the-north-An-article-by-Zipi-Israeli-in-The-Jerusalem-Post.pdf.
13. Yehuda Ben Meir and Olena Bagno-Moldavky, *The Voice of the People: Israeli Public Opinion on National Security 2012* (Tel Aviv: Institute for National Security Studies, 2012), 24, https://www.inss.org.il/wp-content/uploads/systemfiles/memo126e%20(2)410001833.pdf.
14. The English translation on WCIOM's website does not refer to nuclear use, but the Russian version does: "Скажите,пожалуйста, какие из стран, организаций, по Вашему мнению, представляют длявРоссии угрозу, связанную с ис пользованием атомного оружия?" In English: "Please state which countries, organizations, in your opinion, pose a threat for Russia connected with the use of nuclear weapons?" See "Nuclear War: A Real Threat or Myth?," *WCIOM*, August 6, 2019, https://wciom.com/index.php?id=61&uid=1696.
15. Daryl G. Press, Scott D. Sagan, and Benjamin A. Valentino, "Atomic Aversion: Experimental Evidence on Taboos, Traditions, and the Non-Use of Nuclear Weapons," *American Political Science Review* 107, no. 1 (2013): 188–206, doi:10.1017/S0003055412000597.
16. Andy Byrom, "British attitudes on nuclear weapons," *Journal of Public Affairs* 75, no. 1 (2007): 71–77, doi:10.1002/pa.228.

asked whether respondents would support or oppose the United Kingdom using nuclear weapons in response to a nuclear attack recorded even higher support for nuclear use—a stark contrast to the results detailed above (Table 5B). And indeed, clear disparities are apparent across age groups: younger respondents demonstrate greater opposition than older generations.

Table 4: Acceptability of Nuclear Use

Q: "For each of the following weapons, in your opinion, do you think their use in wars or armed conflict is acceptable under some circumstances or is it never acceptable? Nuclear weapons - an atomic bomb which releases large quantities of energy. A single nuclear bomb can destroy an entire city."



Source: International Committee of the Red Cross, *Millennials on War*.

Table 5: British Attitudes toward Nuclear Use

5A: Q: "Do you think a British Prime Minister should or should not be prepared to authorise the use of nuclear weapons in some circumstances?"[17]

NOVEMBER 2019	TOTAL	18-24	25-49	50-64	65+
1. Should we prepared to authorise the use of nuclear weapons in some circumstances	43	29	41	50	45
2. Should not be prepared to authorise the use of nuclear weapons	38	52	39	34	34
3. Don't know	19	19	20	17	21

Source: International Committee of the Red Cross, *Millennials on War*.

17. Sample size: 1,619 adults. "YouGov/The Times Survey Results," YouGov, November 11-12, 2019, https://d25d2506sfb94s.cloudfront.net/cumulus_uploads/document/r183se2eav/TheTimes_Results_Trackers_191112.pdf.

5B: Q: "In the event that Britain came under attack by a foreign country that used nuclear weapons against us, would you support or oppose Britain using nuclear weapons in a counter-attack?"[18]

JULY 2016	TOTAL	18–24	25–49	50–64	65+
1. Would support Britain using nuclear weapons in response to a nuclear attack	60	51	54	63	72
2. Would oppose Britain using nuclear weapons in response to a nuclear attack	21	26	25	18	12
3. Don't know	19	23	20	19	16

Source: International Committee of the Red Cross, *Millennials on War*.

It is unclear in the available English-language sources whether Israel and Russia have been polled on questions related to nuclear use in their respective countries in the recent past. However, historical data also reveals Israeli support for nuclear use in certain circumstances, particularly in response to a nonconventional attack.[19] This is not to suggest that the ICRC survey is an anomaly, nor that the public demonstrate support for nuclear use in any and all circumstances; support is largely confined to few and extreme circumstances. Nonetheless, these results should promote caution in relying on vague hypotheticals and individual polls as reliable indicators of public opinion. More work is clearly required to understand the limits of public opposition toward nuclear use, particularly between generations.

MILLENNIALS ARE AMBIVALENT ABOUT NUCLEAR WEAPONS

The most significant and overlooked explanation for millennial's low prioritization of nuclear weapons, however, is that they are *ambivalent*, both about the perceived value of nuclear weapons and about what should be done about them. Ambivalence should not be confused with indifference, although it is often mistaken for it. It denotes the holding of contradictory views—of competing, conflicting attitudes that can manifest incoherently on complex, polarizing issues. This ambivalence generates a vague apprehension toward nuclear weapons—perhaps even a latent dissatisfaction—but not an overwhelming rejection of the status quo. Nuclear weapons, it seems, are both a benefit and a burden: to be retained in the interim but done away with as soon as possible.

THE RISKS AND UTILITY OF NUCLEAR WEAPONS

Evidence of this ambivalence is not necessarily apparent by analyzing responses to questions in isolation but by comparing responses to multiple questions. Take, for example, those relating to the risks and utility of nuclear weapons. While millennials demonstrated cognizance of the risks accompanying them (large majorities across nuclear weapons states agreed that nuclear weapons "are an existential threat to humanity," Table 6), they exhibited considerable divergence regarding their utility as a deterrent and in making possessor states more/less safe (Tables 7 and 8). Particularly in the United States and the United Kingdom, respondents were divided over the deterrent and security value of nuclear weapons. In France, Russia, and Israel, meanwhile, respondents demonstrated considerably more faith in nuclear deterrence but less so in the contribution of these weapons to their security. Significantly, those who thought nuclear weapons "made no difference"

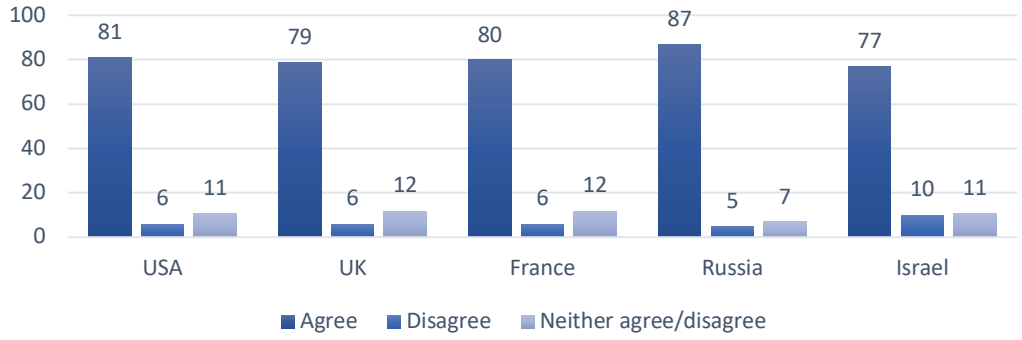
18. Sample size: 1,161 adults. "YouGov Survey Results," YouGov, July 26-27, 2016, https://d25d2506sfb94s.cloudfront.net/cumulus_uploads/document/sdchc0pmmj/InternalResults_160727_Nukes_W.pdf.
19. Asher Arian, "Public Opinion and Nuclear Weapons," *Strategic Assessment* 1, no. 3 (1998): 8–11, https://www.inss.org.il/publication/public-opinion-and-nuclear-weapons/.

were relatively high across all nuclear weapons states. These are not necessarily incompatible views, but they demonstrate a complexity that often gets lost when one views responses in isolation.

Other factors, such as status and prestige, may have inadvertently shaped responses. French elites, for example, have routinely associated nuclear weapons with an independent foreign and defense policy, a sentiment which, absent significant political debate, is likely shared by the French electorate.[20] Through weapons parades and evocative speeches, President Putin regularly exploits Russia's nuclear arsenal to generate domestic legitimacy and consolidate his grip on power. These efforts appear to have been relatively successful: "military might, including nuclear weapons" has consistently ranked as important criteria for great power status in Russian polling.[21]

Table 6: Nuclear Weapons as an Existential Threat to Humanity

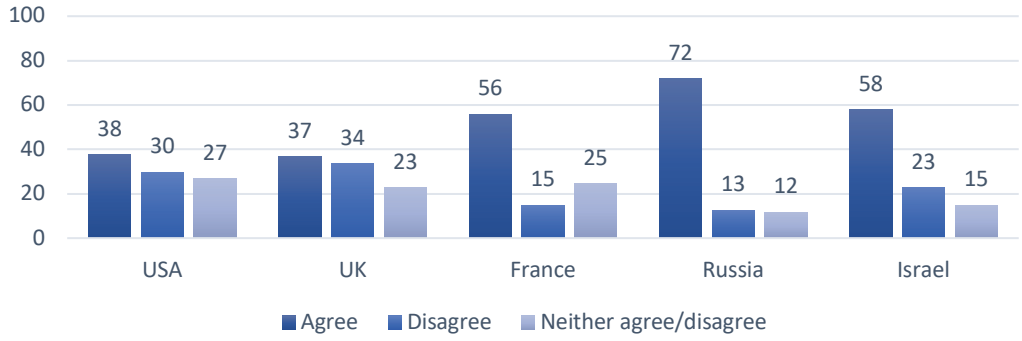
Q: "To what extent do you agree or disagree with the following statements . . . Nuclear weapons are an existential threat to humanity."



Source: International Committee of the Red Cross, *Millennials on War*.

Table 7: The Effectiveness of Nuclear Deterrence

Q: "To what extent do you agree or disagree with the following statements . . . Nuclear weapons are an effective instrument of deterrence."

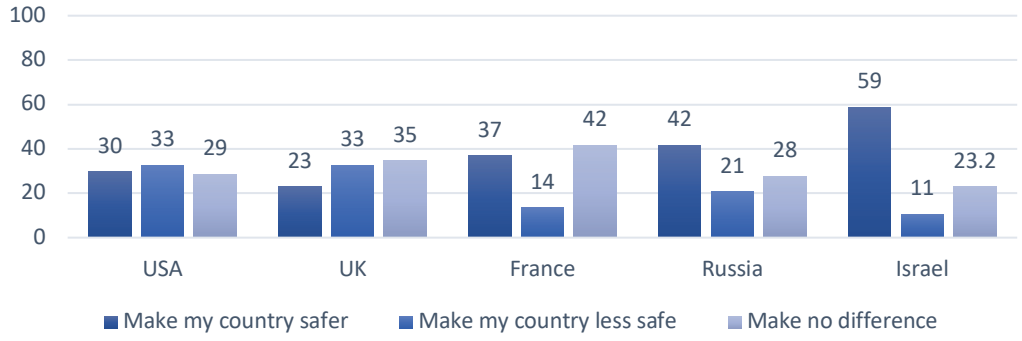


Source: International Committee of the Red Cross, *Millennials on War*.

20. Bruno Tertrais, "French Perspectives on Nuclear Weapons and Nuclear Disarmament," in *Unblocking the Road to Zero, ed. Barry Blechman* (Washington, DC: Stimson Center, 2009), 14–15, https://www.stimson.org/project/unblocking-the-road-to-zero/#:~:text=Project%20Info,viable%20and%20practical%20policy%20option.
21. Levada Analytical Center, *Russian Public Opinion 2018* (Moscow: 2018), https://www.levada.ru/cp/wp-content/uploads/2019/07/2018-Eng.pdf.

Table 8: The Security Value of Nuclear Weapons

Q: "To what extent do you agree or disagree with the following statements . . . Nuclear weapons by my country make my country less/more safe."[22]



Source: International Committee of the Red Cross, *Millennials on War*.

DISARMAMENT OR RETENTION?

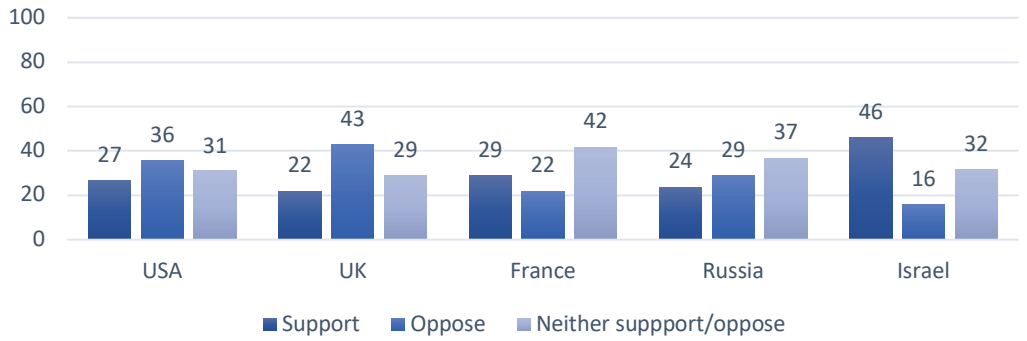
Ambivalence is also evidenced in response to questions relating to disarmament and retention. While a plurality agreed that "countries which have nuclear weapons should eliminate them," this did not neatly translate into opposition toward nuclear retention (Tables 9 and 10).[23] All nuclear weapons states were, on balance, *divided* over whether they would support their country retaining their nuclear arsenals. Those who would "neither support nor oppose" were again particularly high, averaging 34 percent. This passivity is significant, for it suggests that, at least in the short term, millennial appetite for a revision of status quo policies is limited. While support for disarmament is high and aligns with previous polling, which consistently indicates public support for the concept of nuclear reductions, these results suggest that there is more complexity to their views than these questions allow.[24] At the very least, it would be simplistic to characterize them as an explicit mandate to renounce nuclear arsenals.

That being said, there is a discernible trend. Those countries more skeptical of nuclear weapons providing security (the United States and United Kingdom) were *more* inclined to support disarmament and oppose retention, while those countries more inclined to perceive nuclear weapons as enhancing their security (France and Russia) are *less* inclined to support disarmament and oppose retention (and, in Israel's case, oppose development of nuclear weapons). How this translates across generations cannot be determined by this survey, but it may suggest that public preferences around nuclear weapons are partly shaped by perceptions of their utility in the prevailing security environment. If this is the case, governments interested in maintaining legitimate nuclear arsenals might have more to gain by explaining these benefits to their domestic audiences as opposed to avoiding public discussion altogether.

22. Respondents in Israel were asked the question prospectively: "To what extent do you agree or disagree with the following statements . . . Nuclear weapons by my country would make my country less/more safe."
23. Support for disarmament was particularly high in the United Kingdom, where public debate around Trident renewal has subject the country's nuclear arsenal to significant popular scrutiny.
24. "Publics around the World Favor International Agreement To Eliminate All Nuclear Weapons," World Public Opinion, December 9, 2008, http://worldpublicopinion.net/publics-around-the-world-favor-international-agreement-to-eliminate-all-nuclear-weapons/.

Table 9: Retaining Nuclear Weapons

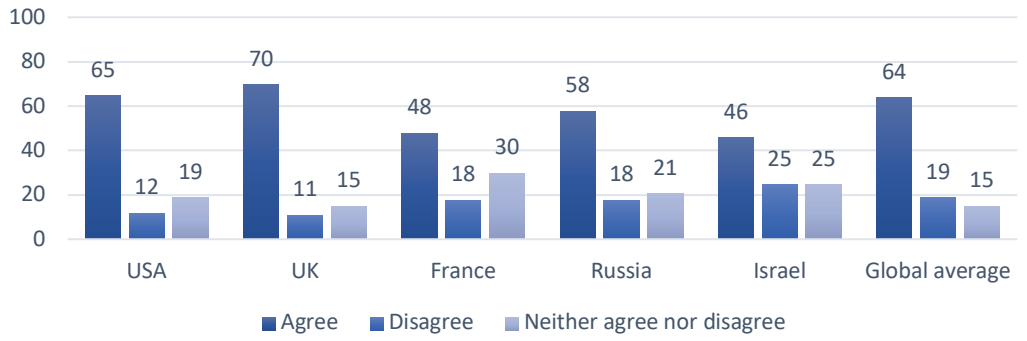
Q: "Would you support or oppose [RESPONDENT'S COUNTRY] to keep their nuclear weapons?"[25]



Source: International Committee of the Red Cross, *Millennials on War*.

Table 10: Disarmament

Q: "To what extent do you agree or disagree with the following statements? Countries which have nuclear weapons should eliminate them."



Source: International Committee of the Red Cross, *Millennials on War*.

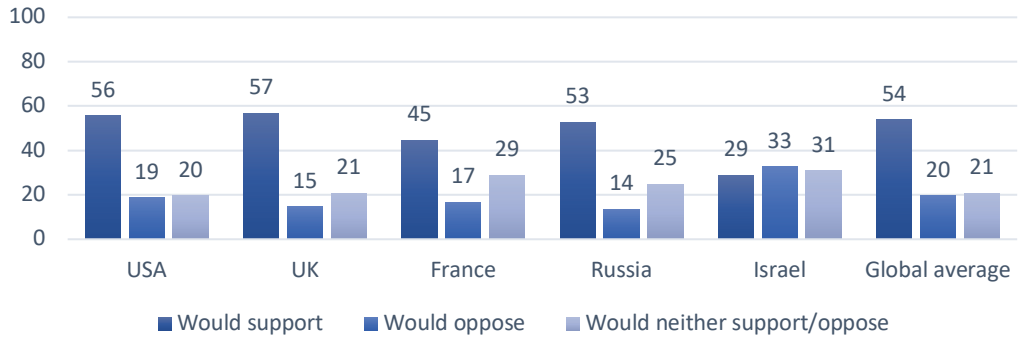
Two additional data points are also of note. First, awareness of the TPNW was only 37 percent among the whole sample and fluctuated significantly among nuclear weapons states (29 percent in France; 31 percent in the United Kingdom; 38 percent in the United States; 49 percent in Israel; and 55 percent in Russia). Paradoxically, awareness was highest in Russia, which is generally considered to be the country among this sample least susceptible to civil society messaging and pressure. On one hand, awareness of the TPNW might appear relatively high. Having only opened for signature in September 2017, the treaty is still relatively new, has not yet entered into force, and relates to a niche area of international affairs compared to other more salient policy issues or those attracting greater public interest, such as trade and the environment. On the other hand, awareness could be viewed as relatively low, especially given the broad array of pro-ban activities directly targeting the public, including financial divestment campaigns, city appeals, and parliamentary pledges, not to mention the Nobel Peace Prize for the International Campaign to Abolish Nuclear Weapons (ICAN).

25. Respondents in Israel were asked: "Would you support or oppose Israel in developing nuclear weapons?"

Second, support for the TPNW was lower in every country than for the abstract concept of elimination (Table 11). Lack of awareness might have played an important role in this result, but unfortunately the underlying data set did not isolate the responses for those who said they had heard of the treaty. But given that the survey offered some information about the main tenets of the treaty without mentioning any of the controversy surrounding it ("Countries that join this kind of international agreement commit to not using, possessing or developing nuclear weapons"), one might ask if this drop in support might have something to do with the conditions under which the public would support disarmament.

Table 11: Joining the TPNW

Q: "Countries that join the Nuclear Weapon Ban commit to not using, possessing or developing nuclear weapons. Would you support or oppose [COUNTRY] in joining this kind of agreement?"



Source: International Committee of the Red Cross, *Millennials on War*.

Previous polling on nuclear disarmament demonstrates that the effectiveness of verification, perceptions of power imbalances, reciprocity, and trust have to varying degrees swayed support for specific disarmament proposals. This is especially true in the United Kingdom, for example, where support for disarmament has historically been high but contingent on a multilateral approach with other states.[26] The same can also be said of the United States, where support for specific arms control initiatives has been qualified by reciprocity, adequate verification measures, and perceptions of the trustworthiness of the Soviet Union/Russia to live up to agreements. Appetite for disarmament in Israel, meanwhile, has never been strong. Israelis overwhelmingly endorse a policy of nuclear ambiguity, a Middle East Nuclear Weapons Free Zone has only ever received minor support from the public, and this sentiment remains even when faced with a scenario in which Iran acquires a nuclear capability.[27]

Recent polls on the TPNW in France, commissioned by anti-nuclear and religious groups, have recorded high levels of support for the treaty (74 percent in 2015; 67 percent in 2018).[28] Unfortunately, however, these questions are often framed problematically, thus undermining

26. Byrom, "British attitudes on nuclear weapons," 72. See also "Scots split on support for nuclear weapons in Britain," Ipsos MORI, February 9, 2019, https://www.ipsos.com/ipsos-mori/en-uk/scots-split-support-nuclear-weapons-britain.
27. Meir and Bagno-Moldavky, *The Voice of the People*, 25–26
28. "Les Français et l'interdiction et l'élimination complète des armes nucléaires," IFPOP, October 2015, https://www.ifop.com/wp-content/uploads/2018/03/3176-1-study_file.pdf; and Laurent de Boissieu, "Les Français contre le nucléaire militarie," *La Croix*, July 4, 2018, https://www.la-croix.com/France/Securite/Francais-contre-nucleaire-militaire-2018-07-04-1200952564. La Croix did not publish the questionnaires and codebooks.

the integrity of the results.[29] Take a 2015 poll administered by the French commercial polling organization Institut français d'opinion publique (IFPOP). Before asking respondents whether they want France to "negotiate and ratify with all the states concerned a treaty to ban and completely eliminate nuclear weapons, under strict and effective mutual and international control," the questionnaire employs a litany of anti-nuclear statements, some of which are (mis)leading, such as that nuclear use is a violation of international law and is a crime against humanity; that France is obliged under the Non-Proliferation Treaty to negotiate the complete elimination of nuclear weapons; or by selectively referring to the "unanimous" 1996 International Court of Justice opinion regarding good faith effort towards disarmament.[30] Another survey, commissioned by ICAN on NATO host states, is equally problematic in its bias.[31]

The strategic rationale behind designing surveys this way is obvious, particularly for those in advocacy, but one might ask whether this approach is fruitful, or ultimately counterproductive. Crafting surveys that are deliberately leading and biased do not gain their desired influence among policymakers and for good reason: the data is poor, and any conclusions drawn are tenuous and contestable. Instead of designing questions to conform with existing positions, efforts would be better served by constructing objective questionaries that interrogate the inconsistencies highlighted above. This approach might seem unappealing, but it may yield valuable benefits. By understanding the dynamics of public opinion on nuclear weapons more fully—through identifying what moves and shapes support and opposition for specific policy options—these groups would be better attuned in their public messaging and engagement. In a recent article, Matt Korda asked how to get people to *care* about nuclear weapons.[32] A first step would be to undertake an intellectually honest effort to understand what people really think about them and how the public approach this policy issue relative to other pressing concerns. One could go further and suggest that this should be a fundamental priority for those who "represent the people."

CONCLUSION

Perhaps the most important lesson to draw from this analysis is that the public has often held complex views on nuclear weapons, which is arguably symptomatic of the issues and the gravity of the stakes involved. Support for disarmament, for example, has often existed in tandem with support for nuclear retention and, in certain circumstances, nuclear use. Some publics have historically believed nuclear deterrence works but still think nuclear use is likely. In many ways, these results are not incoherent but reasonable responses to a complex and polarizing issue. Experts have debated the utility of nuclear deterrence, the impact of nuclear weapons on international stability, and how best to manage them since the beginning of the nuclear age, and there is anything but consensus on the answers. To expect more decisive and uniform perspectives from the public is not only unwise, but unrealistic and misguided.

29. Furthermore, while 74 percent supported the TPNW, there are clear disparities between age groups: 77 percent of those aged between 35 and 65+ supported the treaty, compared with 64 percent of those aged between 18 and 34.
30. For a legal analysis of nuclear deterrence and the International Court of Justice 1996 opinion, see Newell L. Highsmith, *On the Legality of Nuclear Deterrence* (Livermore, CA: Lawrence Livermore National Laboratory Center for Global Security Research, April 2019), Livermore Papers on Global Security No. 6, https://cgsr.llnl.gov/content/assets/docs/CGSR_LivermorePaper6.pdf.
31. "One Year on: European Attitudes toward the Treaty on the Prohibition of Nuclear Weapons, a YouGov Poll of Four NATO States," International Campaign to Abolish Nuclear Weapons, www.icanw.org/wp-content/uploads/2018/07/YouGov_ICAN_EU-NATOTPNW2018.pdf.
32. Matt Korda, "Do Young People Care About Nuclear Weapons?," Instick, February 27, 2020, https://inkstickmedia.com/do-young-people-care-about-nuclear-weapons/.

This raises an uncomfortable question for both advocates and critics of nuclear weapons. How should one respond to, or seek to shape, a public that is at best ambivalent about these weapons? Nuclear critics, particularly those advocating for nuclear disarmament, may determine that these results justify their cause: the overwhelming majority of global respondents favor disarmament. But this conclusion is simplistic, ignores ample evidence to the contrary, and overlooks crucial facts: that millennials are *divided*, not wholly opposed to, the perceived benefits of nuclear weapons and that some see an inherent value in possession. This should encourage pause, especially from those who claim to speak for the public on these matters.

Advocates of nuclear weapons, particularly those in government, might also find solace in these findings, and it may be that rising international tensions, concerns about global instability, and tacit acceptance of the status quo will preclude any significant anti-nuclear scrutiny or mobilization. It is equally possible, however, that as the world emerges from the Covid-19 pandemic, the public will take a critical eye to government spending, especially on endeavors that do not materially enhance public well-being and question the value of maintaining a nuclear capability in a world more acutely sensitive to the basic requirements of human security. Avoiding public engagement on nuclear issues may not only be more difficult to sustain over the long term but prove self-defeating; absent deterrence education and outreach efforts, future governments could become more susceptible to disarmament pressure.

While by no means a comprehensive review of public sentiments across nuclear weapons states, this analysis highlights the inadequacies of superficially reviewing responses to individual surveys and underscores the importance of seriously interrogating the form, phrasing, and broader public polling context of nuclear issues. Nuclear discourse is plagued with untested assumptions and beliefs about public sentiments and reliance on vague, abstract surveys, which are often taken as authoritative when they tell us little, if anything, about the conditionality or durability of these attitudes. In the worst cases, polls are cherry-picked or designed to advance political agendas or defend a theoretical position. Yet, one poll, as demonstrated above, rarely tells the entire story. In failing to scrutinize public opinion data more thoroughly, it is possible to risk reducing public sentiments to unhelpful, if not misguided, binaries, robbing public attitudes of any complexity. A more serious interpretation would find that the public is both concerned *and* complacent about nuclear weapons. The question that policymakers and others in the nuclear field should be asking is why.

No First Nukes

Replacing the U.S. Nuclear First Strike Mission with Non-Nuclear Hypersonic Weapons

Ruby Russell[1]

INTRODUCTION

The 2020 U.S. presidential primary debates generated renewed public interest in a long deliberated question within the nuclear weapons landscape: should the United States declare a no-first-use (NFU) nuclear policy? The question over whether the United States should explicitly commit never to use nuclear weapons first in any conflict—including in response to a chemical, biological, cyber, or conventional attack—has been debated by more than one U.S. administration and was considered most seriously under President Barack Obama. While ultimately electing to stay with the traditional posture of "ambiguity" rather than adopt an NFU policy, through the 2010 *Nuclear Posture Review* (NPR) President Obama committed the United States to "work to establish conditions under which such a policy could safely be adopted."[2] But what are those conditions exactly and how might they be established?

Parallel to renewed debates on NFU is the advancement and pursuit by the United States of non-nuclear hypersonic weapons (HSWs). These highly maneuverable systems are unique in their ability to traverse unpredictable flight paths at speeds far greater than Mach 5, or five times the speed of sound. With no existing anti-missile system capable of intercepting projectiles maneuvering at such speeds, these weapons have the potential to provide the United States with the ability to hold hostage strategic targets thousands of miles away and to execute a devastating conventional

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2. U.S. Department of Defense (DOD), Nuclear Posture Review (Washington, DC: February 2018), 22, https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF; and DOD, Nuclear Posture Review Report (Washington, DC: April 2010), xii, https://dod.defense.gov/Portals/1/features/defenseReviews/NPR/2010_Nuclear_Posture_Review_Report.pdf.

attack within minutes.[3] Could the advent of highly maneuverable HSWs help bring about the very conditions outlined in the 2010 NPR, wherein non-nuclear strategic systems play a meaningful role in strategic deterrence? Can the unique qualities of modern non-nuclear HSWs adequately replicate the strategic goals envisioned for U.S. nuclear weapons in a first-strike scenario, allowing the United States to finally declare a nuclear policy of NFU?

This study examines the role of nuclear first-strike options in the U.S. deterrence strategy and explores whether non-nuclear HSWs, supplemented with additional measures to bolster extended deterrence, are sufficient to carry out the United States' current first-use mission. Additionally, this study assesses the potential normative benefits of adopting an NFU policy, including raising U.S. moral credibility within the nuclear nonproliferation and disarmament arena and increasing U.S. bargaining power to negotiate verifiable arms control treaties with Russia and China.

FIRST-USE AND DETERRENCE

In order to assess the merits of an NFU policy, it is critical to understand the strategic purpose behind maintaining a first-use nuclear option in the first place. What role does retaining the right to use nuclear weapons first play in the U.S. deterrence strategy and how does it manifest itself? Can first-use be characterized as a physical capability or is it merely an intent? An examination of these questions will help establish a basis upon which to explore whether the nuclear first-use option can be replicated with a non-nuclear alternative. However, before proceeding, it is important to note that while twenty-first century concepts of deterrence have expanded to include considerations of non-military force such as cyber weapons, this work will focus on *nuclear* deterrence—defined as "the belief that nuclear weapons are so devastating that nuclear strikes must be avoided at almost any cost."[4] With this definition in mind, how does first-use fit into nuclear deterrence?

Notably, the phrase "first-use" is rarely used to characterize current U.S. nuclear policy. Instead, the United States often refers to maintaining a policy of "ambiguity" in regard to the circumstances under which it would actually employ nuclear weapons, including in a first-strike scenario.[5] Given that U.S. declaratory policy on the matter is literally defined by ambiguity, nailing down the underlying strategic purpose and the actual manifestation of first-use proves challenging. That said, an examination of official U.S. policy documents including NPRs as well as the works of government experts leads to at least three primary purposes of a "first-use" nuclear option.

1. A FACET OF BROADER NUCLEAR DETERRENCE

In an elusive effort to outline the circumstances under which nuclear weapons might be employed, the 2018 NPR states that the United States "would only consider the employment of nuclear weapons in extreme circumstances to defend the vital interests of the United States, its allies, and partners. Extreme circumstances could include significant non-nuclear strategic attacks."[6] In an only slightly more specific statement, the 2010 NPR states "there remains a narrow range of contingencies in which U.S. nuclear weapons may still play a role in deterring a conventional or CBW attack against

3. Pagie P. Cone et al., *Assessing the Influence of HSWHSWs on Deterrence* (Maxwell Air Force Base, Alabama: Air Force, June 2019), 59, https://media.defense.gov/2019/Sep/25/2002187108/-1/-1/0/59HYPERSONICWEAPONS.PDF; Steven Simon, "Hypersonic Missiles Are a Game Changer," *New York Times*, January 2, 2020, https://www.nytimes.com/2020/01/02/opinion/hypersonic-missiles.html; and Kris Osborn, "HSWHSWs: Everything you Need to Know About the Ultimate Weapon," National Interest, July 22, 2017, https://nationalinterest.org/blog/the-buzz/hypersonic-weapons-everything-you-need-know-about-the-21637.
4. Cone et al., *Assessing the Influence of HSWHSWs on Deterrence*, 9.
5. DOD, Nuclear Posture Review, 2018, 22.
6. Ibid., 21.

the United States or its allies and partners."[7] In either case, there is no explicit reference to first-use but rather a description of the role of nuclear weapons in *deterring* non-nuclear threats. Such language could be characterized as retention of a first-use option—if an adversary attacks the United States with conventional weapons or non-nuclear weapons of mass destruction (WMDs), it should expect a possible nuclear response (i.e., first-use).

The approach laid out in the 2010 and 2018 NPRs appear to focus on the need to retain the intent or option to use nuclear weapons in response to certain non-nuclear threats in order to bolster deterrence. Under this logic, "[s]trategic planners for nuclear weapons powers see the credible threat of the first-use of nuclear weapons as a powerful deterrent against a range of significant nonnuclear threats."[8] This line of thinking parallels opponents of NFU, who argue that in the absence of retaining a first-use option, "would-be aggressors . . . do not have to fear U.S. nuclear retaliation as long as they attack us or our allies with advanced conventional, chemical, and/or biological weapons."[9] Again, the underlying assumption is that U.S. nuclear weapons are critical to deterring *nuclear* and *non-nuclear aggression*.[10]

But is the intent to use nuclear weapons first really irrevocably intertwined with successful deterrence? Can U.S. nuclear deterrence still function if the intent is not to use nuclear weapons first but rather a non-nuclear alternative such as an HSW capable of destroying an adversary's strategic assets?[11] Could the threat to employ non-nuclear HSWs in response to a non-nuclear attack prove more credible than the nuclear alternative? In her work, Therese Delpech points to the widespread assumption that "nuclear deterrence is not credible unless the actual use of nuclear weapons is contemplated."[12] This assumption, she argues, generates "little perceived difference between a doctrine of deterrence and a doctrine of actual use. This leads to the belief that nuclear deterrence is inseparable from a doctrine of use, when in fact the purpose of deterrence is to prevent use."[13]

If the role of nuclear weapons was circumscribed to deterring adversary nuclear use, where any contemplation of use is limited to response to nuclear attack (or what the 2010 NPR refers to as "sole purpose"), how would U.S. deterrence be impacted and how might it adapt?[14] Is there room for a non-nuclear supplement? From Delpech's perspective, "the relationship between nuclear and conventional weapons is evolving rapidly, and new forms of deterrence are appearing, including those involving the offense-defense balance."[15] Similar thinking is prevalent throughout the 2010 NPR, which states, "[a]s the role of nuclear weapons is reduced in U.S. national security strategy . . . non-nuclear elements will take on a greater share of the deterrence burden."[16]

Although superseded by the 2018 NPR, the 2010 NPR is not an outlier in suggesting that conventional weapons could play a meaningful role in strategic deterrence. In 2005, then commander

7. DOD, Nuclear Posture Review, 2010.
8. Ankit Panda, "No first-use' and Nuclear Weapons," Council on Foreign Relations, July 17, 2018, https://www.cfr.org/backgrounder/no-first-use-and-nuclear-weapons.
9. Keith B. Payne, "Once Again: Why a 'No First-use' Nuclear Policy is a Very Bad Idea," *National Review*, July 6, 2016, https://www.nationalreview.com/2016/07/no-first-use-nuclear/.
10. DOD, Nuclear Posture Review, 2018, vi.
11. Cone et al., *Assessing the Influence of HSWHSWs on Deterrence*, 46.
12. Therese Delpech, *Nuclear Deterrence in the 21st Century* (Santa Monica, CA: RAND Corporation, 2012), 12, https://www.rand.org/content/dam/rand/pubs/monographs/2012/RAND_MG1103.pdf.
13. Ibid., 12.
14. DOD, *Nuclear Posture Review Report*, 2010, 16.
15. Ibid., 5.
16. DOD, *Nuclear Posture Review Report*, 2010, xiii.

of the U.S. Strategic Command (STRATCOM) General James Cartwright testified before the Senate Armed Services Committee that "by replacing some nuclear weapons with conventional weapons in the U.S. strategic war plan the United States might be able to further reduce its reliance on, and, therefore, its number of deployed strategic nuclear weapons."[17] A 2009 congressional commission report led by William Perry and James R. Schlesinger acknowledges that nuclear posture is "not the only element of the U.S. strategic military posture, which also includes . . . non-nuclear means of strategic strike."[18] This thinking applies to extended deterrence as well. In 2016, then secretary of defense Ash Carter stated the United States was "refreshing NATO's nuclear playbook to better integrate conventional and nuclear deterrence."[19]

The above statements make clear that turning to non-nuclear means as a facet of U.S. strategic deterrence is not out of the realm of possibility and continues to be seriously contemplated at the highest levels of government. Thus, even in the absence of the *intent* to use nuclear weapons first, successful deterrence may be possible through the deployment of and threat to use alternative non-nuclear capabilities. However, the question of whether the *right* conventional weapons exist to fill the role intended for nuclear weapons in a first strike, in this case deterring an adversary's non-nuclear attack, has always underlined the debate. This essay will consider whether non-nuclear HSWs are in fact the "right" weapon.

2. DISARMING FIRST STRIKE

A second strategic goal historically envisioned for a nuclear first strike was preemptive disarming or debilitation of an enemy's strategic forces. While this is not a stated goal of U.S. nuclear policy today, an examination of a 1962 declassified briefing by the Chairman of the Joint Chiefs of Staff (JCS) to President John F. Kennedy on the Single Integrated Operational Plan (SIOP) suggests that during the Cold War, a disarming first strike against the Soviet Union was among the top priorities of U.S. strategic war planners.

During this briefing, the JCS chairman explained that the SIOP "provid[ed] for the optimum employment of the US atomic delivery forces in the initial attack of strategic targets in the Sino-Soviet Bloc."[20] The 1962 SIOP was "designed for execution as a whole" and could be executed either "in retaliation to a Soviet nuclear strike of the US" or, notably, "as a preemptive measure."[21] Furthermore, the 1962 SIOP aimed to meet two objectives under either scenario: "a. To destroy or neutralize Sino-Soviet Bloc strategic nuclear delivery capability primary military and government controls of major importance;" and "b. To attack the major urban-industrial centers of the Sino-Soviet Bloc."[22] These objectives provide a small insight into the goals imagined for U.S. nuclear first strike during the Cold War.

17. Amy F. Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles: Background and Issues Objectives of Prompt Global Strike (PGS)*, CRS Report No. R41464 (Washington, DC: Congressional Research Service, February 2020), 9, https://fas.org/sgp/crs/nuke/R41464.pdf.
18. William J. Perry and James R. Schlesinger, *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington, DC: United States Institute of Peace Press, 2009), 5, https://www.usip.org/sites/default/files/America's_Strategic_Posture_Auth_Ed_0.pdf.
19. Vincent A. Manzo and Aaron R. Miles, "The Logic of Integrating Conventional and Nuclear Planning," Arms Control Today, November 2016, https://www.armscontrol.org/act/2016-10/features/logic-integrating-conventional-nuclear-planning.
20. Scott D. Sagan, "SIOP-62: The Nuclear War Plan Briefing to President Kennedy," *International Security* 12, no. 1 (Summer 1987), 41, https://www.belfercenter.org/sites/default/files/legacy/files/CMC50/ScottSaganSIOP62TheNuclearWarPlanBriefingtoPresidentKennedyInternationalSecurity.pdf. See also Steven L. Rearden, *Council of War: A History of the Joint Chiefs of Staff 1942-1991* (Washington, DC: Joint History Office, 2012), https://www.jcs.mil/Portals/36/Documents/History/Institutional/Council_of_War.pdf.
21. Ibid., 49–50.
22. Sagan, "SIOP-62," 43–44.

In another work examining the impact of HSWs on deterrence, Lieutenant Colonel Nathan Terry discusses the first-strike option in the context of "deterrence by denial," or "removing 'strategic options' from the adversary."[23] Under this strategy, according to Terry, a first strike "successfully destroys or disables the adversary's entire ICBM force."[24] Considering the potential objectives outlined above for a first strike, the question remains: could non-nuclear HSWs perform the role of a nuclear first strike, "destroy[ing] or neutraliz[ing]" an adversary's strategic delivery capabilities to the same extent nuclear weapons could? The answer is likely not. However, if a critical number of sites could be held hostage, would that be enough? Could a first strike carried out by non-nuclear HSWs cause enough damage to an adversary's strategic sites to deter or prevent retaliation, especially if backed by the threat of a second-strike nuclear deterrent? This question will be further explored in the section on HSWs.

3. EXTENDED DETERRENCE

Perhaps the most important issue to consider in examining the role of the nuclear first-strike option in U.S. deterrence strategy is extended deterrence. According to the 2009 Congressional Commission on the Strategic Posture of the United States, "U.S. nuclear posture must be designed to address a very broad set of U.S. objectives, including not just deterrence of enemies in time of crisis and war but also assurance of our allies and dissuasion of potential adversaries."[25] By providing a reliable extended deterrent, the United States not only aims to dissuade adversaries from attacking allies or U.S. forces in allied territory but also to dissuade allies from developing their own domestic nuclear weapons programs, thereby stemming further nuclear proliferation.

Both the 2010 and 2018 NPRs are explicit in their assessment of the important role U.S. nuclear weapons have played in extended deterrence. According to the 2010 NPR, "U.S. nuclear weapons have played an essential role in extending deterrence to U.S. allies and partners against nuclear attacks or nuclear-backed coercion by states in their region that possess or are seeking nuclear weapons."[26] Taking it a step further, the 2018 NPR argues "conventional forces alone do not adequately assure many allies and partners. Rather, these states place enormous value on U.S. extended nuclear deterrence."[27]

While neither document disputes the right of the United States to respond in kind to a nuclear attack on an ally, the 2010 NPR flirts with the question of whether responding to a non-nuclear attack on an ally truly requires a nuclear response. As the 2010 NPR hints at, under the right conditions in the post-Cold War era, there may be room for restructuring the concept of extended deterrence. Under this restructuring, nuclear weapons would play the "sole purpose" of deterring a nuclear weapons attack and be bolstered by conventional forces which may be employed in response to a non-nuclear attack on allies. An extended deterrent structured in this manner could in theory create the conditions under which the United States might declare an NFU policy.

To better understand the current U.S. position on the link between NFU and extended deterrence and whether there is room for this position to evolve, it is helpful to look at the genesis of U.S. extended nuclear deterrence during the Cold War. As both advocates and opponents of NFU will attest, the early years of the Cold War were defined by stark disparities between the West's recovering post-WWII forces and the Soviet Union's superior conventional capabilities. Following the 1948 Berlin Crisis specifically, it became "clear that the Soviet Union was aggressive and the United States would

23. Cone et al., *Assessing the Influence of HSWHSWs on Deterrence*, 9.
24. Ibid., 15.
25. Perry and Schlesinger, *America's Strategic Posture*, xvii.
26. DOD, Nuclear Posture Review Report, 2010, xii.
27. DOD, Nuclear Posture Review, 2018, 17.

be unable to stop it through conventional means alone."[28] The United States therefore "adopted a policy of using nuclear weapons to deter or respond to a Soviet invasion of Europe," which included a promise "to respond to any Soviet attack with immediate and massive nuclear retaliation."[29] In advancing this policy, the United States aimed to assure allies in Europe while also discouraging them from pursuing nuclear weapons themselves.[30]

Such thinking led to the establishment of first-use as "a cornerstone of the defensive posture of the North Atlantic Treaty Organization (NATO)."[31] This posture persists today, manifest in NATO's "flexible response" policy, which "allows the alliance to be the first to introduce nuclear weapons into a conflict, including in reply to an attack with conventional weapons."[32] In addition to its European allies, the United States also extends deterrence to allies in East Asia and the Middle East, including South Korea and Japan, to "deter major nonnuclear threats against them."[33]

While the threat of U.S. nuclear first-use as a component of the extended deterrence commitment to NATO allies during the Cold War may have been prudent, it is less clear whether such thinking remains applicable in the twenty-first century. As the 2010 NPR consents, in a post-Cold War world, the "advent of U.S. conventional military preeminence" has fostered in a new strategic environment in which the role of U.S. nuclear weapons in "deterring non-nuclear attacks . . . has declined significantly."[34] Experts advising Congress have reached similar conclusions, acknowledging that "the challenge of deterring Soviet and Warsaw Pact conventional attack obviously disappeared."[35]

Such statements are of course a decade old and fail to account for an evolved strategic environment in which China has continued to qualitatively and quantitatively improve its conventional and nuclear forces and Russia has carried out serious conventional offensives, including the invasion of Georgia in 2008 and the illegal annexation of Crimea in 2014. Even so, continued U.S. military dominance in the post-Cold War environment cannot be discounted. Furthermore, while not NATO members themselves, the invasions of Georgia and Ukraine occurred despite continued deployment of NATO nuclear forces in neighboring countries, potentially calling into question the effectiveness of these nuclear forces in deterring conventional attack in the region.

Beyond European allies, many view the threat of first-use via extended deterrence as essential to assuring allies such as Japan and South Korea, as well as for minimizing incentives to pursue nuclear programs of their own.[36] But the credibility of this first-use threat in response to a non-nuclear attack on an ally remains questionable. As Bernard Brodie, the father of deterrence, asked, "[w]e may be quite sure we will hit back if hit directly ourselves, but will we do so if any of our chief allies is attacked or threatened to attack?"[37]

28. Steve Fetter and Jon Wolfsthal, "No First-use and Credible Deterrence," *Journal for Peace and Nuclear Disarmament* 1, no. 1 (April 2018), doi:10.1080/25751654.2018.1454257.
29. Ibid.
30. Perry and Schlesinger, *America's Strategic Posture*, 4.
31. Panda, "No first-use' and Nuclear Weapons."
32. Jack Mendelsohn "NATO's Nuclear Weapons: The Rationale for 'No First-use'," Arms Control Association, https://www.arms-control.org/act/1999-07/features/natos-nuclear-weapons-rationale-first-use.
33. Panda, "No first-use' and Nuclear Weapons."
34. DOD, Nuclear Posture Review Report, 2010, viii–ix.
35. Perry and Schlesinger, *America's Strategic Posture*, 5.
36. DOD, Nuclear Posture Review, 2018, 70.
37. Bernard Brodie, *The Anatomy of Deterrence* (Santa Monica, CA: RAND Corporation, 1958), 27, https://www.rand.org/pubs/research_memoranda/RM2218.html.

Diving deeper into this question of credibility, Steve Fetter and Jon Wolfsthal examine scenarios in which allies such as Japan might expect the United States to use nuclear weapons in their defense, including in response to conventional attacks by North Korea. The authors conclude that there is no plausible scenario in which nuclear weapons would be expected or needed to be used to meaningfully retaliate against a non-nuclear attack by North Korea. They go on to argue, "if the United States and Japan do not believe that it would make sense to use nuclear weapons first, the threat to do so cannot be a credible deterrent to nonnuclear aggression by North Korea."[38] Furthermore, "making incredible threats weakens the credibility of other commitments. Abandoning incredible threats should make the remaining nuclear use scenarios, and therefore deterrence, more credible."[39]

In bolstering their argument for the success of extended deterrence, opponents of NFU often point to nuclear threats the United States reportedly made during the Gulf War in response to concerns Saddam Hussein might employ chemical weapons. At the time, "Iraq seemed to understand that the threats of retaliation included nuclear weapons. This had an effect on its behavior during Operation Desert Storm, even if the U.S. message was more a bluff than the expression of precisely planned war operations."[40] In the early 1990s, it is possible that threats of nuclear first-use may have been the United States' best option. Looking ahead two decades to the 2010 NPR, however, in this post-Cold War world the United States "continues[s] to strengthen conventional capabilities and reduce the role of nuclear weapons in deterring non-nuclear attacks."[41] As confidence in non-nuclear deterrent alternatives builds and reliable non-nuclear first-strike options diversify, it will be increasingly difficult to justify nuclear fist use in the extended deterrent context.

It should be made clear here that eliminating the nuclear first-strike option from NATO doctrine and U.S. extended deterrence more broadly does not eliminate the nuclear second-strike option nor alter NATO's identity as a nuclear alliance but rather reserves nuclear retaliation for response to a nuclear attack alone. Even still, if the United States forgoes the option of employing nuclear weapons in response to non-nuclear attack, deterrence must be bolstered in some other way. Here, the question must be asked: is there a credible non-nuclear supplement to nuclear deterrence? Specifically, are non-nuclear HSWs capable of replicating the contemporary strategic goals envisioned for U.S. nuclear weapons in a first strike, and therefore of becoming a viable replacement?

HYPERSONIC WEAPONS (HSWS): A SOLUTION TO THE NFU PROBLEM?

Often defined as vehicles or weapons systems capable of travelling faster than Mach 5, hypersonic systems have existed in the U.S. arsenal for decades, including in the form of intercontinental ballistic missile systems (ICBMs).[42] However, advancements in technology have allowed for the onset of highly-maneuverable HSWs, which "combine the maneuverability and accuracy of cruise missiles with the long range and speed of ICBMs."[43] While many are still in the developmental stages, modern hypersonic systems are being designed to travel up to 25,000 kilometers per hour, or between one

38. Fetter and Wolfsthal, "No First-use and Credible Deterrence."
39. Ibid.
40. Delpeche, *Nuclear Deterrence in the 21st Century*, 3.
41. DOD, Nuclear Posture Review Report, 2010, viii–ix.
42. Cone et al., *Assessing the Influence of HSWHSWs on Deterrence*, 59.
43. Ibid., 5.

and five miles per second.[44] Critically, these advanced systems can also be "maneuvered in ways that confound existing methods of defense and detection."[45]

While an ICBM traditionally travels along a predictable parabolic arch, modern HSWs are designed to "fly at unusual altitudes – between a few tens of kilometers and 100 kilometers."[46] According to a study by R. Jeffrey Smith, this lower altitude flight path makes it "roughly 10 to 20 times harder to detect an incoming ballistic missile," such that from the adversary's perspective, the HSW's potential landing zone might appear to be "about as big as Rhode Island."[47] Notably, according to Smith, these weapons fly below altitudes easily detectable by U.S. ballistic missile interceptors, including the Aegis and THAAD systems.[48]

In addition to their unique combination of speed and maneuverability, HSWs may be developed to deliver either nuclear or conventional payloads. While Russia has already introduced the nuclear Avangard hypersonic glide vehicle into its arsenal and China is also reportedly pursuing nuclear-capable hypersonic systems, the United States has notably chosen to focus development efforts on non-nuclear HSWs.[49] Current systems under U.S. development include hypersonic boost-glide vehicles and hypersonic cruise missiles. While the former relies on a conventional missile to "boost" the weapon into a low-altitude hypersonic trajectory, the latter is powered by air-breathing "scram jet" engines which use "shock waves created by [their] speed to compress incoming air in a short funnel and ignite it while passing by."[50]

The logic for pursuing the non-nuclear path becomes clearer upon considering the sheer kinetic impact delivered by a system travelling at hypersonic speeds. According to Smith, conventional HSWs "function like nearly invisible power drills that smash holes in their targets, to catastrophic effect."[51] In his work on hypersonic boost-glide weapons, James Acton compares the top U.S. penetrator weapon, the GBU-57, or Massive Ordinance Penetrator, to a hypothetical boost-glide penetrator weapon. Based on the metrics of the U.S. Hypersonic Technology Vehicle-2, first tested in 2010, Acton estimates a hypersonic boost-glide penetrator could "penetrate more deeply than the Massive Ordnance Penetrator by a factor of 1.5 ± 0.4."[52] Finally, Air Force Chief Scientist Geoffrey Zacharias states that HSWs "have great kinetic energy to get through hardened targets."[53] In fact, in light of their "sheer speed and force," HSWs can be engineered to rely on kinetic energy alone, absent of conventional payloads all together.[54]

Given their capacity to undermine defense systems and kinetic potential, could HSWs play a meaningful role in the U.S. strategic deterrent? As Smith asks, could conventional HSWs "undertake a task long imagined for nuclear arms: a first strike against another nation's government or arsenals, interrupting key chains of communication and disabling some of its retaliatory forces, *all without*

44. Ibid., 59.
45. R. Jeffery Smith, "Hypersonic Missiles are Unstoppable. And they're Starting a New Global Arms Race," *New York Times Magazine*, June 2019, https://www.nytimes.com/2019/06/19/magazine/hypersonic-missiles.html.
46. Cone et al., *Assessing the Influence of HSWHSWs on Deterrence*, 63–64.
47. Smith, "Hypersonic Missiles are Unstoppable."
48. Ibid.
49. Ibid.; and Cone et al., *Assessing the Influence of HSWHSWs on Deterrence*, 1.
50. Smith, "Hypersonic Missiles are Unstoppable"; and Cone et al., *Assessing the Influence of HSWHSWs on Deterrence*, 39.
51. Smith, "Hypersonic Missiles are Unstoppable."
52. James M. Acton, "Supplement to Hypersonic Boost-Glide Weapons," *Science and Global Security* 23, no. 3 (2015), 7, doi:10.1080/08929882.2015.1087242.
53. Osborn, "HSWHSWs."
54. Ibid.

the radioactive fallout and special condemnation that might accompany the detonation of nuclear warheads"?[55] The following sections will examine this question through the lenses of the three possible roles envisioned for a nuclear first strike.

1. A FACET OF BROADER NUCLEAR DETERRENCE

As noted earlier, one goal envisioned for retaining a nuclear first-strike option might include bolstering U.S. deterrence against both nuclear and non-nuclear attacks. If would-be aggressors believe the United States does not maintain the *intent* to use nuclear weapons in response to non-nuclear attacks, they may not be deterred from carrying out a non-nuclear strike. But what if that intent to use was no longer based in a nuclear deterrent but rather in a non-nuclear, precision-guided HSW capable of undermining defense systems and smashing through hardened strategic targets?

The idea of integrating conventional systems into the broader U.S. deterrent strategy is not a new one and has been considered seriously by multiple U.S. administrations over the last two decades. These considerations present themselves most clearly within promotion of Conventional Prompt Global Strike (PGS), a system designed "to maintain and enhance its long-range strike capability so that it can strike anywhere in the world with forces that are based in or near the United States."[56] Within the context of this program, General James Cartwright testified to Congress in 2005 about the potential for the United States to develop a "New Triad Concept," which "joined long-range nuclear-armed missiles with precision-strike conventional weapons in a category called offensive strike weapons."[57] During the testimony, General Cartwright and others suggested that "if missiles could deliver their payloads more precisely to their targets, then, for some categories of targets, they may not need the explosive yield of a nuclear weapon to destroy the target."[58] However, Cartwright emphasized at the time that "the substitution of conventional warheads for nuclear warheads in the U.S. war plan would require significant improvements in the accuracy of U.S. long-range ballistic missiles."[59]

Nearly two decades later, it seems possible that the advent of highly maneuverable, precision-guided HSWs could finally carry out the mission envisioned by General Cartwright, wherein non-nuclear systems play a meaningful role within the broader U.S. strategic deterrent. Consider here a U.S. nuclear deterrent "tipped" by a conventional first-use system capable of travelling at hypersonic velocities while also maneuvering in flight, allowing for the "[bypassing of] modern layered missile defenses" and ability to strike targets with greater precision. Does this capability sufficiently fulfill the role designed for nuclear-armed ICBMs in a first strike? Would intent or threat to use such a capability effectively deter an adversary from launching a WMD or conventional strike on the United States?

In terms of delivering the ability to wreak havoc on first-strike point targets (e.g., a silo, command center, or bunker), especially in a scenario in which the United States is responding to a non-nuclear attack, it seems possible that non-nuclear HSWs could fill this role. However, the question remains as to whether conventional HSWs could deliver the same "psychological effects associated with nuclear weapons," a key facet of nuclear deterrence.[60] While there would be no threat of nuclear fallout, a key psychological effect of nuclear weapons, it could be argued that the intent to use a conventional system in response to a non-nuclear attack, paired with the second-strike nuclear option (fallout and

55. Ibid (Emphasis added).
56. Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles*, 3.
57. Ibid., 8.
58. Ibid., 9.
59. Ibid., 9.
60. Ibid., 9.

all), would be viewed by adversaries as more credible than the first-use of a nuclear weapon. Keeping in mind this non-nuclear first strike would be backed by the threat of a nuclear second strike, the enemy might be sufficiently deterred from launching a non-nuclear attack on the United States. If the enemy were to consider nuclear escalation, all the psychological effects of nuclear weapons would be back in play as part of a nuclear second strike. In this case, it seems possible the United States could retain a robust strategic deterrent while also declaring a nuclear NFU policy.

2. DISARMING FIRST STRIKE

While it seems possible conventional HSWs could be capable of fulfilling the role the nuclear first-strike option plays in bolstering the broader U.S. deterrent, it is less clear whether these systems could truly carry out a disarming first strike on a strategic adversary such as Russia. This is largely due to the fact that nuclear weapons can undoubtedly deliver more explosive power than any conventional system. It is therefore important to briefly consider the true kinetic impact of HSWs relative to nuclear weapons.

There are varying estimates on the potential kinetic impact a HSW can deliver alone, absent of explosives. According to Smith, for example, the "missiles' kinetic energy *at the time of impact*, at speeds of at least 1,150 miles per hour [between Mach 1-2], makes them powerful enough to penetrate any building material or armored plating with the force of three to four tons of TNT."[61] A RAND study estimates that a 500 kg mass travelling at Mach 8 can deliver the equivalent of around 3.5 metric tons of TNT.[62] Notably, of the two hypersonic systems currently under U.S. development, one is being designed to "fly at speeds between Mach 15 and Mach 20, or more than 11,400 miles per hour," presumably allowing for a higher kinetic impact, all without a conventional explosive payload.[63] Even still, four tons of TNT (or even 400 tons) is nothing close to the equivalent of what even the earliest nuclear weapons could deliver. Little Boy for example, the novel gun-type device dropped on Hiroshima in 1945, carried the equivalent of 15,000 tons of TNT.[64] But is that really the type of punch the United States would seek to deliver in a nuclear first strike in the post-Cold War era?

In discussing the need for survivable and flexible nuclear forces, the 2018 NPR states that the U.S. nuclear triad is designed to provide "multiple options to deter effectively and respond as necessary to different threats and circumstances."[65] In this context, three attributes are listed which appear particularly relevant to a first-strike scenario:

1. **Accurate Delivery:** "The precision needed to hold adversary assets at risk while minimizing unintended effects";
2. **Penetrating:** "The capacity to counter active and passive defenses, including hardened and buried facilities, to pose credible deterrent threats and achieve military objectives with high confidence"; and
3. **Diverse and Graduated Options:** The ability to provide "the spectrum of yield options, weapon types, and delivery options necessary to support the most effective tailoring of strategies across a range of adversaries and contingencies."[66]

61. Smith, "Hypersonic Missiles are Unstoppable"; and Simon, "Hypersonic Missiles Are a Game Changer."
62. 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), 13, https://www.rand.org/pubs/research_reports/RR2137.html.
63. Ibid.
64. "Little Boy and Fat Man," Atomic Heritage Foundation, July 23, 2014, https://www.atomicheritage.org/history/little-boy-and-fat-man.
65. DOD, Nuclear Posture Review, 2018, 42.
66. DOD, Nuclear Posture Review, 2018, 44.

It seems possible that non-nuclear HSWs could sufficiently satisfy all three of these criteria. For example, the accuracy of hypersonic systems combined with their speed arguably places them within the "Accurate Delivery" category, especially considering the minimal collateral damage ("unintended effects") delivered by a hypersonic system relative to a nuclear one. Furthermore, in addition to being designed to penetrate buried defenses, a key defining factor of HSWs is their potential to evade existing missile defense systems, both elements of "Penetrating." Finally, conventional HSWs would help diversify the option set for "effective tailoring of strategies," providing war planners and the president with a zero-yield choice.

On the impact front, despite not being able to deliver the same amount of energy as a nuclear system, non-nuclear HSWs still may be able to take out a significant number of strategic sites in a first-strike scenario. For example, a study by industry analysts estimated that "between 10% and 30% of existing targets" in the U.S. war plan could be attacked with conventional weapons."[67] This estimate was made in 2005 in reference to PGS, prior to the advent of highly maneuverable HSWs, which, given their advanced features, might be capable of destroying an even higher percentage of targets. Even still, back in 2005 the PGS program aimed to provide the United States a "leading edge capability that degraded an opponent's defenses," including "ballistic missiles or caches of [WMD]," thereby allowing the United States to "destroy these weapons before an adversary could use them."[68] According to Acton, the "United States has stated explicitly that [conventional] PGS weapons could be acquired to target nuclear-armed ballistic missiles in North Korea and, perhaps in the future, Iran."[69] Such conventional missions appear comparable to those envisioned for a nuclear first strike.

While not fully disarming, it seems clear that the United States would be able to pack a punch with non-nuclear hypersonic systems in a first-strike scenario, all without resorting to nuclear war.[70] And notably, U.S. war planners have contemplated such a strategy in the past with arguably less advanced conventional systems. In the end, a damaging non-nuclear option might present a more optimal strategic scenario, not only equipping the United States with the ability to take out enemy strategic sites while keeping a conflict below the nuclear threshold but also preserving valuable nuclear assets if the conflict should escalate. Again, in this context it may be possible to forego the nuclear first-strike option for an NFU policy tipped by non-nuclear HSWs.

3. EXTENDED DETERRENCE

As discussed earlier, advocates for a U.S. NFU policy often face the greatest opposition in two areas: (1) the policy's potential to undermine extended deterrence assurances; and, as a result, (2) the ensuing domino effect of nuclear weapons development among allies. In addition, allies' historical discomfort with U.S. deliberations over adopting an NFU policy cannot be ignored. In fact, allies such as South Korea, Japan, the United Kingdom, and France reportedly conveyed their concerns to President Obama when his administration was considering adopting an NFU policy in 2016.[71]

67. Elaine M. Grossman, "U.S. General: Precise Long-Range Missiles may Enable Big Nuclear Cuts," *Inside the Pentagon* 21, no. 17 (April 2005), https://www.jstor.org/stable/insipent.21.17.02.
68. Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles*, 6.
69. Acton, "Supplement to Hypersonic Boost-Glide Weapons," 10.
70. For more on how advances in accuracy and remote sensing technologies are eroding the survivability of nuclear arsenals, thereby improving the potential of successfully eliminating hardened nuclear targets in an attempted disarming strike, see: 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), 9–14, https://www.belfercenter.org/publication/new-era-counterforce-technological-change-and-future-nuclear-deterrence.
71. Josh Rogin, "U.S. allies unite to block Obama's nuclear 'legacy'," *Washington Post*, August 14, 2016, https://www.washingtonpost.com/opinions/global-opinions/allies-unite-to-block-an-obama-legacy/2016/08/14/cdb8d8e4-60b9-11e6-8e45-

However, the question of credibility remains: would the United States actually employ nuclear weapons in response to a non-nuclear attack on allies? As many point out, while such a threat might be credible for deterring attack on the homeland, in the overseas context "it runs the risk of appearing as a hollow bluff to allies and adversaries alike."[72] The integration of non-nuclear strategic forces into the U.S. extended deterrent could help close this credibility gap. Specifically, it seems possible that the use of non-nuclear HSWs, capable of evading defense systems and penetrating strategic targets all at hypersonic speeds, could serve as a more credible, and therefore meaningful, extended deterrent.

In order to understand how conventional HSWs might function as a valuable extended deterrent for U.S. allies, it is important to consider how such weapons might be deployed. In fact, many point to HSWs as providing an excellent "standoff capability," where the sheer speed of these weapons provides "the ability to hold distant, time-critical, highly defended, fleeting targets at risk."[73] In discussing the Alternate Re-Entry System, an HSW under the Army's development capable of being launched from bombers, Navy vessels, and the Army's land launchers, Sydney Freedberg compares the versatile weapons system to a "sort of new non-nuclear triad." In fact, according to Pentagon R&D officials, the United States has "land-, sea- and air-based prototyping that will be done" for HSWs.[74]

What does this mean for allies? These incredibly fast, accurate, and destructive systems could be deployed nearly anywhere in the world, from land, sea, or air. The United States could assure allies that this versatile non-nuclear system flying as fast as five miles per second would be capable of destroying enemy strategic targets within minutes, or even seconds, depending on how closely they were deployed to targets. Additionally, according to Brad Roberts, former deputy assistant secretary of defense for nuclear and missile defense, allowing allies such as Japan to maintain conventional strike systems capable of defeating adversary anti-access/area denial strategies could play a meaningful role "in reducing the confidence of enemy leaders that they could strike Japan or U.S. forces in Japan without the risk of a strong Japanese response," thereby bolstering deterrence.[75] On paper, the destructive and precision-based potential of non-nuclear HSWs, combined with a possibly more credible threat of use as compared to nuclear first-use, might provide a satisfactory alternative for allies. But is it enough?

Both the 2010 and 2018 NPRs support negative security assurances as part of U.S. nuclear declaratory policy, wherein the United States commits "not to use or threaten to use nuclear weapons against non-nuclear weapons states that are party to the NPT [Treaty on the Non-Proliferation of Nuclear Weapons] and in compliance with their nuclear non-proliferation obligations."[76] But what about an additional explicit positive security assurance, under which the United States commits bilaterally with allies such as Japan or South Korea to respond to a nuclear attack on their soil with nuclear weapons? Such a commitment in writing might serve to reinforce and therefore reassure allies of the unambiguous and continued U.S. commitment to extend its nuclear deterrent to prevent nuclear warfare while also extending a new, non-nuclear hypersonic deterrent against non-nuclear

477372e89d78_story.html.
72. Manzo and Miles, "The Logic of Integrating Conventional and Nuclear Planning."
73. Osborn, "HSWHSWs"; and James Acton, *Silver Bullet? Asking the Right Questions about Conventional Prompt Global Strike* (Washington, DC: Carnegie Endowment for Peace, 2013), 21, https://carnegieendowment.org/files/cpgs.pdf.
74. Acton, *Silver Bullet?*
75. Taketsugu Sato, "INTERVIEW/ Brad Roberts: Conventional strike capability by Japan good for deterrence," *Asahi Shimbun*, April 5, 2020, http://www.asahi.com/ajw/articles/13240064.
76. DOD, Nuclear Posture Review, 2018, 18.

attacks. Under these conditions, it may be possible for the United States to declare a policy of NFU while also assuring allies and discouraging them from pursuing their own nuclear programs.

NORMATIVE CURRENCY: THE BENEFITS OF DECLARING A POLICY OF NFU

While thus far this work has focused on the possibility of replicating a nuclear first-use mission with non-nuclear HSWs, it has yet to consider the possible benefits associated with adopting a nuclear NFU policy. Is it possible that by adopting an NFU policy the United States could enhance its national security by raising its moral credibility among international peers, providing it with the normative currency to increase its bargaining power in the nuclear nonproliferation and disarmament arena?

The 2010 NPR states that "[b]y reducing the role and numbers of U.S. nuclear weapons we can put ourselves in a much stronger position to persuade our NPT partners to join with us in adopting the measures needed to reinvigorate the non-proliferation regime and secure nuclear materials worldwide."[77] Since the 1995 NPT Review and Extension Conference, the United States has continued to struggle to convince Non-Nuclear Weapon States (NNWS) of the meaningful steps it has taken toward meeting its Article VI disarmament obligations. If the United States were to adopt an NFU policy, replacing its nuclear first-use mission with non-nuclear HSWs, it could demonstrate progress toward nuclear disarmament by reducing the role of nuclear weapons in its national security strategy all while creating new strategic options for defending the homeland. This in turn could provide it with additional moral credibility or what this study calls "normative currency" to bargain for the adoption of stronger nonproliferation measures to meaningfully curb the spread of nuclear technology to bad actors.

In addition to bolstering U.S. moral credibility among NPT member states, adopting an NFU policy could also help improve allies' standing within the NPT fora and their own civil societies well known for opposition to nuclear weapons. In Japan, for example, the government's nuclear nonproliferation and disarmament policy is grounded in its 1968 "Three Non-Nuclear Principles," under which it "pledges not to manufacture, possess, or permit the introduction of nuclear weapons onto Japanese soil."[78] However, the principles come with a major caveat: reliance on the extended U.S. nuclear deterrent. By offering an alternative form of extended deterrence to allies, the United States could bolster arguments for the non-nuclear option by pointing to the moral credibility allies could gain within their domestic constituencies and at the United Nations. With Japan in particular, the United States could be offering the opportunity for Tokyo to finally be the true champion of global nuclear disarmament.

Finally, adoption of an NFU policy could serve as a bargaining chip to bring nuclear powers such as China and Russia to the table to negotiate new verifiable arms control agreements. While a top criticism of NFU is the inability to verify its implementation, a U.S. willingness to adopt NFU after so many years of opposition could help bolster the global norm that nuclear weapons are reserved solely for deterring nuclear attack. Such a move could generate value in the eyes of certain nuclear powers, mollifying growing resistance to negotiating verifiable nuclear arms reductions.

As the original advocate of NFU, China has continued to maintain the policy since its first nuclear test in 1964.[79] According to China's 2019 Defense White Paper, "China is always committed to a

77. DOD, Nuclear Posture Review Report, 2010, v–vi.
78. "Japan: Nuclear," Nuclear Threat Initiative, Last Updated October 2018, https://www.nti.org/learn/countries/japan/nuclear/.
79. Panda, "No first-use' and Nuclear Weapons."

nuclear policy of no first-use of nuclear weapons at any time and under any circumstances, and not using or threatening to use nuclear weapons against non-nuclear-weapon states or nuclear-weapon-free zones unconditionally."[80] Furthermore, in a testament to the value China places on NFU, it has long advocated other nuclear states declare NFU policies as well, going so far as to call on NWS to negotiate a "Treaty on Mutual No-First-Use of Nuclear Weapons."[81] While the Russian record on NFU is not nearly as robust as China's, the Soviet Union did maintain an NFU pledge between 1982 and 1991, and the Russian Federation between 1992 and 1993.[82] Notably, however, many argue that the NFU pledge was never viewed as credible and instead served as "a propaganda move aimed at the antinuclear movements in the West, and not as a credible policy."[83] Even still, the decision to take the pledge suggests the Soviet Union and the Russian Federation saw some normative value in maintaining an NFU policy, even if just to buy credibility among Western antinuclear groups.

Given the value China in particular has placed on NFU, it seems possible that a U.S. move to declare an NFU policy could entice China to the arms control negotiating table. If the United States were to back China's mutual NFU treaty, would China consider discussions to limit or control its nuclear cache, something it is historically reticent to pursue while the United States and Russia maintain much larger strategic stockpiles? And if China expressed an interest in coming to the table to discuss limits on strategic weapons, would Russia be more willing to back U.S. efforts to secure a trilateral U.S.-Russia-China arms control treaty? While declarations of NFU are not necessarily verifiable, such a pledge by the United States could serve as a catalyst for the negotiation of truly verifiable treaties.

THE DOWNSIDE: HYPERSONIC "FALLOUT"

While highly maneuverable conventional HSWs do not deliver the lethal radioactive fallout associated with nuclear weapons, they do come with a type of fallout of their own: major concerns over stability, crisis management, and unintended conflict escalation. As Smith points out, the development of such technologies "threatens to outpace any real discussion about the potential perils of such weapons, including how they may disrupt efforts to avoid accidental conflict, especially during crises."[84]

Examining the potential instability affiliated with the introduction of modern HSW systems, conventional or nuclear, into the U.S. or any other country's arsenal is not the focus of this work. In part, this is because there is already a host of literature on this topic.[85] Furthermore, this work focuses on the potential to replicate and replace a mission already associated with instability and crisis escalation—the first-use of nuclear weapons. However, it is important to briefly consider the impact negative perceptions of HSWs might have on any potential normative currency to be gained with elevating them to the first-use mission.

As noted above, many point to the potential for HSWs to introduce a dangerous degree of volatility into strategic stability. As Smith highlights, experts fear that highly maneuverable HSWs will induce a "new arms race," threatening to "upend existing norms of deterrence and renew Cold War-era

80. State Council Information Office of the People's Republic of China, *China's National Defense in the New Era* (Beijing, July 2019), 10, http://www.xinhuanet.com/english/2019-07/24/c_138253389.htm.
81. Cheng Jingye, "Statement by H.E.Mr.Cheng Jingye," Permanent Mission of the People's Republic of China to United Nations and other International Organizations in Vienna, April 30, 2012, 4.
82. Panda, "No first-use' and Nuclear Weapons."
83. Serge Schmemann, "Russia Drops Pledge of No First-use of Atom Arms," *New York Times*, November 4, 1993, https://www.nytimes.com/1993/11/04/world/russia-drops-pledge-of-no-first-use-of-atom-arms.html.
84. Ibid.
85. See, for example, Cone et al., A*ssessing the Influence of HSWHSWs on Deterrence*; and Acton, *Silver Bullet?*

tensions."[86] The point is a fair one. If an adversary detects the launch of a foreign missile headed in its direction, but has no way of tracking or intercepting it due to its hypersonic speed and unpredictable flight pattern, what is to stop that adversary from launching all its strategic assets at once, for fear of losing them in a potential nuclear strike? Is it possible for the United States to dispel such perceived notions of instability?

First, as argued in this work, any such deployments would be underpinned by the declaration of a nuclear NFU policy, in theory reducing the chances of nuclear use and thereby enhancing strategic stability. Thus, while it is true HSWs might bring a new set of stability issues, this major step forward on the nuclear front could not be discounted and may buy enough normative currency in NPT fora to outweigh the loss incurred through deployment of non-nuclear hypersonics. The United States might also consider offering transparency measures at potential launch locations of non-nuclear HSWs, indicating to would-be adversaries that a launch detected from a specific location is a non-nuclear HSW, and not a nuclear one.

Second, Russia has already introduced a nuclear-armed HSW into its arsenal (the Avangard) without major ramifications for strategic stability. Furthermore, with many countries already reportedly pursuing their own HSW systems, widespread hypersonic deployment is likely inevitable.[87] This evidence is not meant to oppose multilateral efforts to develop norms and rules surrounding the deployment, use, and transparency of hypersonic systems but rather to illustrate that the United States may be facing a limited window of opportunity in which to elevate and incorporate these non-nuclear systems into its strategic plan before new restrictions are developed, thereby opening the opportunity to declare a policy of nuclear NFU.

CONCLUSION

This work has sought to assess the potential impact of advancements in non-nuclear HSWs on the United States' long-held opposition to adopting a nuclear NFU policy. Specifically, it has examined whether non-nuclear HSWs can adequately replicate the strategic goals envisioned for U.S. nuclear weapons in a first-strike scenario, allowing the United States to finally declare a nuclear policy of NFU.

Beginning by laying out the fundamental strategic purposes of maintaining a nuclear first-strike option—including to bolster broader deterrence, to maintain the ability to launch a disarming first strike, and to extend deterrence to allies—this work tested these strategic goals against the advanced capabilities of highly maneuverable non-nuclear HSWs, capable of evading anti-missile systems and accurately penetrating deeply buried targets at hypersonic speeds. While they may not pack the same punch as a nuclear warhead, through examinations of the 2010 and 2018 NPRs this work has shown the potential for non-nuclear HSWs to sufficiently meet twenty-first century expectations for a first-strike scenario, all without the nuclear fallout. Furthermore, this work argues that as confidence in non-nuclear deterrent alternatives builds and reliable non-nuclear first-strike options diversify, it will be increasingly difficult to justify nuclear fist use, especially in the extended deterrent context.

In addition to assessing the potential for non-nuclear HSWs to carry out the goals envisioned for a nuclear first-use mission, this work also examined whether the United States could enhance its national security by declaring a policy of NFU, raising its moral credibility among international peers and providing it with the normative currency to increase its bargaining power in the nonproliferation

86. Smith, "Hypersonic Missiles are Unstoppable."
87. Cone et al., *Assessing the Influence of HSWHSWs on Deterrence*, 36.

and disarmament arena. By offering an alternative conventional first-strike deterrent backed by nuclear second-strike positive security assurances, it seems possible the United States could extend a more credible and politically palatable deterrent to allies while creating incentives for nuclear powers such as China to come to the arms control negotiating table.

Admittedly, this work does not thoroughly examine the potential instability affiliated with the introduction of modern HSW systems into the U.S. arsenal or any other country's arsenal. It also concedes that any normative currency gained though adoption of an NFU policy could be compromised by negative views affiliated with the uncertainties surrounding HSWs. However, as noted above, the purpose of this work is to assess the potential to replicate and replace a mission already associated with instability and crisis escalation—the first-use of nuclear weapons. Furthermore, in addition to the potential for a U.S. NFU declaration to establish a greater degree of global strategic stability, the United States could also offer a set of transparency measures to help dispel uncertainties and perceptions of instability associated with HSWs.

Through an examination of strategic warfare, HSWs, and the equity of norms, this work has sought to demonstrate the potential for highly maneuverable non-nuclear HSWs to adequately carry out the strategic goals envisioned for a nuclear first-strike mission, finally creating the conditions under which non-nuclear weapons can play a meaningful role in strategic deterrence and allowing the United States to declare a policy of nuclear NFU.

The Testing Moratorium

Is the United States Falling Behind?

Stephan A. Varga[1]

ABSTRACT

After conducting over 1,000 nuclear tests, the United States enacted a testing moratorium in 1992. Since then, the United States has relied on its Stockpile Stewardship Program (SSP) to maintain the safety and reliability of its nuclear arsenal. For over 25 years, this program has used extensive scientific innovation to guarantee the U.S. nuclear deterrent works. However, this program fundamentally relies on non-nuclear test results to create modeling and simulations. Ultimately, the national labs certify the U.S. nuclear deterrent based on scientific judgment. Meanwhile, the international security environment has degraded since 1992. There are alarming concerns about Russia's new nuclear capabilities and Russian investment in its nonstrategic nuclear stockpile. North Korea demonstrated not only the capability to produce thermonuclear weapons but also the capability to strike the continental United States. Without nuclear testing, the burdens placed on stockpile stewardship increase each year. Eventually, the United States will require actual data which the stockpile stewardship program cannot provide.

INTRODUCTION

On July 16, 1945, the United States successfully conducted the first nuclear test, near Alamogordo, New Mexico. The device, known as "Trinity," was plutonium-based, yielded 21 kilotons, and tested an implosion design which would ultimately be incorporated into the Mark 3 weapon used on Nagasaki, Japan. After Trinity, the United States entered an era of nuclear testing which spanned almost five decades. Across 55 testing series, the United States conducted more than 1,000 nuclear tests, which included 210 atmospheric detonations, 815 underground tests, and 5 underwater tests. Then, on September 23, 1992, the United States conducted its final nuclear test, codenamed "Divider."[2]

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2. Nevada Operations Office, *United States Nuclear Tests: July 1945 through September 1992* (Las Vegas, NV: U.S. Department of Energy, September 2015), https://www.nnss.gov/docs/docs_LibraryPublications/DOE_NV-209_Rev16.pdf.

Within a week after the Divider test, President George H. W. Bush signed the Energy and Water Development Appropriations Act of 1993. This law included a nine-month moratorium on any underground nuclear testing but allowed for 15 tests over a three-year period.[3] On July 3, 1993, President Bill Clinton issued Presidential Decision Directive (PDD) 11, which extended the moratorium.

To date, every administration has extended the moratorium. Nearly three decades have passed since the last U.S. nuclear test. During this time, U.S. national laboratories have developed incredibly sophisticated modeling techniques designed to ensure the nuclear arsenal's safety and reliability. Unfortunately, the United States is approaching a tipping point. The international security environment has significantly changed over the past 27 years. Both Russia and China have made considerable improvements to their nuclear capability. Pakistan, India, and North Korea have become nuclear powers, and Iran has been acquiring both the tools and capacities needed for a nuclear weapons program. And finally, the United States is shifting its defense posture toward great power competition, which includes accomplishing military and political objectives against nuclear-armed adversaries as well as improving and enhancing its nuclear arsenal.[4]

Amid this international security environment, the United States still relies on a nuclear validation and verification methodology which is largely informed through supercomputer simulations. This paper summarizes the origins of the moratorium, examines new nuclear capabilities in Russia and North Korea, and identifies unintended consequences of the testing moratorium that put at risk the reliability and overall readiness of the U.S. nuclear deterrent.[5]

TO TEST OR NOT TO TEST

The Energy and Water Development Appropriations Act of 1993, as originally introduced, did not include a nuclear testing moratorium. After a vote of 68–26 in the Senate, language was included placing a nine-month-long moratorium on nuclear testing, with no underground tests being conducted after 1996.[6] This was in line with language in the proposed Comprehensive Nuclear-Test-Ban Treaty (CTBT). President Bush, recognizing that a test ban had strong congressional support, signed the bill.[7] This bill would ultimately be invalidated, as it ended the legislative ban on testing if any country also tested a nuclear weapon. Both India and Pakistan conducted tests in 1998, leaving the moratorium's continuance to executive policy.

The following year President Clinton, aspiring toward a comprehensive test ban, announced his administration would extend the moratorium, deeming the arsenal safe and reliable.[8] In the absence of nuclear testing, President Clinton issued PDD-15 on November 3, 1993. This directive primarily tasked the Departments of Energy and Defense to develop the SSP, focusing on the safety

3. U.S. Congress, House, *Energy and Water Development Appropriations Act*, H.R.5373, 102nd Cong., 2nd sess., June 1992, https://www.congress.gov/bill/102nd-congress/house-bill/5373/text.
4. While India conducted its first nuclear tests in 1974, Prime Minister Atal Bihari Vajpayee formally declared the country a nuclear weapons state in May 1998.
5. The scope of this paper is limited to the topics listed. It does not address the potential geopolitical ramifications which could result if the United States resumed a nuclear testing regimen.
6. Michael R. Gordon, "Senate, in Defiance of Bush, Votes to End All Nuclear Tests in '96," *New York Times*, August 4, 1992, https://www.nytimes.com/1992/08/04/world/senate-in-defiance-of-bush-votes-to-end-all-nuclear-tests-in-96.html.
7. Siegfried S. Hecker, "George H.W. Bush worked toward a soft nuclear landing for the dissolving Soviet Union," The Bulletin of Atomic Scientists, December 4, 2018, https://thebulletin.org/2018/12/george-h-w-bush-worked-toward-a-soft-nuclear-landing-for-the-dissolving-soviet-union/.
8. "PDD/NSC-11, Moratorium on Nuclear Testing," Office of the Press Secretary, July 3, 1993, https://fas.org/irp/offdocs/pdd11.htm.

and reliability of the arsenal.[9] However, PDD-15 also directed that a testing capability be retained. PDD-15 required a nuclear test be implemented, if directed, within six months prior to 1996 and within two to three years after 1996. These requirements were made under the assumption the ratification of the CTBT was imminent.

When President Clinton sent the treaty to the Senate, it languished and quickly became stale. After a two-year delay, the Senate ultimately voted 51–48 against ratifying the CTBT, far from the 67 needed for ratification.[10] The CTBT remains signed but unratified and currently resides with the Senate Foreign Relations Committee.[11] After 20 years, each successive administration has extended the moratorium originally emplaced by President George H.W. Bush. There was serious speculation over whether the Trump administration would resume nuclear testing.[12] Regardless, each administration over the past 25 years has relied on the SSP to ensure the U.S. nuclear stockpile is safe and reliable.

STOCKPILE STEWARDSHIP

Up until the moratorium, U.S. weapons went through a series of simulations and field tests to ensure everything worked within design specifications.[13] The United States regularly replaced nuclear weapons and their components. This was crucial because U.S. nuclear weapons were designed to be replaced every 10 to 15 years; testing was used as a means to verify their surety.[14] When President Clinton extended the moratorium, it is assumed he accepted measured risk to the safety and reliability of the arsenal.

"Safety" refers to the chance of an accidental nuclear yield, while "reliability" refers to the confidence that the weapon will work as expected. To mitigate this risk, President Clinton issued PDD-15 and established the SSP. The main goal of the SSP is "to maintain a high level of confidence in the safety, reliability and performance of the U.S. nuclear weapons stockpile in the absence of nuclear testing."[15]

To comply with measures outlined in PDD-15, the Departments of Defense and Energy implemented a variety of new programs such as hydrodynamic testing and weapons effects simulations to certify the stockpile.[16] Both departments were forced to rely heavily on a combination of previously collected data, new data from non-nuclear tests, and extensive computational modeling.[17] The SSP is how the secretaries of defense and energy have annually certified the nuclear arsenal since 1992.

Fundamental to the SSP are the various life extension programs (LEPs). Each weapon in the U.S. arsenal has an associated LEP to ameliorate any aging issues. The current nuclear arsenal was put into service at the end of the Cold War—the "youngest" U.S. nuclear weapon is more than 30 years

9. "Presidential Decision Directive/NSC-15," Office of the White House, November 3, 1993, https://clinton.presidentiallibraries.us/items/show/12743.
10. "Senate Rejects Comprehensive Test Ban Treaty; Clinton Vows to Continue Moratorium," Arms Control Association, https://www.armscontrol.org/act/1999-09/press-releases/senate-rejects-comprehensive-test-ban-treaty-clinton-vows-continue.
11. Mary Beth D. Nikitin, *Comprehensive Nuclear-Test-Ban Treaty: Background and Current Developments*, CRS Report No. RL33548 (Washington, DC: Congressional Research Service, 2016), 5, https://crsreports.congress. gov/product/pdf/RL/RL33548.
12. John Hudson and Paul Sonne, "Trump administration discussed conducting first U.S. nuclear test in decades," *Washington Post*, May 22, 2020, https://www.washingtonpost.com/national-security/trump-administration-discussed-conducting-first-us-nuclear-test-in-decades/2020/05/22/a805c904-9c5b-11ea-b60c-3be060a4f8e1_story.html. Although discussions of nuclear testing may be politically motivated, new technical data could be acquired from even a single test.
13. Clay Dillingham, *But will it work?* (Los Alamos: National Security Science, April 2013), 5, https://www.lanl.gov/discover/publications/national-security-science/2013-april/_assets/docs/stockpile.pdf.
14. Ibid.
15. Office of the White House, "Presidential Decision Directive/NSC-15."
16. Ibid.
17. Ibid.

old. Aging components pose significant issues for nuclear weapons. A host of chemical and material properties change as nuclear weapons age: materials breakdown and release gas, radioactive decay interferes with electronic and plastic components, and temperature changes alter material properties. These are only a few of the issues associated with aging nuclear weapons. The life extension programs aim to mitigate these issues and certify the weapon for an additional 20 to 30 years.[18]

The need to understand weapons phenomena without testing sparked numerous scientific and technological breakthroughs, particularly in the fields of supercomputing and high-fidelity modeling. For example, the Confined Large Optical Scintillator Screen and Imaging System (CoLOSSIS) assembles two-dimensional images into three-dimensional images, helping the labs better visualize anomalies inside weapons. The National Ignition Facility boasts the world's largest and highest-energy laser beam. It is capable of recreating temperatures and pressures that exist only inside nuclear detonations. Improvements made at the High Explosive Applications Facility have resulted in superior insensitive high explosives, making the arsenal safer.[19] Without a doubt, SSP efforts not only made the arsenal safer and more reliable but significantly contributed to the general body of science. However, legitimate concerns about the stockpile's age, safety, and reliability still remain.[20] Given the current global security environment and emerging threats, these concerns need to be addressed.

THE MORATORIUM IN AN ERA OF INCREASED THREATS

RUSSIA

Since their first nuclear demonstration in 1949, Russia's nuclear capabilities have always been at the forefront in shaping U.S. nuclear policy. At its peak, Russia possessed an arsenal consisting of approximately 40,000 nuclear warheads.[21] Through a series of arms control treaties, that number dropped to approximately 6,150.[22] Although their total arsenal is greatly reduced, Russia still possesses the world's largest nuclear arsenal. Russia poses a unique and considerable threat to the United States because of its large strategic arsenal as well as its continued improvements to nonstrategic nuclear capabilities since 2010.[23]

After several years of negotiations, the United States acknowledged in 2010 that political and military relations with Russia were warming, specifically stating, "Russia and the United States are no longer adversaries, and prospects for military confrontation have declined dramatically."[24] That sentiment was reversed in the 2018 *Nuclear Posture Review* (NPR), which stated a growing concern about the quantity and development of nuclear capabilities. Since the 2010 NPR, the United States developed and fielded one new nuclear delivery system, the F-35A fighter jet. In contrast, Russia developed and fielded 14 new systems, which span across every leg of their nuclear triad. [25]

18. "Maintaining the Stockpile," National Nuclear Security Agency, https://www.energy.- gov/nnsa/missions/maintaining-stockpile.
19. Arnie Heller, "Stockpile Stewardship at 20 Years," Science and Technology Review, July/August 2015, 7–14, https://str.llnl.gov/content/pages/july-2015/pdf/08.15.1.pdf.
20. Dillingham, *Will It Work?*, 1–5.
21. Hans M. Kristensen and Matt Corda, "Status of World Nuclear Forces," Federation of American Scientists, https://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/.
22. Hans M. Kristensen and Matt Korda, "Russian nuclear forces, 2019," *Bulletin of the Atomic Scientists* 75, no. 2 (March 2019): 74, doi:10.1080/00963402.2019.
23. Department of Defense (DOD), *2018 Nuclear Posture Review* (Washington, DC: 2018), 9, https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF.
24. DOD, *2010 Nuclear Posture Review* (Washington, DC: 2010), iv, https://dod.defense.gov/Portals/1/features/defenseReviews/NPR/2010_Nuclear_Posture_Review_Report.pdf.
25. DOD, *2018 Nuclear Posture Review*, 8.

In his 2018 Address to the Federal Assembly, Russian President Vladimir Putin formally announced that Russia was developing and fielding new strategic capabilities which could penetrate any U.S. missile defense.[26] One of these new capabilities is the Avangard hypersonic glide vehicle. Russia fielded the Avangard on deployed intercontinental ballistic missiles (ICBMs) in December 2019 and promised to field two ICBM regiments (12 missiles total) by 2027.[27] The Avangard's hypersonic speed and advertised maneuverability make it a challenge for U.S. missile defense. Russia's heavy new ICBM, the Sarmat, is another upgrade to Russia's strategic nuclear capability, which was shown following a ballistic trajectory over the South Pole in Putin's speech. Two other weapons, a nuclear-powered transoceanic torpedo and a nuclear-powered cruise missile are probably further away from fielding but demonstrate the level of interest Russia is making in developing these technologies.[28]

There is also trepidation regarding Russia's nonstrategic nuclear weapon (NSNW, or tactical) stockpile.[29] After the testing moratorium was put in place, both the United States and Russia entered an era of nuclear disarmament. Currently, the U.S. tactical stockpile solely consists of the B61 gravity bomb. The B61 can only be delivered by three fighter jets—the F-15E, F-16C/D, and PA-200.[30] In contrast, the U.S. Intelligence Community estimates that Russia maintains an arsenal of over 2,000 tactical nuclear warheads which can be delivered by multiple platforms across multiple domains.[31]

It is clear that Russia is investing heavily into its nuclear arsenal; substantial capability developments and large NSNW stockpile advantage pose military and political risks to the United States and its interests. There are also assessments from the U.S. Intelligence Community that Russia "probably is not adhering to its nuclear testing moratorium in a manner consistent with the "zero-yield" standard."[32] While the United States adheres to a strict interpretation of the testing moratorium, Russia is believed by some to have maintained its testing programs and to have conducted numerous low-yield tests over the past 20 years.[33]

NORTH KOREA

To further illustrate that the current global security environment is unlike that of 1992, a significant new threat has emerged in North Korea's nuclear capabilities. After exiting from the Nuclear Non-Proliferation Treaty (NPT) in 2003, North Korea pursued an aggressive nuclear weapons program. Within three years of exiting the NPT, North Korea announced on October 3, 2006 their intentions to conduct an underground nuclear test.[34] Six days later, the country detonated their first device.

26. Vladimir Putin, "Presidential Address to the Federal Assembly," (speech, Moscow, March 1, 2018), http://en.kremlin.ru/events/president/news/56957.
27. Jonathan Marcus, "Russia deploys Avangard hypersonic missle system," BBC, December 27, 2019, https://www.bbc.com/news/world-europe-50927648; and Franz-Stefan Gady, "Russia: Avangard Hypersonic Warhead to Enter Service in Coming Weeks," *The Diplomat*, November 14, 2019, https://thediplomat.com/2019/11/russia-avangard-hypersonic-warhead-to-enter-service-in-coming-weeks/.
28. Putin, "Presidential Address to the Federal Assembly."
29. For the purposes of this paper, the term "tactical nuclear weapon" is defined as those systems which are not governed by New START.
30. "B61-12 Life Extension Program," National Nuclear Security Administration (NNSA), https://www.energy.gov/sites/prod/files/2018/12/f58/B61-12%20LEP%20factsheet.pdf.
31. Robert P. Ashley Jr, "Russian and Chinese Nuclear Modernization Trends," (speech, Hudson Institute, May 29, 2019), https://www.dia.mil/News/Speeches-and-Testimonies/Article-View/Article/ 1859890/russian-and-chinese-nuclear-modernization-trends/.
32. Ibid.
33. Mark B. Schneider, "Yes, the Russians Are Testing Nuclear Weapons and It Is Very Important," Center for Security Policy, August 14, 2019, https://www.centerforsecuritypolicy.org/wp-content/uploads/2019/08/Schneider_Nuclear_08-14-2019-1.pdf.
34. "North Korea pledges to test nuclear bomb," CNN, October 4, 2006, https://www.cnn.com/2006/WORLD/asiapcf/10/03/nkorea.nuclear/index.html.

Between 2006 and 2016, North Korea tested four more nuclear devices; all were reported by media to be low yield.[35] That all changed on September 3, 2017. This was North Korea's largest test to date and marked a major shift in their nuclear capability—the previous tests were all thought to be fission-only—but the 2017 test successfully showcased a thermonuclear capability.[36] The ability to test thermonuclear weapons demonstrated not only the ability for more sophisticated weapon designs but also the capability to make more powerful weapons.

To complement their blossoming nuclear program, North Korea aggressively expanded their missile program. Between 1984 and 2005, the country conducted 24 full-flight tests of their short and intermediate-range ballistic missiles.[37] After the nuclear test in 2006, they continued investing in their short and intermediate-range systems and also rapidly developed their long-range capabilities.

From 2006 to 2019, North Korea conducted 158 full-flight missile launches, which included successfully launching a satellite into orbit with the Tapeodong-2 missile. While the Tapeodong-2 could theoretically range the United States, it did not demonstrate atmospheric reentry; that changed in 2017 when North Korea successfully tested the Hwasong-14 and Hwasong-15, both of which are believed by missile defense experts to be nuclear-capable.[38] These two tests demonstrated to the world that North Korea was capable of striking the United States. Ultimately, in 2017, North Korea officially became part of an extremely small group of countries capable of striking the United States with nuclear ICBMs.

The previous Russian and North Korean examples showcase only a fraction of modernized nuclear forces. Unfortunately, they are not the only countries expanding their nuclear capabilities. China is also investing heavily in nuclear forces: U.S. experts believe China's nuclear forces are likely to double to approximately 600 warheads over the next decade, and China, like Russia, is believed to have conducted underground nuclear tests.[39] The stark reality is that the global nuclear threat is increasing. U.S. adversaries are increasing their nuclear capabilities and have either blatantly tested devices (i.e., North Korea) or are believed to have resumed low-yield tests (i.e., China and Russia). Adversaries acquiring testing data could gain a technical edge over the United States for future weapon development.

THE AGE OF THE U.S. STOCKPILE AND THE DEGRADATION OF THE NUCLEAR WORKFORCE

One of the most touted concerns for the U.S. stockpile is its age. When President Bush agreed to halt nuclear testing in 1992, the W88 warhead—considered to be the flagship in the U.S. arsenal—was only

35. Ibid.
36. Mary Beth D. Nikitin and Samuel D. Ryder, "North Korea's Nuclear and Ballistic Missile Programs," Congressional Research Service, updated June 6, 2019, https://crsreports.congress.gov/product/pdf/IF/IF10472.
37. Missile Defense Project, "Missiles of North Korea," Missile Threat, Center for Strategic and International Studies, June 14, 2018, last modified March 4, 2020, https://missilethreat.csis.org/country/dprk/.
38. Ibid.
39. This approximation is based on an assessment by Kristensen and Korda. See Hans M. Kristensen and Matt Korda, "Chinese nuclear forces, 2019," *Bulletin of the Atomic Scientists* 75, no. 4 (June 2019): 171–178, doi:10.1080/00963402.2019.1628511; Robert P. Ashley Jr, "Russian and Chinese Nuclear Modernization Trends," (speech, Hudson Institute, May 29, 2019), https://www.dia.mil/News/Speeches-and-Testimonies/Article-View/Article/ 1859890/russian-and-chinese-nuclear-modernization-trends/; and U.S. Department of State, *2020 Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments (Compliance Report)* (Washington, DC: June 2020), 49, https://www.state.gov/wp-content/uploads/2020/06/2020-Adherence-to-and-Compliance-with-Arms-Control-Nonproliferation-and-Disarmament-Agreements-and-Commitments-Compliance-Report-1.pdf.

4 years old.[40] Today, it is 32 years old and is the "youngest" warhead in the U.S. arsenal. In stark contrast, the B61 gravity bomb has been in service since 1968 and is projected to remain so beyond 2025.[41]

When it comes to aging, arguments immediately gravitate toward the plutonium pit. This attention, however, is somewhat misguided. In 2006, Linton Brooks, the administrator of the National Nuclear Security Administration, declared, "the degradation of plutonium in our nuclear weapons will not affect warhead reliability for decades."[42] In fact, an initial study in 2006 and another one in 2012 assessed the pits to have at least an 85-year life span.[43]

That the pits are *assessed* to have a long life span does not negate the fact that the arsenal is aging. Older components are replaced, sometimes with newer technologies, component designs are reengineered, and so on. While the labs meticulously test these new additions, it is impossible to guarantee older pits will work the way they were intended with these newer modifications. Instead, the labs must rely on considerable scientific assumptions to make a judgment.

While the pits may be age-resistant, the workforce is most certainly not. In FY 2020, workers with 20 or more years total experience comprised 20 percent of the total workforce.[44] Currently, almost 30 percent of the workforce only has between one and five years of experience working in the weapons complex.[45] Additionally, over 25 percent of the workforce is currently eligible for retirement.[46] With every passing year, the number of personnel who participated in full-yield tests decreases and, with that, so does experience.

The erosion of experience becomes dire in the context of the ubiquitously poor documentation on nuclear weapons design throughout the nuclear weapons complex. In 2014, the Department of Energy (DOE) inspector general reported that:

> Pantex Plant (Pantex) officials could not locate as-built product definitions for 14 of 36 (39 percent) nuclear weapons that we selected from the current stockpile for testing . . . Sandia National Laboratories (SNL) officials responsible for neutron generator components could not locate 16 of the 36 (44 percent) neutron generator drawings identified in the as-built product definitions . . . . The Los Alamos National Laboratory (LANL) CM [configuration management] information system allowed changes to classified nuclear weapons drawings without using an approved change notice.[47]

Because the U.S. nuclear weapons enterprise cannot be certain of the important original nuanced details in the manufacture and assembly of its nuclear weapons, nuclear testing becomes a significant issue for the labs' latest generation of weapons designers. In a roundtable discussion

40. "W88 Alteration 370 Program Successfully Moving Forward," NNSA, January 16, 2018, https://www.energy.gov/nnsa/articles/w88-alteration-370-program-successfully-moving-forward.
41. "B61-12 Life Extension Program," NNSA.
42. "Studies Show Plutonium Degradation in U.S. Nuclear Weapons Will Not Affect Reliability Soon," NNSA, November 29, 2006, http://www.lasg.org/MPF2/documents/NNSA_PUdegradation_press-release_29Nov2006.pdf.
43. B. Chung and A. Heller, *Plutonium at 150 Years: Going Strong and Aging Gracefully* (Livermore, CA: Lawrence Livermore National Laboratory, December 2012), https://digital.library.unt.edu/ark:/67531/metadc828611/m2/1/high_res_d/1059084.pdf.
44. NNSA, *Fiscal Year 2020 Stockpile Stewardship Management Plan* (Washington, DC: Department of Energy, July 2019), 168, https://www.energy.gov/sites/prod/files/2019/08/f65/FY2020__SSMP.pdf.
45. Ibid.
46. Ibid.
47. Department of Energy Inspector General, *Audit Report, National Nuclear Security Administration Nuclear Weapons Systems Configuration Management* (Washington, DC: Department of Energy, March 2014), https://www.energy.gov/sites/ prod/files/2014/ 03/f14/IG-0902.pdf.

with second-generation designers, one designer admitted, "[w]e're being asked to do the same job the first-generation designers did—ensure that the U.S. nuclear deterrent works—but without testing," while another stated, "[i]f we want to know positively how our nuclear stockpile will work, we obviously should be doing nuclear tests."[48] Instead of current nuclear test data, the designers are reusing old, and often incomplete, data to validate their current experiments based on assumed designs. With over 25 years of non-nuclear testing, an entire generation of weapons designers partially rely on institutional knowledge and data. In short, U.S. firsthand knowledge of explosive nuclear testing is disappearing.

In an era where knowledge of testing is eroding, PDD-15 still requires the United States to maintain the capability to resume testing within 24 to 36 months. Although there has not been a nuclear test in over 25 years, the weapons labs continue subcritical nuclear testing to assist in validating their models. These tests do not produce a nuclear yield or explosion, and while these tests provide invaluable information, by the labs' own admission, they "don't address all of the issues required to maintain test readiness within a 24- to 36-month timeframe."[49]

Over the past 25 years, there has essentially been a complete turnover of personnel. This turnover makes meeting the 24- to 36-month timeline difficult. C. Paul Robinson, former director of Sandia National Laboratories, shares this concern about U.S. test-readiness. According to Robinson, "[t]here is essentially no test readiness. The whole testing process . . . would in essence have to be reinvented, not simply resumed."[50] Robinson makes the point that essential personnel with critical skills such as stemming (a process which prevents radioactive gases from venting) and heavy construction operators (for drilling holes over 4,000 ft deep) no longer exist. As Mr. Robinson points out, "the kind of detailed geologic and safety analyses and yield predictions needed to successfully contain a nuclear test would depend upon people who have no nuclear testing experience."[51] The United States may still have the scientific prowess to conduct a full-scale underground test, but it is clear that firsthand "know-how" is disappearing.

MODELING AND SIMULATION

The U.S. nuclear stockpile is often compared to a car built in the 1980s. The car sits in a garage and is maintained; parts are routinely tested and swapped out, but the car never moves. Unfortunately, this analogy assumes that nuclear weapons are simple—after all, the combustion engine is a relatively simple device. The analogy is also based around the idea that replacing individual components will ensure that the whole system works. U.S. nuclear weapons are far from simple and comparing them to such a simple device can be misleading.

To say that nuclear weapons are complex would be a gross understatement. For the weapon to work as intended, a flawless synergy in plasma and solid-state physics, chemical interactions, and other complex matters must occur—many of these interactions are not yet fully understood.[52] The SSP "guarantees" the stockpile's safety and reliability through rigorous component testing and intense

48. Langdon Bennett et al., "Part 2: Second-Generation Designers," National Security Science, February 2014, 27–33, https://www.lanl.gov/discover/publications/national-security-science/2014-february/_assets/docs/NSS_FEB2013_PGJ2.pdf.
49. "Do Subcritical Experiments Help?," National Security Science, December, 2016, 16, https://www.lanl.gov/discover/publications/national-security-science/2016-december/_assets/docs/NSS-dec2016_do-subcritical-experiments-help.pdf.
50. C. Paul Robinson, "Nuclear Test Readiness," National Security Science, December 2016, 10, https://www.lanl.gov/discover/publications/national-security-science/2016-december/_assets/docs/NSS-dec2016_nuclear-test-readiness.pdf.
51. Ibid.
52. Clay Dillingham, *But will it work?*, 5.

modeling and simulations. However, the "guarantee" of weapons working is largely predicated on one fundamental assumption: maintaining and testing subsystems, and using validation models based on 30-year-old data, guarantees the complete system works.

The labs have made significant improvements in supercomputing and continually assess and improve their models using a variety of data. However, when it comes to analyzing data from nuclear yields, those data sets are at least 25 years old. At some point the labs have to use old data to validate their current models. Doing so increases error, as old data may propagate uncertainty and error. Based on the DOE inspector general report, some of the data appear to be missing entirely. Even if the data were complete, there is a likelihood of it being less accurate. Sensors, computing power, and even knowledge of nuclear interactions were nowhere near as advanced as they are now. Newer technologies in data collection and computational abilities are much more sophisticated than they were 25 years ago; in fact, in the general scientific community, it is not uncommon for new data to invalidate previous data.

The safety and reliability of the U.S. arsenal is ultimately based on the scientific judgment of people who have never conducted a full-scale test. In the absence of any testing, the only scientific foundation to build that judgment on is from old data and modeling results. Without new data, those modeling results will eventually diverge from scientific truth, and any scientific knowledge gained at that point would be "fruit from the poisoned tree." All models, unfortunately, have uncertainties which will propagate and increase if left unchecked. The point of testing is to identify, reduce, or even eliminate uncertainty. In 1997, C. Paul Robinson testified before the Senate Armed Services Committee that, "[f]or a device as highly consequential as a nuclear weapon, testing of the complete system . . . is the preferred methodology . . . . To forego that validation through testing is . . . to live with uncertainty."[53]

THE MORATORIUM AND ITS IMPLICATIONS ON A REDUCED ARSENAL

When President Bush initially signed the testing moratorium in 1992, he actually opposed it. Both he and secretaries of energy and defense opposed any legislation which banned weapons testing, largely citing weapons safety.[54] On his departure from office, President Bush submitted a report to Congress which:

> . . . strongly urges the Congress to modify this legislation urgently, in order to permit the minimum number and kind of underground nuclear tests that the United States requires — regardless of the action of other states — to retain safe and reliable, although dramatically reduced, nuclear deterrent forces.[55]

Through a series of arms control agreements with Russia, the United States reduced its overall stockpile. When President Bush assumed office in 1989, the stockpile consisted of 22,217 warheads; by the time he signed the moratorium, the stockpile dropped by almost 40 percent to 13,707 warheads.[56] Today's active stockpile consists of approximately 3,822 warheads, and that number will continue shrinking.[57]

53. "Nuclear Weapons Complex Modernization," Hearing before the Strategic Forces Subcommittee," 110th Cong., 2nd sess., Jul 17, 2008, 141, https://www.govinfo.gov/content/ pkg/CHRG-110hhrg45134/pdf/CHRG-110hhrg45134.pdf.
54. "CTBT Truth or Consequences #3: President Bush Did Not 'Impose' a Test Moratorium – It Was Imposed on Him," Center for Security Policy, October 11, 1999, https://www.centerforsecuritypolicy.org/1999/10/11/c-t-b-t-truth-or-consequences-3-president-bush-did-not-impose- a-test-moratorium-it-was-imposed-on-him-2/.
55. Ibid.
56. "Stockpile Numbers," Department of Defense, https://open.defense.gov/portals/23/documents/frddwg/2017_Tables_UNCLASS.pdf.
57. Ibid. This number also does not include weapons awaiting dismantlement or that are retired.

The national labs remove a small number of warheads from the stockpile each year to conduct their certification process. According to former Sandia National Laboratories Director Jill Hruby, removing 13 warheads from each family guarantees 90 percent confidence that labs will find a defect within two years which affect 10 percent of the stockpile.[58] Of those removed, one device undergoes destructive testing, and the others are returned to the stockpile.

While the destruction of one weapon per year does not sound like a great loss, a potential problem in 10 percent of the stockpile is. As the stockpile becomes smaller, increasing stress will be placed on the SSP to perform its mission. Hruby shared this sentiment: "[e]ventually, the infrastructural demands of preserving the stockpile's integrity will outweigh the resources available for necessary maintenance."[59]

CONCLUSION

As the United States continues its no-testing policy, it must continue relying on the SSP. Undoubtedly, this program has greatly advanced overall scientific knowledge on weapons physics. Proponents of the moratorium assert that the SSP provides the United States with all the data it needs. However, that argument relies almost exclusively on scientific assumptions and judgments. Judgments can be wrong, as demonstrated on March 1, 1954 when the U.S. weapons experts miscalculated the expected yield of the Castle Bravo nuclear test. Designers of this weapon calculated the device would produce a yield of 5 to 6 megatons—because of a lack of understanding of some nuclear interactions, the yield was closer to 15 megatons. While this event occurred nearly 70 years ago, it demonstrates the unintentional consequences of miscalculations.

Certainly, knowledge of nuclear weapons has expanded, but there are still gaps. Former lab directors acknowledge this point in spite of 28 years of a rigorous scientific analysis. Inevitably, a time will come when U.S. nuclear weapon safety and reliability will require something more than the SSP can provide. Secretary Gates articulated this in 2008: "[a]t a certain point, it will become impossible to keep extending the life of our arsenal – especially in light of our testing moratorium." [60]

It is encouraging that the Trump administration is discussing testing. However, if the past 25 years serves as any indication, it is unlikely testing will resume any time soon. U.S. leadership seems placated with maintaining the stockpile using scientific judgments rooted in data that is at least 30 years old. Ultimately, the president may to need to authorize employing nuclear weapons. Nuclear weapons must work the first time, every time. If the president employs a nuclear weapon and it fails, could the United States accept, "but the models showed . . .?"

58. Caitlyn Collete, "Safe, Secure, Reliable Nuclear Weapons: A Discussion with Former Sandia Labs Director Jill Hruby," Nuclear Threat Initiative, February 19, 2019, https://www.nti.org/analysis/atomic-pulse/safe-secure-reliable-nuclear-weapons-discussion-former-sandia-labs-director-jill-hruby/.
59. Ibid.
60. Robert Gates, "Nuclear Weapons and Deterrence in the 21st Century" (speech, Carnegie Endowment for International Peace, October 28, 2008), https://carnegieendowment.org/2008/10/28/gates-nuclear-weapons-and-deterrence-in-21st-century-event-1202.

Public Opinion on Nuclear Weapons and Arms Control in Russia

Anna Wagner[1]

INTRODUCTION

In the last two decades, Russia has invested substantially in developing new types of nuclear weapons. At the same time, arms control treaties are disappearing one after another. While strategic security concerns are major reasons behind the Russian government's decision to modernize and expand its nuclear capabilities, domestic politics also can play a role. This paper explores public attitudes toward nuclear weapons in Russia in the last two decades and how such attitudes are shaped. Understanding domestic politics and their potential impact on nuclear modernization can be valuable for the future of arms control.

Nuclear weapons are an important part of the Russian national security strategy. Innovative nuclear capabilities have always been a symbol of scientific development for the Soviet Union and later the Russian Federation. Today, the nuclear weapons program is an indispensable tool in determining Russia's identity as an influential player in international affairs. The Russian public regards nuclear weapons as a symbol of national pride. In his 2018 annual address, Russian president Vladimir Putin showcased several new types of nuclear-capable weapons. This speech was a signal to Russian adversaries that Moscow is prepared to respond to any aggression. It also demonstrated to the domestic audience that large military investments in the time of the great power competition are necessary and that Putin is prepared to defend his country.[2] The Russian president needs to justify large-scale spending on the military and ensure that the public continues to support it.

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2. Steven Pifer, "Putin on the nukes," Brookings, Order From Chaos, March 2, 2018, https://www.brookings.edu/blog/order-from-chaos/2018/03/02/putin-on-the-nukes/.

There is abundant literature examining states' decisions to develop and expand their nuclear weapons programs. The security of a state is seen as one of the primary reasons for acquiring nuclear weapons programs.[3] For Russia, such threats can include U.S. nuclear and strategic capabilities, NATO expansion, China's growing military, and great power competition. Further, nuclear weapons can be cost-effective in comparison with precision-guided conventional weapons. Thus, Russia continues modernizing its existing arsenal and adding nuclear and nuclear-capable weapons such as Avangard, Kinzal, Burevestnik, Poseidon, and others.

Alongside security concerns, different domestic actors can play an important role in the acquisition and development of new capabilities.[4] Moreover, a nuclear arsenal can become an important part of state identity.[5] In the case of Russia, the nuclear arsenal is linked to Russia's position in the international arena as a great power. To better understand the role of these weapons in forming state identity, this paper examines available public opinion data in Russia. Reviewing this data can also shed light on the Russian government's strategies in shaping public attitudes about arms control and expensive investments in modernization.

To better understand internal politics, it is also essential to look into the role of military elites and the defense sector in the decisionmaking process to modernize and expand the nuclear weapons program. Today, military leadership and key Russian military strategists have an influential position in debates over deterrence policies.[6] During the Cold War, Soviet military elites were also heavily involved in policymaking. A centralized political and military system allowed for more investments in the nuclear sector. In the last two decades, Russia developed and updated its nuclear strategies based on a fast-changing international environment. The military doctrine adopted in 1993 was revised in 2000, 2010, and 2014 with more reliance on nuclear weapons.[7] In June 2020, Russia issued the "Fundamentals of Russia's State Nuclear Deterrence Policy" document.[8] This document has never been released to the public before, which once again highlights the significance of nuclear weapons in the Russian defense strategy. Available public polls show that the general population has been changing its views on nuclear weapons in the last two decades. There is a strong sense of national pride in the nuclear arsenal. The surveys show that the Russian government has reinforced the idea that military strength has nuclear weapons at its core. There is also an interest from the government to learn more about public opinion on this matter. Such rhetoric helps to justify large investments in times of economic recession. At the same time, public opinion data show support for arms control and nonproliferation.

3. See Kenneth Waltz, "The Spread of Nuclear Weapons: More May Be Better," *Adelphi Papers* 21, no. 171 (1981), https://www.tandfonline.com/toc/tadl19/21/171; and Scott D. Sagan, "Why Do States Build Nuclear Weapons?: Three Models in Search of a Bomb," *International Security* 21, no. 3 (1996): 54–86, doi:10.2307/2539273.
4. See Scott Sagan, "Why Do States Build Nuclear Weapons?"; Morton H. Halperin, Priscilla Clapp, and Arnold Kanter, *Bureaucratic Politics and Foreign Policy*, 2nd ed. (Washington, DC: Brookings Institution Press, 2006), https://www.brookings.edu/book/bureaucratic-politics-and-foreign-policy/; and Etel Solingen, "The Political Economy of Nuclear Restraint," *International Security* 19, no. 2 (1994): 126–169, doi:10.2307/2539198.
5. Sagan, "Why Do States Build Nuclear Weapons?," 73–75.
6. Due to the nature of this paper, the impact of the military is not covered. For more information on Russian military thought today, please see a recent report by Anya Fink and Michael Kofman, *Russian Strategy for Escalation Management: Key Debates and Players in Military Thought* (Arlington, VA: CNA, April 2020), https://www.cna.org/CNA_files/PDF/DIM-2020-U-026101-Final.pdf.
7. Amy F. Woolf, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*, CRS Report No. R45861 (Washington, DC: Congressional Research Service, updated January 2020), 4, https://crsreports.congress.gov/product/pdf/R/R45861.
8. "The Executive Order on the Fundamentals of Russia's Nuclear Deterrence State Policy," Presidential Executive Office, June 2, 2020, http://static.kremlin.ru/media/events/files/ru/IluTKhAiabLzOBjIfBSvu4q3bcl7AXd7.pdf.

The study of public attitudes toward nuclear weapons and modernization programs and other domestic factors is valuable and timely. Understanding the full spectrum of potential motives behind these programs can assist academics and practitioners in developing fit-for-purpose policies for arms control. Different internal actors can influence the decisionmaking process and shape public opinion. Such an impact can vary to a certain degree in different countries. It can also help to determine how strong the internal politics are in comparison to external threats. As a result, states such as Russia and the United States will require a different approach to arms control.

Public opinion in Russia can hardly influence decisionmakers to shift their policies with regards to nuclear weapons. Instead, the government looks for ways to change public attitudes or direct them to other matters. The first section of this paper reviews how two major polling organizations in Russia, Levada Center and VTsIOM, conduct their polls. The next section will provide an overview of the data collected from both polling organizations on public views toward nuclear weapons and what these weapons represent for Russian people. The next section will explore polls that are related to arms control rather than nuclear weapons. The final section provides conclusions about public opinion related to nuclear weapons and arms control in Russia.

HOW ARE THE POLLS CONDUCTED, AND SHOULD WE TRUST THEM?

The information on public opinion in Russia is scarce. The largest public opinion poll center is state-owned, the Russian Public Opinion Research Center (VTsIOM/VCIOM). The more reputable source is a non-governmental research organization, the Levada Analytical Center. The Levada Center has been conducting research since 1987 and is actually the original VTsIOM. In 2003, the Federal Agency for State Property Management decided to change the center's role. The research team disagreed with the decision and left the organization in its entirety. Consequently, the Levada Center was created as an independent research institution. Since then, the Levada Center has been scrutinized by the Russian government. In 2016, when new legislation on "foreign financing" limited funding from abroad, the Levada Center was required to register as a "foreign agent" and became subject to various restrictions.[9]

The Levada Center conducts an omnibus survey monthly. This type of survey includes multiple topics. The representative sample is from the urban and rural population of Russia. A total of 1,600 people from 50 regions are surveyed in the study.[10] The center also conducts in-depth interviews, small focus groups, and discussions. VTsIOM is funded by the government and therefore has presumably more resources and is able to conduct omnibus surveys daily as a result. These surveys are called VCIOM-Sputnik. The interviews are conducted over the phone with 600 respondents from at least 80 Russian regions (48,000 respondents in a month). Before 2017, VTsIOM conducted monthly in-person surveys, called Express, with 1,600 respondents.[11]

Since VTsIOM is funded by the government, many consider survey results unreliable and biased. The debate is usually not about survey results, but rather how VTsIOM poses their questions. One of the contentious and widely discussed topics is the president's ratings. For example, both

9. "Levada Announcement," Levada Center, September 7, 2016, https://www.levada.ru/cp/wp-content/uploads/2016/09/Levada-Announcement.pdf.
10. The statistical error does not exceed 3.4 percent. The omnibus survey is based on the nationwide, multi-stage, stratified and probability sample (N=1600) that represents the adult population of Russia over 18 years of age. See more at "Levada Omnibus Survey," Levada Center, https://www.levada.ru/en/methods/omnibus/.
11. "VCIOM-Sputnik survey," VCIOM: Russia Public Opinion Research Center, https://wciom.com/index.php?id=45.

Levada and VTsIOM ask about confidence in Russian politicians on a weekly basis. In January 2019, Levada's survey showed that 35 percent of respondents trust the president, while VTsIOM reported 30.6 percent. Both organizations asked an open-ended question by providing names of different politicians: "What politician do you trust?"[12] When in August 2019 approval ratings of the president were dropping, VTsIOM stopped publishing weekly results from an open-ended question and changed to monthly polls. Now, VTsIOM publishes results from a closed-ended question every week: "Do you trust Vladimir Putin?" As a result, Putin's approval ratings look significantly higher, with over 60 percent of respondents showing confidence in the president.[13] By manipulating how the questions are formed, they can lead to desired answers. Both VTsIOM and the Levada Center have received negative feedback about the way they formulate their survey questions.[14]

Every so often, results from both organizations differ significantly, which can also add to the uncertainty of how the information is collected. The 2019 survey about migration conducted by VTsIOM showed that only 4.8 percent of Russian citizens under 35 are willing to emigrate to another country.[15] The Levada Center results demonstrated that 53 percent of Russian citizens aged 18 to 24 would like to emigrate to another country.[16] Another example comes from the polling results measuring support for the amendments to the constitution of Russia in 2020. VTsIOM projected that 67 to 71 percent would vote for amendments, while the Levada Center's results showed only 44 percent.[17] Finally, the Levada Center does not publish results from surveys about presidential elections because they could potentially face fines due to their classification as a foreign agent.[18]

There are inconsistencies between the two polling organizations. While results should be taken with a grain of salt, they still can help in understanding public attitudes in Russia. Polls can demonstrate government interests in society, why particular information is collected, or even which polls the government might or might not manipulate. The poll data can demonstrate how people respond to new policies. By analyzing Russian public opinion, it is possible to examine the trends in attitudes toward nuclear weapons and how these attitudes might change over time.

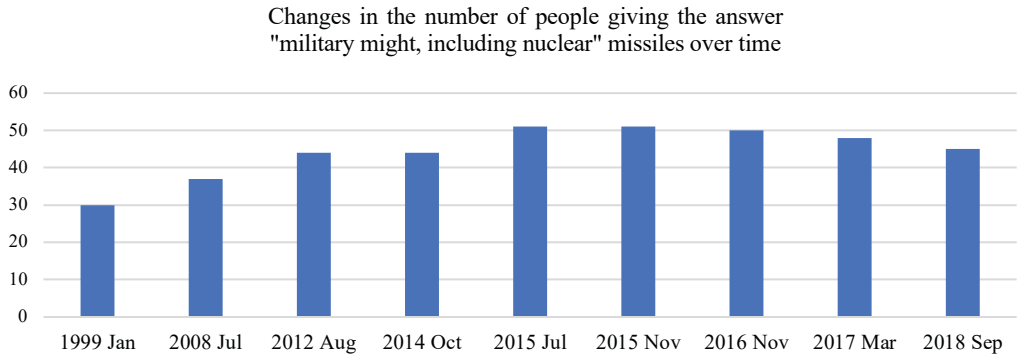
PUBLIC ATTITUDES TOWARD NUCLEAR WEAPONS

To examine public attitudes toward nuclear weapons and how they evolve, this analysis considers available poll results from VTsIOM's online database that include the words "nuclear," "atomic," "disarmament," and "arms control."[19] There were 172 polls between 1992 and 2017 with the word "nuclear" in them. In VCIOM-Sputnik polls that were conducted between 2017 and 2018, the word

12. Elena Mukhametshina, "Uroven' doveriya k Vladimiru Putinu za dva goda snizilsya pochti v dva raza" [The level of trust in Vladimir Putin has almost halved in two years], Vedomsti, Febraury 11, 20202, https://www.vedomosti.ru/society/articles/2020/02/11/822815-uroven-doveriya.
13. "Doveriye politikam" [Confidence in Politicians], VTsIOM, https://wciom.ru/news/ratings/doverie_politikam_1/.
14. Ekaterina Kamenova, "Predvzyatost' ili polittekhnologiya: stoit li verit' oprosam obshchestvennogo mneniya v Rossii?" [Bias or political technology: Is it worth believing opinion polls in Russia?], MBK Media, Accessed July 17, 2020.
15. "VTSIOM ob"yasnil plany molodezhi uyekhat' iz Rossii zhelaniyem posmotret' mir" [VTsIOM explained the plans of young people to leave Russia with a desire to see the world], RBC News, November 27, 2019, https://www.rbc.ru/society/27/11/2019/5dde21599a79471b799492e7.
16. Stepan Goncharov & Denis Volkov, "Emigratsionnyye Nastroyeniya" [Views on Emigration], Levada Center, November 26, 2019, https://www.levada.ru/2019/11/26/emigratsionnye-nastroeniya-4/.
17. "VTSIOM: za vneseniye popravok v Konstitutsiyu sobirayutsya progolosovat' okolo 70% rossiyan" [VTsIOM: about 70% of Russians are going to vote for amendments to the Constitution], *Novaya Gazeta*, June 23, 2020, https://novayagazeta.ru/news/2020/06/23/162515-vtsiom-za-vnesenie-popravok-v-konstitutsiyu-sobirayutsya-progolosovat-okolo-70-rossiyan.
18. Elena Mukhametshina, Svetlana Bocharova, and Olga Churakova, "Vybory prezidenta ostalis' bez nezavisimoy sotsiologii" [Presidential elections left without independent sociology], *Vedomosti*, January 16, 2018, https://www.vedomosti.ru/politics/articles/2018/01/16/747868-vibori-bez-sotsiologii.
19. Russian Public Opinion Research Center, VCIOM, https://wciom.ru/database/.

"nuclear" appeared in 71 questions and responses.[20] Additionally, VTsIOM's online database included approximately 130 instances in which either a question or an answer included the words "atomic," "disarmament," or "arms control." These results should also include surveys conducted by the team that began the Levada Center in 2006. In addition, the analysis considers several Levada Center publications. The survey questions or responses that refer to nuclear weapons policies in other countries (Iran, North Korea, Pakistan, India), the civilian nuclear industry, the Chernobyl disaster, and the Kursk submarine disaster were not included in the review.

Figure 1: What Makes a Country Great?



Note: Figure 1 demonstrates changes in the public attitudes when asked what makes a country a great power over a 20-year span. The sum of answers is higher than 100 percent due to respondents selecting multiple answers. Figure 1 demonstrates how the answer "Military might, including nuclear missiles" became more popular over time.

Source: Levada Analytical Center, *Russian Public Opinion – 2018* (Moscow: 2019), 33, https://www.levada.ru/cp/wp-content/uploads/2019/07/2018-Eng.pdf.

Over the years, both polling organizations asked various questions about public attitudes toward the nuclear arsenal and its significance in the lives of Russian people. Nuclear weapons make the population feel safe and respected, as polls suggest.

One of the questions asked for several years was: "What, in your opinion, makes a country a 'Great Power'?" Figure 1 appears in Levada's annual report on its sociopolitical and socioeconomic research.[21] The answer related to nuclear weapons remains relatively high throughout the years. It is interesting that while the answer "military" remains the third-most popular choice, the answer "respect and authority in the world" is gradually dropping. One of the reasons may be the growing confidence in the military, which results in fewer people being concerned about world status. The well-being of citizens remains the top answer. Figure 1 does not include all variations of this question as the wording and options for survey answers have changed throughout the years. Thus, not all available survey results are in this table. In 2000, 26 percent responded that nuclear weapons make Russia a great country, making it the sixth most popular answer.[22] Two years later, this number grew to 31 percent and became the fifth most popular answer.[23] At the same time, a large

20. Russian Public Opinion Research Center, VCIOM – Sputnik, https://bd.wciom.ru/baza_rezultatov_sputnik/.
21. Levada-Center, *Russian Public Opinion – 2018* (Moscow: 2019), https://www.levada.ru/cp/wp-content/uploads/2019/07/2018-Eng.pdf.
22. "Results of the Express monthly polling," Russian Public Opinion Research Center, VCIOM, November 30, 2000, https://bd.wciom.ru/zh/print_q.php?s_id=346&q_id=27942&date=30.11.2000
23. "Results of the Express monthly polling," Russian Public Opinion Research Center, VCIOM, January 15, 2002, https://bd.wciom.ru/zh/print_q.php?s_id=534&q_id=38397&date=15.01.2002.

majority supported arms reductions (see Figure 3). In 2005, 22 percent of respondents believed that nuclear weapons make a country a great power.[24] The PIR Center, a Russian research organization for international security, compared VTsIOM's poll results about nuclear weapons from 2006 with a similar survey conducted by the Public Opinion Foundation (FOM) in 2000.[25] The analysis revealed that the possession of nuclear weapons is regarded as insurance of the preservation of world power, especially as a military power.[26]

Figure 1 also demonstrates how the answer "military might, including nuclear missiles" has changed over the years. After 2014, there is a spike in support for this answer. This is consistent in the Levada Center's article about another survey question related to nuclear weapons: "What should the country possess, above all, to gain the respect of other states?" The Levada Center reports that in 1997, only 13 percent of respondents saw nuclear weapons as the source for respect, whereas 23 percent considered natural resources as a more significant factor. Later, the percentage answering "military and nuclear weapons" grew. In 2006, it was 20 percent, in 2011 it was 21 percent, and after the annexation of Crimea in 2014 it reached 33 percent.[27] In 2016, the number grew to 36 percent.

The spike in results after 2014 is not surprising and is likely connected to the conflict in Ukraine. In a 2015 Russian propaganda movie, Vladimir Putin stated that he did not exclude the possibility of using nuclear weapons in the Crimean crisis.[28] Such remarks can easily mislead the population on how serious the use of nuclear weapons is and how devastating the consequences can be. Plus, the public also sees how influential these weapons can be in conducting diplomacy.

In December 2015, the Levada Center asked people a series of questions about threats for Russia from the United States. One of the questions was directly related to Putin's remarks from the 2015 movie—"Do you feel threatened (afraid) because of Vladimir Putin's remarks on his readiness to use nuclear weapons?" In the five-point scale (1 being no fear and 5 being extreme fear), 25 people answered that they do not feel threatened, while 16 answered that they feel threatened.[29] Such questions are aimed at understanding how the public reacts toward the president's speeches. Such threats might have an element of propaganda, but they can lower the threshold of using nuclear weapons. Such rhetoric is also a real danger to the international community at large. By playing geopolitical games, the Russian government can blur the lines of why nuclear weapons should never be used. It can potentially lead the country to nuclear escalation.[30]

In a poll conducted in 2016, the Levada Center reported that many see nuclear weapons as essential to gaining respect from other countries.[31] The purpose of the polling was to find out what Russia

24. "Results of the Express monthly polling," Russian Public Opinion Research Center, VCIOM, August 7, 2005, https://bd.wciom.ru/zh/print_q.php?s_id=134&q_id=11428&date=07.08.2005.
25. I. A. Achtamzyan, *Vserossiyskiy sotsiologicheskiy opros: "Rossiyane ob ugrozakh, svyazannykh s oruzhiyem massovogo unichtozheniya," [The All-Russia opinion poll. "What Russian people say about threats posed by weapons of mass destruction"]* (Moscow: PIR Center, 2006), http://pircenter.org/media/content/files/9/13463956470.pdf.
26. Ibid., 12.
27. "Rossiyu uvazhayut za rakety" [Russia is respected for the missiles], Levada Center, November 14, 2016, http://www.levada.ru/2016/11/14/rossiyu-uvazhayut-za-rakety/.
28. "Putin ugrozhal Zapadu yadernym oruzhiyem iz-za Kryma" [Putin threated the West to use Nuclear Weapons because of Crimes], BBC, March 15, 2015, https://www.bbc.com/russian/russia/2015/03/150315_putin_crimea_documentary.
29. "Ugroza Dlya Rossii So Storony Ssha" [Threat for Russia From The US], Levada Center, May 12, 2015, https://www.levada.ru/2015/05/12/ugroza-dlya-rossii-so-storony-ssha/.
30. Levada Center, *The Russian Public Opinion Herald: Data. Analysis. Discussions*, 3-4 (127) (Moscow: July-December 2018), https://www.levada.ru//cp/wp-content/uploads/2019/02/2-2018-new.pdf.
31. "Oruzhiye i resursy: Za chto mozhno uvazhat' Rossiyu," [Weapons and resources: the reasons why Russia is respected], Levada Center, November 18, 2016, http://www.levada.ru/2016/11/18/oruzhie-i-resursy-za-chto-mozhno-uvazhat-rossiyu/print/.

should possess or be doing to earn respect in the world. The interviewers asked two questions: why a country should be respected and why Russia is respected.

The most prevalent answer to the first question (what makes a country respected?) is a "high welfare of citizens." The second-most popular response is "military strength and nuclear weapons." Russians are immensely proud of their cultural heritage, but literature and art received less than 10 percent of responses. The answer "developed education system" only received 2 percent. The Levada Center summed up the results "as long as there is money, the rest is not appreciated." As for the second question (what makes Russia respected?), the majority responded: "military power and nuclear weapons" (38 percent). "Natural resources" received 18 percent. Only 6 percent of respondents believe Russia is not respected in the world at all. The answer "military and nuclear weapons" is popular in both questions and all categories of respondents. The second-most popular factors such as "vast territory and rich natural resources" are four times less popular. Culture appears to be eight times less popular. The Levada Center concluded that the image of Russia rests on "nuclear missiles and oil derricks."

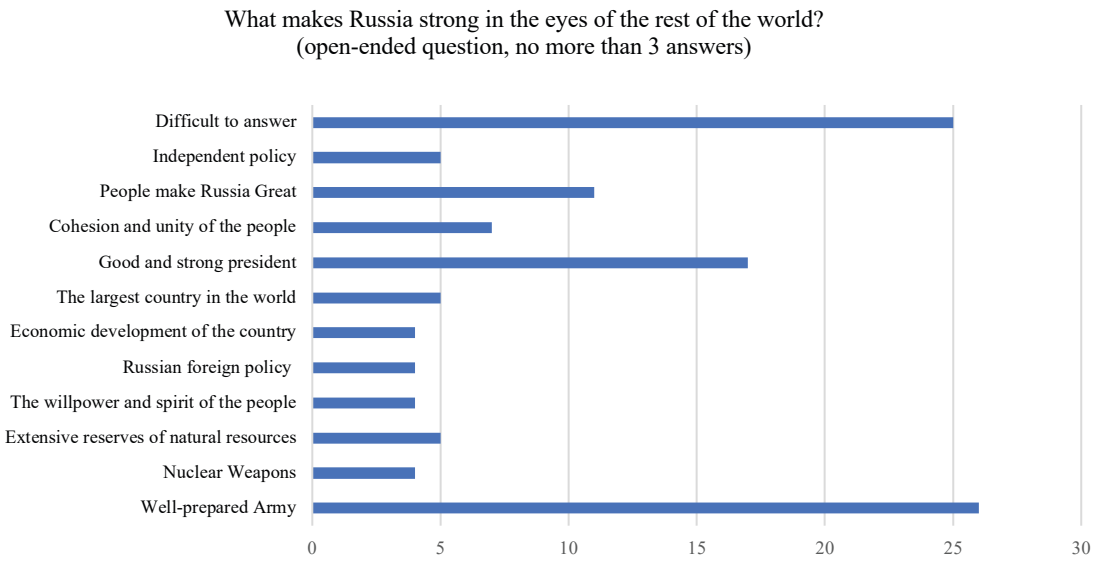
In mid-2017, when the relations between the United States and North Korea deteriorated, VTsIOM asked what steps Russia and other nuclear-weapon states should take with respect to countries developing nuclear weapons. The results showed that 37 percent of respondents believed that these countries should be isolated and sanctioned, while 42 percent thought these countries have the same right as other nuclear-weapon states to develop their arsenal.[32] It appears that a large number of respondents do not consider proliferation a real and dangerous problem. They might not have sufficient information about the nuclear weapons program in North Korea. On the other hand, respondents might be comparing Russia with other states and its right to have nuclear weapons, hence, they believe it is fair for others to develop it.

In 2018, VTsIOM asked a question about what makes Russia strong in the eyes of other nations (see Figure 2).[33] In a multiple-choice response, a "well-prepared army" received 26 percent, and "nuclear weapons" as a separate option received 4 percent. Additionally, 3 percent chose "the best weapons" as their response. By combining all three answers under the military category, it would be by far the most popular answer, at 33 percent. Nuclear weapons are rated the same as Russia's foreign policy and the economic development of the country. The poll results clearly demonstrate how defense capabilities, including nuclear weapons, are critical in determining Russia's place in the world.

On March 1, 2018, during Vladimir Putin's annual state of the nation address, he spoke about new types of nuclear-capable weapons and reiterated Russia's stand on the use of nuclear weapons. This address was watched by millions in Russia, and it is no surprise that a large part of it was dedicated to military affairs. VTsIOM conducted its usual poll a week and a half after to find how the public reacted to this speech. The poll asked what respondents remembered from the president's statements in the past two weeks. It was a multiple-choice question. The statement on the use of nuclear weapons was mentioned by 20 percent of respondents, while 13 percent remembered the new types of weapons and how they can evade missile defense systems.[34] In comparison, only 24 percent of respondents indicated that they remembered the president's speech to mark International Women's Day on March 8, one of the most popular public holidays in Russia.

32. "Results of the SPUTNIK Russian daily omnibus," Russian Public Opinion Research Center, VCIOM, May 14, 2017, https://bd.wciom.ru/trzh/print_q.php?s_id=29&q_id=1457&date=14.05.2017.
33. "Results of the SPUTNIK Russian daily omnibus," Russian Public Opinion Research Center, VCIOM, April 29, 2018, https://bd.wciom.ru/trzh/print_q.php?s_id=125&q_id=10062&date=29.04.2018.
34. "Results of the SPUTNIK Russian daily omnibus," Russian Public Opinion Research Center, VCIOM, March 11, 2018, https://bd.wciom.ru/trzh/print_q.php?s_id=125&q_id=10062&date=29.04.2018.

Figure 2: April 29, 2018 Poll Results



Note: Only answers higher than 4 percent are shown.

Source: "Results of the SPUTNIK Russian daily omnibus," Russian Public Opinion Research Center, VCIOM, April 29, 2018, https://bd.wciom.ru/trzh/print_q.php?s_id=125&q_id=10062&date=29.04.2018.

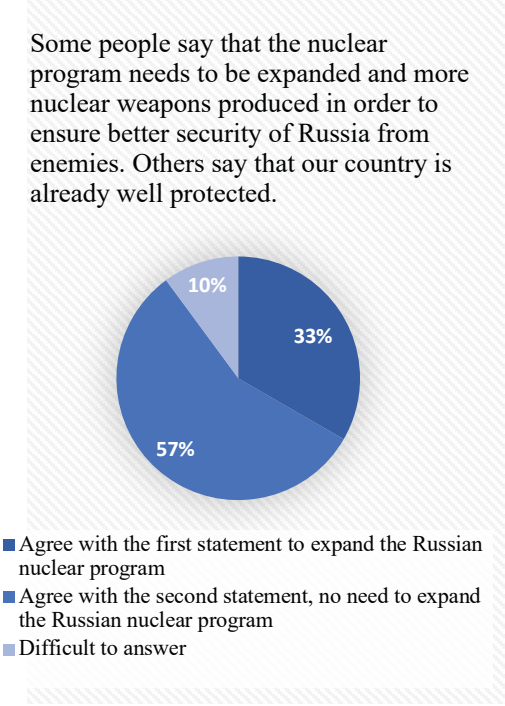
After this initial poll, VTsIOM conducted more surveys that included questions about nuclear weapons in March, April, and November of the same year. In April, a majority of respondents (26 percent) said that a well-prepared army makes Russia strong in the eyes of the rest of the world. Other popular responses to questions included "people" (11 percent), "strong president" (17 percent), and "difficult to answer" (25 percent). Additionally, the answers "nuclear weapons" and "the best weapons in the world" received 4 and 3 percent, respectively.[35]

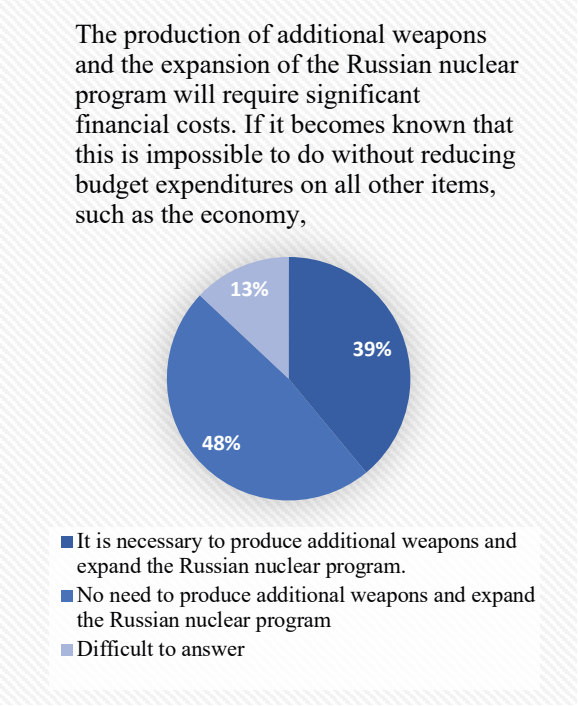
In November, respondents were asked if Russia should expand its nuclear capabilities or not.[36] The majority of respondents said that Russia should not expand its nuclear program (see Figures 3 and 4). Interestingly, when respondents were given additional information that producing more weapons is costly, more people said that additional nuclear weapons should be produced.

The Russian government has a growing interest to learn more about public views on various matters. In the age of the internet, public opinion matters more than it did two decades ago. By understanding how Russian people perceive issues such as nuclear weapons, the Russian government can further shape public attitudes. As a result, the public can value these weapons more over time. Additionally, patriotism has become an essential tool of Putin's policies, and a strong military and nuclear weapons are parts of that toolbox. A new modernized arsenal demonstrates a scientific advantage. Finally, based on the survey results, the nuclear arsenal helps people believe that Russia plays a critical role in the international arena.

35. "Results of the SPUTNIK Russian daily omnibus," Russian Public Opinion Research Center, VCIOM, April 4, 2018, https://bd.wciom.ru/trzh/print_q.php?s_id=125&q_id=10062&date=29.04.2018.
36. "Results of the SPUTNIK Russian daily omnibus," Russian Public Opinion Research Center, VCIOM, November 4, 2018, https://bd.wciom.ru/trzh/print_q.php?s_id=144&q_id=11986&date=04.11.2018.

Figures 3 and 4: November 4, 2018 Poll Results





Note: Questions were not fully shown on the website.

Source: "Results of the SPUTNIK Russian daily omnibus," Russian Public Opinion Research Center, VCIOM, April 29, 2018, https://bd.wciom.ru/trzh/print_q.php?s_id=144&q_id=11986&date=04.11.2018.

ARMS CONTROL SURVEYS

Nuclear arms control treaties are a valuable tool in enhancing security, limiting the numbers of nuclear weapons in the world, providing transparency, and ensuring trust between the United States and Russia. However, one treaty after another has gradually disappeared, which can lead to a new arms race. In 2001, the United States withdrew from the Anti-Ballistic Missile (ABM) Treaty. The United States claimed the treaty prevented U.S. development of defense against attacks from "rogue-state" ballistic missiles.[37] This treaty provided a limit on missile defenses, which in return limited the strategic arms race. In 2019, the United States left the Intermediate-Range Nuclear Forces (INF) Treaty due to Russia's violations in developing an intermediate-range ground-launched cruise missile.[38] The only nuclear arms control treaty that remains in force between the United States and Russia is New START, which will expire in February 2021. Reviewing available VTsIOM surveys can provide information about how the Russian public views arms control and whether the public supports it.

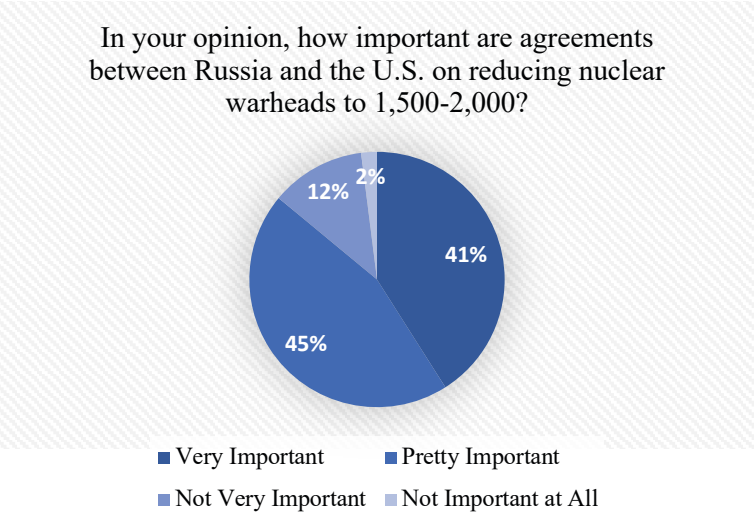
Based on available data, arms control-related surveys are not common. For example, on May 24, 2002, Russia and the United States signed the Strategic Offensive Reductions Treaty (SORT). The Russian public was asked a variety of questions at that time related to arms control and nuclear weapons. On

37. "The Anti-Ballistic Missile (ABM) Treaty at a Glance," Arms Control Association, Last Reviewed: July 2017, https://www.arms-control.org/factsheets/abmtreaty.
38. Todd Lopez, "U.S. Withdraws From Intermediate-Range Nuclear Forces Treaty," U.S. Department of Defense News, August 2, 2019, https://www.defense.gov/Explore/News/Article/Article/1924779/us-withdraws-from-intermediate-range-nuclear-forces-treaty/.

May 15, VTsIOM asked how important agreements between Russia and the United States are. Figure 5 demonstrates that the public thinks that arms control agreements are very important.

There were a number of polls that mentioned nuclear weapons in the context of arms control between 2009 and 2013. At that time, President Dmitry Medvedev and President Barack Obama made several statements about commitments to disarmament and pursuing a new treaty replacing SORT.[39] One of President Obama's statements at that time was his famous Prague speech about a nuclear-free world. In summer 2009, VTsIOM asked the Russian public usual questions about President Medvedev's recent speeches. Respondents did not indicate nuclear weapons as something significant that they remembered.[40]

Figure 5: May 15, 2002 Poll Results



Source: "Results of the Express monthly polling," Russian Public Opinion Research Center, VCIOM, May 15, 2002, https://bd.wciom.ru/zh/print_q.php?s_id=298&q_id=23613&date=15.05.2002.

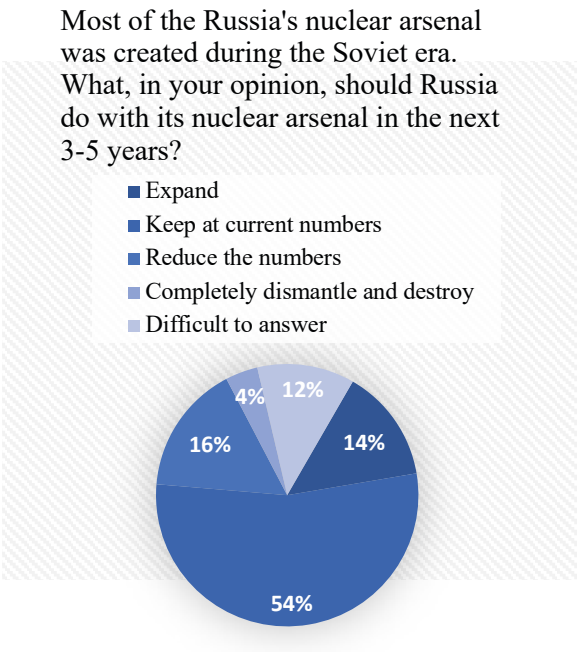
In August 2009, VTsIOM surveyed the public about the Russian arsenal and asked if it should be expanded. Many survey participants did not support the production of new nuclear weapons and answered that the government's measures are sufficient (see Figures 6 and 7). Additionally, when asked about what Russia should do about its nuclear arsenal in the long run, the majority answered to keep the numbers as they are.[41] Such results were favorable for the Russian government, as it was in the process of negotiating and later implementing the New START Treaty. It was signed in April 2010. The public did not impact the decisions over nuclear forces, but rather the government examined where people stood on the issue. After the treaty was signed, VTsIOM once again asked the public about their views on the nuclear arsenal. Most of the respondents (59 percent) indicated that they

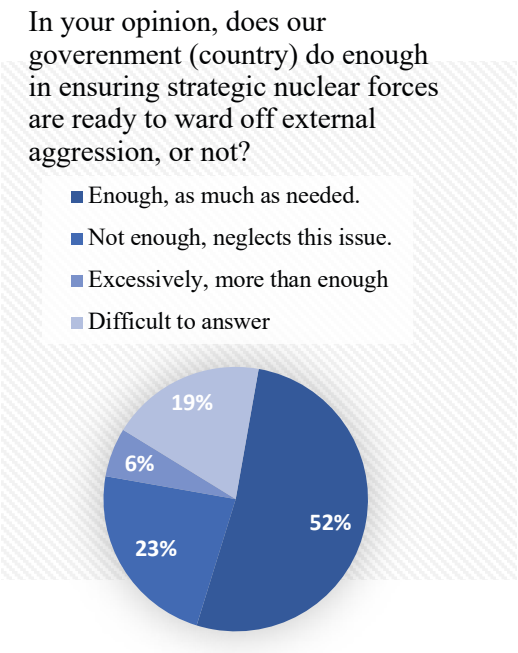
39. Vladimir A. Orlov, "US-Russia Dialogue on Nuclear Nonproliferation and Arms Control: What it Means for Europe and the World," *CERI Strategy Papers*, September 28, 2009, https://www.sciencespo.fr/ceri/sites/sciencespo.fr.ceri/files/n4_28092009.pdf.
40. See "Results of the SPUTNIK Russian daily omnibus," Russian Public Opinion Research Center, VCIOM, June 21, 2009, https://bd.wciom.ru/database/baza_rezultatov_sputnik/; "Results of the SPUTNIK Russian daily omnibus," Russian Public Opinion Research Center, VCIOM, June 28, 2009; and "Results of the SPUTNIK Russian daily omnibus," Russian Public Opinion Research Center, VCIOM, July 12, 2009.
41. "Results of the Express monthly polling," Russian Public Opinion Research Center, VCIOM, August 23, 2009, https://bd.wciom.ru/zh/print_q.php?s_id=616&q_id=44518&date=23.08.2009.

believe Russia should not disarm any further.[42] Out of 19 percent who responded that Russia should continue nuclear disarmament, the majority of respondents said that it would make the world safer.

Throughout 2010, VTsIOM asked about the use of nuclear weapons and how likely Russia would be to use them or be attacked by another country using nuclear weapons. The majority responded that these case scenarios are unlikely.[43]

Figures 6 and 7: August 23, 2009 Poll Results





Source: "Results of the Express monthly polling," Russian Public Opinion Research Center, VCIOM, August 23, 2009, https://bd.wciom.ru/zh/print_q.php?s_id=616&q_id=44517&date=23.08.2009.

Since the New START treaty will expire in February 2021 and will allow the buildup of strategic weapons on both sides, it will be valuable to review VTsIOM's public opinion if the relevant surveys are conducted. Current talks between the United States and Russia regarding the agreement extension do not appear to be fruitful. The United States wants to see China included in the new treaty as well as expand the agreement to include non-strategic weapons.[44] Russian counterparts disagree on both. Deputy Foreign Minister of the Russian Federation Sergei Ryabkov stated that there will not be a deal based on what the United States proposes.[45]

42. "Results of the Express monthly polling," Russian Public Opinion Research Center, VCIOM, May 1, 2009, https://bd.wciom.ru/zh/print_q.php?s_id=667&q_id=48074&date=01.05.2010.
43. See "Results of the Express monthly polling," Russian Public Opinion Research Center, VCIOM, May 1, 2010; "Results of the Express monthly polling," Russian Public Opinion Research Center, VCIOM, July 24, 2010; and "Results of the Express monthly polling," Russian Public Opinion Research Center, VCIOM, June 5, 2010, https://bd.wciom.ru/database/baza_rezultatov_opro-sa_s_1992_goda/.
44. Michael R. Gordon, "Russia Rebuffs Trump's Arms-Control Proposal," *Wall Street Journal*, October1, 2020, https://www.wsj.com/articles/russia-rebuffs-trumps-arms-control-proposal-11601557462.
45. Elena Chernenko, "Na toy osnove, kotoruyu predlagayut amerikantsy, khoroshaya sdelka ne prosmatrivayetsya" [Based on the Americans are proposing, there will not be a good deal], *Kommersant*, September 22, 2020, https://www.kommersant.ru/doc/4501227.

Available survey results show that the Russian public is aware of arms control agreements and sees value in them. The polls also demonstrate that the government was interested in public views when it negotiated the New START. While people see pride and strength in the nuclear arsenal, they still believe that the weapons should be controlled and not expanded further.

CONCLUSION

The use of nuclear weapons poses one of the greatest threats to international peace and security. Nuclear weapon states see the development of new capabilities as a national security priority. Notwithstanding a growing number of international movements against nuclear weapons, high costs of research and development, and potential risks of the biggest crisis in the world, the renewed great power competition sets the world for a new arms race. To understand how countries such as Russia look at arms control, it is important to explore the role of domestic politics alongside strategic stability and external threats.

Today, the Russian government is supportive of extending the New START Treaty. Russia does not have the same defense budget as the United States to enter a costly arms race. Still, military power has become the most important basis for the legitimacy of authoritarianism in Russia. Russian patriotism has merged with an idea of military power derived from the nuclear arsenal. Lev Gudkov, the director of Levada Center, calls it "the era of developed militarism."[46] In public opinion, the only grounds for Russia's authority in the world are based on the idea that "they respect us because they are afraid."[47] Such views on nuclear weapons can create difficulties for the government if it seeks to sell a new arms control treaty to the public. People might not have power over the decisionmaking process in Russia, but Putin is nevertheless concerned with how his policies are viewed at home.

Available public polls on nuclear weapons suggest that nuclear weapons remain an indispensable part of Russia's state identity. More people see military strength and nuclear weapons as the main symbol of international prestige and pride. At the same time, the polls between 2009 and 2013, when the New START was negotiated and implemented, show that many people are in favor of arms control. While support for nuclear weapons does not change and only strengthens with time, people see value in controlling proliferation and keeping the numbers as they are. Further reviewing polls can help in examining what tactics the Russian government might use to shape public opinion, how it redirects the public to patriotism instead of economic hardships, and how it works toward perpetuating the status quo.

Many are skeptical about the future of arms control for a variety of reasons, such as emerging technology and verification issues. One after another, the treaties between the United States and Russia have been collapsing. New START is on its last legs. Arms control agreements can stabilize relations between superpowers, manage their nuclear stockpiles, and provide better transparency. Analyzing domestic politics and public opinion can help better understand how states shape their deterrence strategies. Public views on nuclear weapons can be a valuable part of an innovative approach to arms control.

46. Lev Gudkov, "Epokha Razvitogo Militarizma" [The Era of Developed Militarism], Levada Center, May 14, 2019, https://www.levada.ru/2019/05/14/epoha-razvitogo-militarizma/.
47. Ibid.

The Erosion of Advice and Consent

Congress's Diminishing Role in Arms Control

Paul Warnke[1]

INTRODUCTION

For more than half a century, Congress has played an influential role in shaping U.S. nuclear arms control efforts. Using its constitutional authority to approve or reject treaties and the power of the purse to force or constrain the development of weapons systems at the center of arms control talks, the legislative branch has been both a facilitator and a spoiler in a president's pursuit or abandonment of arms control. As one Cold War observer put it, "[a]n important function of Congress in arms control is to serve as a balance wheel, keeping U.S. policy on the delicate course between military weakness and an uncontrolled arms race."[2] Today, however, as strategic insecurities deepen in what some have declared a new era of great power competition, and as arms control agreements unravel, the spokes of that wheel are coming loose.

Fueled by growing partisanship, differences of congressional opinion over the merits of arms control agreements and nuclear weapons programs are widening, making the task of coalition-building among members, and generating consensus on key nuclear policy issues increasingly difficult. As a result, Congress has largely sat on the sidelines in recent years as presidents craft and implement their arms control agenda. In the face of entrenched domestic partisanship during his second term, President Obama dodged the legislative branch in pursuit of his nuclear policy goals. Although the 2010 *Nuclear Posture Review* prioritized ratification of the Comprehensive Nuclear-Test-Ban Treaty (CTBT), the administration solidified its commitment to the treaty by negotiating

1. Paul Warnke is a foreign policy legislative fellow in the United States Senate. The views expressed in this article are those of the author and do not represent the views of his employer.
2. "United States: Report on the Congressional Role in Nuclear Arms Control," *International Legal Materials* 26, no.1 (January 1987): 36, https://www.cambridge.org/core/journals/international-legal-materials/article/abs/united-states-report-on-the-congressional-role-in-nuclear-arms-control/7415FF50D0918842810CFE9AE4077A2F.

a UN Security Council resolution—a move that did not require congressional buy-in. Under the Trump administration, Congress continued to be sidelined, but in different ways. Whereas Obama constructed arms control initiatives sometimes without direct congressional approval, Trump tore down longstanding accords with little domestic resistance. His administration withdrew from the Intermediate-Range Nuclear Forces Treaty (INF Treaty) and the Open Skies Treaty without meaningful congressional consultation and did little to engage Congress on the issue of New START extension.

This paralysis has accompanied—and exacerbated—a breakdown in executive-congressional relations. Friction between the two branches over the direction of U.S. foreign policy has long been a fact of political life, a built-in feature of checks and balances. But the comity and consultation that typically characterized executive-congressional arms control interactions in the Cold War have disintegrated in recent years into a bitter standoff between Congress and the president, one that has not only culminated in an impeachment trial at home but also exposed the limits of Congress's influence on arms control decisions. For instance, the Obama administration sidestepped a Congress beset with partisanship when it concluded the Joint Comprehensive Plan of Action (JCPOA) as a political commitment, rather than as a Senate-approved treaty or congressional-executive agreement.[3] Conversely, the Trump administration withdrew from a number of landmark treaties often without congressional buy-in or prior consultation. In another swipe at congressional prerogative, the Trump administration ignored mandated reports and certifications on the administration's arms control policy. To make matters worse, the headfirst rush into an uncontrolled nuclear competition, at a time when the United States is pursuing an across-the-board modernization program, is straining the linkage between arms control and nuclear weapons spending that has long underpinned congressional action and consistency on strategic policy.

The sections that follow trace the arc of congressional influence and engagement on arms control, from debates over the ratification of key agreements to funding decisions on controversial weapons systems that lay at the heart of treaty talks. After analyzing the sources of congressional influence and their historical underpinnings, this paper explores the reasons for and implications of Congress's declining role in arms control policy. This study argues that a Congress so divided or disengaged that it is unable to act as a counterbalance to or a willing partner in the president's arms control agenda will further imperil arms control and intensify, even more, the vacillations that now characterize U.S. nuclear policy.

ADVICE AND CONSENT

Gerald C. Smith, the chief U.S. negotiator for the SALT I agreement, once remarked, "[i]f a majority vote of both Houses of Congress is sufficient to make war, it should be sufficient to make agreements having peaceful purposes."[4] From this peculiar constitutional arrangement, whereby two-thirds of the Senate rather than a simple majority must approve a treaty, Congress derives its traditional power to shape arms control policy. Except for the SALT I interim agreement, which was a congressional-executive agreement, most arms control agreements have been submitted to the Senate as treaties. Because of the difficulty of clearing the two-thirds hurdle for treaty ratification, senators can, and often do, intervene in the treaty-making process before the crucial final roll-call vote. From the onset of arms control talks, an administration must factor in congressional opinion, mindful that a proposal must be acceptable not only to the counterparty but also to two-thirds of the Senate. Arms control

3. Matthew Weybrecht, "State Department Affirms That Iran Deal Is Only a Political Commitment," Lawfare, November 28, 2015, https://www.lawfareblog.com/state-department-affirms-iran-deal-only-political-commitment.
4. As quoted in Michael Krepon, "Conclusion," in *The Politics of Arms Control Treaty Ratification*, Michael Krepon and Dan Caldwell, eds. (New York: Palgrave Macmillan, 1991), 412 – 413.

skeptics leverage threats to block a treaty as a way of inserting themselves into negotiations and molding an agreement more to their liking. To prevent a minority of senators from amassing enough strength to reject a treaty, a president must therefore carefully manage the politics of ratification, from the start of talks to the final vote.

At the most basic level, when the majority party in the Senate is the same as the president's, obtaining Senate support for an arms control treaty becomes mathematically and politically easier. Surpassing the 67-vote threshold poses less of a challenge, while the risk diminishes that a ratification debate will turn into a partisan clash or a referendum on an incumbent president's reelection prospects, rather than an examination of a treaty's substance. Nonetheless, a favorable partisan alignment is no guarantee of approval. An administration must still deftly orchestrate Senate consideration of a treaty by: placating key senators who command the votes of their colleagues, such as the Senate majority and minority leaders and influential members on the Senate Foreign Relations Committee (SFRC) and Senate Armed Services Committee (SASC); inviting senators to observe negotiations and attend treaty signing ceremonies; and involving senators in the design of the treaty itself.[5]

Another mechanism for passing the two-thirds threshold—one on which Senate approval often hinges—is logrolling: the process of securing approval of an arms control treaty in exchange for the president's commitment to support nuclear modernization packages. Designed to mollify arms control skeptics, these packages can include new weapons systems or enhanced intelligence collection efforts—measures that serve to offset the perceived risks of constraining U.S. nuclear forces and the potential noncompliance of other states parties.[6]

In his study on logrolling and arms control, Paul Stockton separates lawmakers into three ideological camps according to their positions on strategic policy. Arms controllers typically oppose nuclear weapons development and contend that mutual restraint, coupled with possession of a second-strike capability, reduces the risks of nuclear war and arms racing. Force modernizers, on the other hand, favor the development of weapons systems and the strategic doctrine of counterforce. Rather than constrain U.S. nuclear forces through negotiated limits, this camp advocates for new capabilities that will give the United States a qualitative or quantitative edge in its competition with adversaries. Between these two camps lie moderates who see merit in both arms control and force modernization and typically do not adhere closely to any one strategic doctrine. Given these flexibilities, moderates constitute the swing bloc that can control the future of an arms control agreement or a new weapons system. In the context of treaty ratification, logrolling allows arms controllers and force modernizers "to trade support for their respective goals, and build winning coalitions for proposals that accommodated the interests of both." For moderates, logrolling is particularly appealing, as it allows them to have it both ways and shields them from being labeled too dovish or too hawkish.[7] Although linking ratification of arms control accords to nuclear modernization can seem self-defeating—that the price of consecrating arms limitations is further arms development—it has underpinned Senate support for arms control agreements and Congress's function as a balance wheel for U.S. nuclear policy for more than half a century.

5. Miller, "Politics over Promise," 83.
6. Krepon, "Conclusion," 450.
7. Paul N. Stockton, "The New Game on the Hill: The Politics of Arms Control and Strategic Force Modernization," *International Security* 16, no. 2 (Fall, 1991): 158–165, doi:10.2307/2539063.

THE CASE OF THE LIMITED TEST BAN TREATY

If there is a template for successfully steering an arms control treaty through the Senate, it was the one President Kennedy developed for the Limited Test Ban Treaty (LTBT) in the fall of 1963. The first significant international accord limiting nuclear weapons development, the LTBT banned nuclear test explosions in the atmosphere, outer space, and underwater. As Theodore C. Sorenson, Kennedy's chief speechwriter, recalled, "[n]o other accomplishment in the White House ever gave Kennedy greater satisfaction."[8] Kennedy directed the LTBT through the Senate to an extent uncommon for a president, not only shaping the broader strategy on the treaty's negotiation and ratification but also personally intervening at key points to orchestrate its implementation.

When the Kennedy administration submitted the LTBT to the Senate, it enjoyed a favorable political landscape. Democrats outnumbered Republicans two to one in the Senate, and the year before Kennedy had held firm against the Soviet Union in the Cuban Missile Crisis, earning the president significant foreign policy capital and elevating his standing in the country and with Congress.[9] Despite these advantages, Kennedy knew he could not rely on a party-line vote and would need a handful of Republican votes to cushion the defection of southern Democrats. The timing of the LTBT's conclusion—the last year of Kennedy's first term—threatened to undercut this goal. Kennedy's likely challenger in the upcoming presidential election, Senator Barry Goldwater (R-AZ), staunchly opposed the LTBT, raising the specter that the Republican caucus would vote en masse to deny the incumbent president a foreign policy victory.[10]

As a former senator attuned to the sensitivities of his old colleagues and the value of friendly executive-congressional relations, Kennedy employed several tactics to minimize partisanship and encourage senatorial buy-in for the treaty. First, in the spring and summer months leading up to LTBT negotiations in Moscow, Secretary of State Dean Rusk and Arms Control and Disarmament (ACDA) Deputy Director Adrian Fisher briefed the committees that would be the most active in the Senate's consideration of the LTBT—the SFRC, SASC, and the Joint Committee on Atomic Energy (JCAE). Secretary Rusk again met with the three committees while the talks were in progress and at one point showed a draft text to the members of the SFRC.[11] These interactions kept key Senate committees informed of the substance and direction of talks as well as allowed them to be more involved in the treaty-making process.

Second, when the United States and the Soviet Union agreed to final treaty text in early August, the Kennedy administration invited a bipartisan group of six senators to the signing ceremony in Moscow.[12] They were selected to attend for distinct reasons, each one able to sway their senate colleagues on the basis of committee assignment and party. Two chaired pivotal committees, J. William Fulbright (D-AK) on the SFRC and John O. Pastore (D-RI) on the JCAE. Hubert Humphrey (D-MN), the number two Democrat on the SFRC and the majority whip, was one of the Senate's staunchest arms control advocates and would become the LTBT's most vocal supporter during the ratification debate.[13] Lending partisan balance to the congressional delegation, Leverett Saltonstall

8. Theodore C. Sorenson, *Kennedy: The Classic Biography* (New York: Harper & Rowe, 1965), 738–740.
9. Benjamin S. Loeb, "The Limited Test Ban Treaty," in *The Politics of Arms Control Treaty Ratification*, 171.
10. Arthur Krock, "Kennedy and Goldwater: Senator's Policies and President's Criticism are Examined," *New York Times*, September 28, 1963.
11. Loeb, "The Limited Test Ban Treaty," 197.
12. "Texts of Communique and Speeches at Signing of Treaty for Nuclear Test Ban," *New York Times*, August 6, 1963.
13. Samuel Shafter, "Hubert Humphrey Comes On Strong," *New York Times*, August 26, 1963.

(R-MA) of the SASC and George Aiken (R-VT) of the SFRC possessed the needed defense and foreign policy credentials to rally their Republican colleagues to back the treaty. Although the group's attendance at the LTBT's signing in Moscow was purely ceremonial, it illustrated the careful attention to detail with which the Kennedy administration handled the Senate in the treaty's formulation, and it set the stage for the ensuing ratification debate.

To lock in final Senate approval of the LTBT, the Kennedy administration agreed to a sizable package of safeguards. It did so both to assuage the concerns of the nuclear weapons laboratories and the Joint Chiefs of Staff, whose support was a key ingredient for clearing the two-thirds threshold for ratification, and to secure the backing of pivotal Republican leaders and force modernizers who carried considerable sway over their Senate colleagues. Chief among them was Everett Dirksen (R-IL), the Senate minority leader. As administration negotiators and their Soviet counterparts hashed out the LTBT, Dirksen took to the Senate floor on multiple occasions to express his misgivings about the test ban treaty, stating it would surrender U.S. nuclear strength to Moscow and spark Soviet adventurism in Europe.[14] His initial—and quite public—criticism of Kennedy's efforts, however, would quickly vanish. Kennedy knew Dirksen from his Senate days and invited the minority leader and majority leader, Mike Mansfield (D-MT), to the White House on the first day of floor debate on the treaty. The president handed the two Senate leaders a letter outlining the four safeguards the administration would implement to ensure continued improvement of U.S. nuclear weaponry in the absence of atmospheric testing and hedge against possible Soviet non-compliance: (1) an aggressive underground test program; (2) maintenance of nuclear weapons laboratories; (3) a test readiness program for resumed atmospheric testing in the event of Soviet non-compliance; and (4) enhanced intelligence and test monitoring capabilities.[15]

Kennedy's maneuvering ultimately proved decisive. Dirksen not only officially endorsed ratification of the LTBT and delivered the president's message outlining the safeguards package to his colleagues on the Senate floor—both moves that helped minimize partisan divisions and dispel the misgivings of his colleagues over some of the treaty's perceived faults— but he also put his foot down on a poison-pill reservation proposed by Goldwater, the presumptive Republican presidential nominee, which in effect muted a major source of opposition.[16] Lastly, the Kennedy administration's acceptance of safeguards helped secure the support of Senator Henry Jackson (D-WA), a firm advocate of nuclear weapons spending and testing who had expressed serious concerns over the LTBT's limitations. With Jackson and Dirksen's backing, the Senate approved the LTBT by an 80-19 vote; of the 19 dissenting, there were 11 Democrats and 9 Republicans. It was a wide margin of victory that averted the partisan schism the administration had originally feared.

The role Congress played in the LTBT's establishment was manifold. First and foremost, it was one of consent. In approving the test ban treaty, the Senate exercised its Article 2, Section 2 powers to cement the major arms control achievement of the Kennedy administration. This required careful stewardship from both the executive branch and senators, such as Fulbright and Humphrey, who rallied their colleagues to support the treaty, worked with the State Department to produce testimony and documents, and, in Fulbright's case, performed the part of floor manager for the final roll-call vote. Clearing the two-thirds hurdle also required Senate bipartisanship and compromise.

14. Loeb, "The Limited Test Ban Treaty," 182.
15. "Meetings: Tape 109. Meeting on Nuclear Test Ban Treaty with Senators Mansfield and Dirksen, 9 September 1963," John F. Kennedy Library, September 9, 1963, https://www.jfklibrary.org/Asset-Viewer/Archives/JFKPOF-MTG-109-002.aspx.
16. E.W. Kenworthy, "Dirksen Endorses Unqualified Treaty," *New York Times*, September 9, 1963.

Mansfield and Dirksen, the Senate party floor leaders, worked together and with the administration to dampen partisan treatment of the treaty. And Humphrey and Jackson found common ground on nuclear policy, even if temporarily, through the ritual of logrolling.

Congress also performed the crucial role of advice. Key committees held frequent hearings with administration witnesses and outside experts on the LTBT's substance, both before and during the ratification debate. This facilitated information-gathering on the part of senators and extensive deliberations of the treaty's merits. In an atmosphere of amicable congressional-executive relations, senators also involved themselves in the formulation of the LTBT, in substantive as well as ceremonial ways. For example, Kennedy initially pressed for a comprehensive nuclear test ban in talks with the Soviets but was forced to settle for a partial ban after pro-defense senators signaled to the administration that a comprehensive treaty would meet significant resistance.[17] Thus, even though congressional opinion moved in the direction of arms control in the aftermath of the Cuban Missile Crisis, it still acted as a check on Kennedy's treaty ambitions and, in turn, helped keep U.S. nuclear policy on an even keel between far-reaching restraint and uncontrolled competition.

POWER OF THE PURSE

Another congressional mechanism for shaping U.S. arms control policy is the power of the purse. Since the late-1960s, when the convulsions of the Vietnam War fueled a more assertive Congress in foreign policy, the legislative branch has at times used nuclear weapons funding decisions to force a president's arms control agenda in a certain direction.[18] In notable cases, such as Nixon's anti-ballistic missile (ABM) program, Congress curbed the procurement of a weapons system it viewed as destabilizing, costly, and too technically challenging and that was the subject of U.S.-Soviet arms control talks at the time of its development. For other weapons systems, such as Reagan's MX ICBM program, Congress tied funding to the president's endorsement of a specific arms control proposal with the Soviet Union. Unlike the Senate's constitutional authority to approve treaties, which gives Congress the opportunity to intervene in the formulation of arms control policy passively and only in its final stages, the annual budgetary process opens the door for earlier and more active interventions.

Yet, although lawmakers have successfully curtailed controversial nuclear weapon programs on behalf of arms control, they often stop short of canceling them entirely.[19] Part of this congressional restraint stems from the need to show the Pentagon a degree of deference and to reach compromise with pro-defense members on weapons systems they support. The other part arises from the bargaining chip rationale—the notion that the development of offensive and defensive strategic weaponry can, in fact, improve arms control efforts by enhancing a president's negotiating leverage with competitors. Administration officials and pro-defense lawmakers have often leaned on this argument to defend embattled nuclear weapons programs. If Congress terminates a program, proponents contend, adversaries will have less incentive to make concessions at the negotiating table. By this logic, Congress's use of the purse to limit nuclear weaponry, even if well-intentioned, can backfire and harm arms control prospects.

17. Glenn T. Seaborg and Benjamin S. Loeb, *Kennedy, Khrushchev and the Test Ban* (Berkeley: University of California Press, 1981), 195.
18. James C. DeLaet and James M. Scott, "Treating-Making and Partisan Politics: Arms Control and the U.S. Senate, 1960-2001," *Foreign Policy Analysis* 2, no. 2 (April 2006): 180–181, doi:10.1111/j.1743-8594.2006.00026.x.
19. Lindsay, *Congress and Nuclear Weapons*, 3.

THE CASE OF NIXON'S SAFEGUARD PROGRAM

Congress's success in reining in Safeguard, Nixon's ABM program, demonstrates that the power of the purse can serve as a powerful and precise tool for influencing a president's arms control agenda. In the late-1960s, debate erupted in Congress over the Nixon administration's plans to develop and deploy ABM batteries at Minutemen bases as a means of shielding U.S. land-based nuclear forces against a preemptive Soviet attack. A loose-knit bipartisan coalition of arms controllers and moderates, headed by Senators John Sherman Cooper (R-KY) and Philip A. Hart (D-MI), led the charge in the Senate to block development of the Safeguard system. Composed of Democrats and Republicans and members from both the SASC and SFRC, the group contended that ABM deployments were ineffective and destabilizing in equal measure.[20] They warned that investing in defensive capabilities would compel Moscow to build up its offensive forces with countervailing moves, intensifying the action-reaction dynamics of the arms race and endangering the new-fledged SALT I talks. Opponents of Safeguard thus hoped that enacting domestic limitations through the annual budgetary process—or, at least, exerting enough political pressure that the administration would have little choice but to negotiate—would facilitate the conclusion of international constraints.

In their first bid to slow down the program, Cooper and Hart offered an amendment to the FY 1970 National Defense Authorization Act to bar funding for the production and deployment of Safeguard sites. The amendment failed by a single vote, 51-50, with Vice President Spiro Agnew casting the rare tiebreaking vote. Yet, even in defeat, the razor-thin margin signaled to the Nixon administration that its ABM program faced an uphill battle in Congress.[21] The SFRC, which Senator Fulbright chaired and which included Cooper, Hart, and other vocal arms controllers as committee members, emerged as a counterweight to the defense-minded SASC, then the bastion of Safeguard supporters in the Senate. The SFRC held frequent hearings on the issue, broadening the range of debate from the narrow technical and strategic aspects of ABM to its foreign policy and arms control implications.[22]

In the domestic upheaval caused by the Vietnam War in the late-1960s, grassroots organizations and lobbying groups figured prominently in the ABM debate. On the anti-ABM side, national committees sprung into existence, such as "Americans United to Stop the ABM" and "Citizens Concerned about the ABM," with the goal of pressuring wavering senators to oppose the Safeguard program. Working with the bipartisan coalition of senators leading the fight against ABM funding, these organizations distributed educational materials to voters, organized speaking engagements, and made direct-mail appeals. To counter the groundswell of activism against Safeguard, supporters of ABM formed groups in an effort to redirect the national discussion. Defense practitioners and intellectuals, through promotional materials and more discreet lobbying, sought to make the strategic and technical case for Safeguard as the Senate deliberated over ABM funding.[23] The flurry of activity underscored the ways in which public opinion can shape congressional action on arms control and nuclear weapons issues.

The more congressional and public opposition grew and the longer it persisted, the more Safeguard proponents in the administration and Congress were forced to shift their rationale for the program.

20. John W. Finney, "Lines Are Drawn For Battle On Arms Spending," *New York Times*, July 26, 1970.
21. Warren Weaver Jr. "Nixon Missile Plan Wins In Senate By A 51-50 Vote; House Approval Likely," *New York Times*, August 7, 1969.
22. J. William Fulbright, "Washington Scene: Foreign Policy Implications of the ABM Debate," *Bulletin of Atomic Scientists* 25, no. 6 (September 1969): 20–23, doi:10.1080/00963402.1969.11455230.
23. "ABM Debate: Both Sides Are Going to the People," *New York Times*, April 6, 1969; and William Chapman, "ABM Dispute Spurs Partisan Activity," *Washington Post*, June 16, 1969.

Running parallel to and closely intertwined with the domestic debate on ABM were U.S.-Soviet arms control talks on limiting offensive and defensive nuclear arms. In congressional hearings, defense officials moved away from the strategic and technical justifications for Safeguard, instead portraying it as an indispensable bargaining chip in negotiations.[24] Senator Henry Jackson, a stalwart ABM supporter, reinforced this point to his colleagues when he argued that Safeguard would force Moscow to accept a cap on offensive capabilities by demonstrating U.S. determination to nullify any buildup with a committed defense. The Senate minority leader, Robert P. Griffin (R-MI) went even further, calling efforts to cancel Safeguard a vote against arms control talks and a "vote against the President of the United States."[25]

In the end, these appeals succeeded in softening the opposition. Cooper, a leader of the anti-ABM coalition, backed Safeguard in 1971 out of concern that its cancellation would affect the ongoing SALT negotiations.[26] The parallel congressional and international efforts to limit ABM capabilities would nevertheless converge as both reached their end points. In a compromise between Safeguard proponents and critics, Congress restricted deployment to two sites and preparation for two additional sites in the FY 1972 defense authorization bill.[27] Less than a year later, the Nixon administration concluded tight constraints on ballistic missile defenses in the ABM Treaty with the Soviet Union, codifying in a binding treaty the very limits Safeguard opponents had been seeking through the domestic authorization and appropriations processes. In its resolution of ratification for the ABM Treaty, the SFRC judged that national restraint in armaments can have "a salutary effect upon the Soviet Union" by breeding matching restraint and creating an environment more favorable for arms control.[28]

Employing the power of the purse to limit weapons programs is neither a simple nor a surefire approach. The congressional campaign against Safeguard succeeded in large part because it crossed party lines, enlisted in its ranks both moderates and arms controllers, and produced sufficient momentum to last multiple funding cycles. Moreover, it was bolstered by an active, forceful SFRC that inserted itself in debates over nuclear weapons spending and effectively scrutinized the linkage between force structure decisions and arms control. And lastly, Safeguard, with its installations strewn across the continental United States, was a uniquely controversial program that generated extensive public grassroots opposition and a constellation of anti-ABM lobbying groups, making it less politically risky for lawmakers to challenge it.[29]

TODAY'S SHIFTING ROLE

Senate approval of the LTBT and the debate over Safeguard offer important snapshots of a Congress actively molding the arms control agenda, in tandem with but also against presidential efforts, and

24. "Pentagon Aide Urges Deployment Of More Missiles As 'Bargaining Chips' for Talks With the Soviet Union," *New York Times*, July 14, 1971, https://www.nytimes.com/1971/07/14/archives/pentagon-aide-urges-deployment-of-more-missiles-as-bargaining-chips.html.
25. John W. Finney, "Expansion of ABM Backed By 52-47 Vote," *New York Times*, August 13, 1970, https://www.nytimes.com/1970/08/13/archives/expansion-of-abm-backed-by-senate-by-52to47-vote-but-another-test.html.
26. Lindsay, *Congress and Nuclear Weapons*, 120.
27. "Report on the Congressional Role in Nuclear Arms Control," *International Legal Materials*, 12.
28. Report by the Senate Foreign Relations Committee on the Treaty on Limitation of Antiballistic Missile Systems (July 21, 1972), S. Ex. Rept. 92–28, 92. Cong., 2nd Session, https://books.google.com/books?id=jpct4_FvEgYC&pg=PA30&lpg=PA30&dq=%22a+salutary+effect+upon+the+Soviet+Union%22+Senate+Foreign+Relations+Committee&source=bl&ots=3uwBU63Mcu&sig=ACfU3U0GpYLwfCBY7igwDGHSGT2M75ribQ&hl=en&sa=X&ved=2ahUKEwiOg8q8gODtAhVrRN8KHXz_D9cQ6AEwAXoECAMQAg#v=onepage&q=%22a%20salutary%20effect%20upon%20the%20Soviet%20Union%22%20Senate%20Foreign%20Relations%20Committee&f=false.
29. "ABM Debate: Both Sides Are Going to the People," *New York Times*.

thus serve as sharp contrasts to today's Congress. After President Trump abandoned longstanding treaties, and as Russia contravenes its international obligations and a number of countries modernize their nuclear arsenals, pursuing negotiated agreements or self-limiting steps as a tool of strategic policy is at risk of becoming obsolete. In policy documents and speeches, the Trump administration made clear its disdain for arms control and predisposition for a nuclear buildup.[30]

Congress is starkly split on which approach is best: reinvigorated competition or a renewed commitment to arms control. These fault lines of opinion largely run down the aisle, separating the parties into the two camps. For example, in their reactions to the Trump administration's decision to withdraw from the INF Treaty in February 2019, the Republican chairs of the SFRC and SASC applauded the move to abandon the treaty and thereby free the United States from constraints on developing and deploying INF-banned systems.[31] Their counterparts, the ranking Democratic members on the two committees, took the opposite position, declaring that the move "could spark a new arms race" and that "President Trump clearly lacks an appreciation or understanding of the importance of arms control treaties."[32]

The two parties appear equally divided over the future of the New START Treaty, with Democrats overwhelmingly supporting extension and Republicans, apart from a small group of members, poised to let it lapse. At the end of 2018, sizable groups of Democratic and Republican senators each wrote letters to President Trump sketching out their respective views of the U.S.-Russia nuclear relationship. Where the Democratic letter opposed the Trump administration's development of new nuclear capabilities and unequivocally endorsed extension of New START as a way of heading off an arms race, the Republican letter wholeheartedly supported nuclear modernization projects and new weapons programs and stressed Russia's record of treaty non-compliance and its nuclear weapons buildup as factors that must inform the administration's arms control calculus.[33] The letters, in many ways, represented a study in contrast between arms controllers and force modernizers, revealing sharp differences over threat perceptions of Russia, the importance of achieving an edge in the U.S.-Russia strategic competition, and the desirability of engaging in arms control with adversaries.

30. Department of Defense, *2018 Nuclear Posture Review* (Washington, DC: February 2018), https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF; Tim Morrison, "Transcript: Special Presidential Envoy Marshall Billingslea on the Future of Arms Control," Hudson Institute, May 22, 2020, https://www.hudson.org/research/16062-transcript-special-presidential-envoy-marshall-billingslea-on-the-future-of-nuclear-arms-control.
31. "Risch Statement On U.S. Withdrawal from INF Treaty," James E. Risch, February 1, 2019, https://www.risch.senate.gov/public/index.cfm/2019/2/risch-statement-on-u-s-withdrawal-from-inf-treaty; and "SASC Chairman Inofe on U.S. Withdrawal of INF Treaty," James M. Inhofe, February 1, 2019, https://www.inhofe.senate.gov/newsroom/press-releases/sasc-chairman-inhofe-on-us-withdrawal-of-inf-treaty.
32. "Reed Criticizes Trump Administration's Intention to Withdraw From Nuclear Treaty," Jack Reed, February 1, 2019, https://www.reed.senate.gov/news/releases/reed-criticizes-trump-administrations-intention-to-withdraw-from-nuclear-treaty; and "Menendez Statement on Trump Administration's Withdrawal From Nuclear Treaty," Senate Foreign Relations Committee, February 1, 2019, https://www.foreign.senate.gov/press/ranking/release/menendez-statement-on-trump-administrations-withdrawal-from-nuclear-treaty.
33. "Rubio Joins Colleagues To Urge President Trump To Consider Key Factors In Review Of New START Treaty," Marco Rubio, November 29, 2018, https://www.rubio.senate.gov/public/index.cfm/2018/11/rubio-joins-colleagues-to-urge-president-trump-to-consider-key-factors-in-review-of-new-start-treaty; and "Senators Gillibrand, Merkley, Warren, Markey, Feinstein, Klobuchar Lead Group of 26 Senators In Calling President Trump To Work To Preserve These Vitally Important Treaties, Avoid Dragging Our Country Into A Dangerous New Nuclear Arms Race With Russia," Kristen Gillibrand, December 13, 2018, https://www.gillibrand.senate.gov/news/press/release/following-president-trumps-alarming-decision-to-develop-new-nuclear-weapons-while-also-moving-to-unilaterally-abandon-the-bipartisan-nuclear-treaties-that-have-helped-keep-the-world-safe-from-nuclear-war-for-decades-senators-gillibrand-merkley-warren-markey-feinstein-klobuchar-lead-group-of-26-senators-in-calling-on-president-trump-to-work-to-preserve-these-vitally-important-treaties-avoid-dragging-our-country-into-a-dangerous-new-nuclear-arms-race-with-russia.

PARTISAN POLARIZATION

These ideological splits have existed for more than half a century, but they have grown more irreconcilable and map more closely onto party lines than in the past. In their study on arms control treaty-making and partisan politics from 1960 to 2001, James C. DeLaet and James M. Scott conclude that in the post-Cold War era bipartisan support for arms control has significantly diminished and that "partisan calculations" more so than "policy preferences" now shape lawmakers positions on nuclear policy.[34] While senators addressed substantive issues in their consideration of the CTBT, the party-line vote rejecting the treaty in 1999 was a harbinger of growing partisan divisions over arms control.[35] The ratification debate over New START in 2010 further highlighted this trend. Even though the Obama administration successfully steered the treaty through the Senate, partisan acrimony and extraneous domestic and electoral politics colored Senate deliberations.[36]

The implications of this entrenched partisanship for arms control and for the broader role Congress plays in nuclear policy are diverse and many. For one, the task of building consensus on a certain arms control approach or a new weapons system has grown increasingly difficult. For a president seeking Senate consent to an arms control accord, cultivating a close relationship with the Senate leader of the opposing party, as Kennedy did with Senator Dirksen for the LTBT, becomes more crucial yet also more unattainable in an environment defined by political combativeness and zero-sum thinking. Indeed, bipartisan backing is so important for treaty ratification that no major arms control treaty, with the exception of New START, has been approved without the support of the Senate minority leader.

Consensus-building among lawmakers, likewise, feels more and more like a futile endeavor. The bipartisanship that Senators Mansfield and Dirksen forged in approving the LTBT or that Senators Cooper and Hart relied on in blocking Safeguard has diminished in today's climate of hyper-partisanship. For some lawmakers, compromise, once the lifeblood of legislative action, can be a political liability. The 2012 primary defeat of six-term Senator Richard G. Lugar (R-IN)—a longstanding influential member of the SFRC who played a key role in securing Senate approval of several arms control treaties and who went against many in his party to ensure passage of New START—illustrated the political perils of reaching across the aisle.[37] Should bipartisanship continue to erode and bridge-building senators from key committees become scarcer, ideological disagreements over arms control will deepen and room for political compromise will shrink.

A second implication of partisan polarization, one closely related to the first, is that clearing the super-majority requirement for Senate approval of treaties has turned into a more difficult, politically fraught process. In the past, arms control treaties have typically cleared the two-thirds hurdle with overwhelming bipartisan majorities. In final roll-call votes, 19 senators opposed the LTBT; 2 voted against the ABM Treaty; 5 voted against the INF Treaty; 6 opposed START I; and none opposed SORT. But as Presidents Clinton and Obama learned from the Senate's handling of the CTBT and New START, partisan calculations and unrelated domestic issues as much as disagreements over a treaty's substance can shape ratification debates. In their study, DeLaet and Scott find that these

34. DeLaet and Scott, "Treaty-Making and Partisan Politics," 181, 195.
35. Helen Dewar, "Senate Rejects Test Ban Treaty," *Washington Pos*t, October 14, 1999, https://www.washingtonpost.com/wp-srv/politics/daily/oct99/senate14.htm.
36. Peter Baker, "Democrats Scramble to Save Votes to Ratify Nuclear Pact," *New York Times*, December 19, 2010, https://www.nytimes.com/2010/12/20/us/politics/20start.html.
37. Monica Davey, "Lugar Loses Primary Challenge in Indiana," *New York Times*, May 8, 2012, https://www.nytimes.com/2012/05/09/us/politics/lugar-loses-primary-challenge-in-indiana.html.

dynamics affect the thinking of Republican senators more than Democratic ones, with Republicans more apt to defer to their presidents and defy ones of the opposing party, and Democrats more likely to be bipartisan on arms control policy.[38] Such trends help validate the old adage that Democratic presidents should negotiate treaties and Republican presidents should direct ratification campaigns.[39] As such, they reinforce the point that Democratic presidents, in particular, have to rely on party-line votes and thus an extremely favorable partisan mix in the Senate to ratify arms control treaties.

Third, partisan polarization makes the quadrennial presidential electoral cycle an increasingly important variable for treaty ratification. The arms control process has often been tethered to domestic politics, with candidates attacking the approach of the other as too weak or too hardline. For Nixon, conclusion and ratification of the SALT I accords months before the 1972 election was a boon for his candidacy, focusing domestic attention on the president's foreign policy accomplishments and diplomacy chops with the Soviet Union.[40] The opposite was true for Jimmy Carter, whose failure to ratify the SALT II treaty contributed to his loss to Ronald Reagan in the 1980 presidential election. The tendency to cast arms control efforts against the backdrop of domestic politics has been both beneficial and detrimental for presidents, but the more bitter and combative electoral politics become, the more ratification debates risk turning into referenda on a president's domestic standing rather than on the treaty itself.

The sexennial electoral cycle for senators has also turned into a more important variable in today's partisan era. For senators in cycle who face a tough reelection campaign, supporting the arms control agenda of a president from the other party can be a risky gambit. Senator Jacob Javits (R-NY), the ranking minority member on SFRC and a supporter of President Carter's SALT II efforts, was defeated in the 1980 elections when a wave of conservatism unseated moderate incumbents.[41] Senator Lugar, who held the same position on SFRC during the New START ratification debate and was viewed as overly moderate during the Republican primaries in Indiana, met a similar electoral fate in 2012.

In a similar vein, the biennial congressional cycle, and how it alters the partisan composition of the Senate, now exerts a greater pressure on a president's arms control agenda. Fearing a mid-term wave that sweeps into office senators of the opposing party, presidents may feel that they face a self-imposed domestic deadline to conclude and ratify an arms control treaty. Thus, as the presidential and congressional electoral cycles converge and collide, the window of opportunity for treaty ratification shrinks—and timing becomes everything. To successfully implement their arms control agenda, presidents must pin their hopes on the right international conditions aligning precisely with the right domestic ones.

BREAKDOWN IN CONGRESSIONAL-EXECUTIVE RELATIONS

The escalating partisanship of recent years has precipitated and compounded a breakdown in congressional-executive relations. These trends have not only changed and circumscribed the Senate's exercise of consent in the area of arms control but have also chipped away at the Senate's constitutional role of advice. In order for Congress to be an active player in the formulation of arms control policy, it must have a firm understanding of a president's agenda and the trajectory of ongoing negotiations, as well as consistent access to intelligence data on the nuclear programs

38. DeLaet and Scott, "Treaty-Making and Partisan Politics," 195.
39. Krepon, "Conclusion," 417.
40. Alan Platt, "The Anti-Ballistic Missile Treaty," in *The Politics of Arms Control Treaty Ratification*.
41. Krepon, "Conclusion," 423.

of adversaries.[42] Given its supporting role in foreign policy and intelligence-gathering, Congress depends heavily on the executive branch for most of this information. It has various tools at its disposal to collect information, such as holding oversight hearings and classified briefings, mandating periodic or one-time reports, and sending congressional observer groups to international talks. Keeping these avenues of information open, however, hinges on friendly relations between the two branches and, above all, on the willingness of the White House to share access and intelligence.

In the case of the LTBT, the Kennedy White House consulted early and often with Senate leadership and influential senators from the key committees on the scope and direction of test ban talks, sending top administration officials to Capitol Hill for hearings and even inviting a bipartisan Senate group to attend the LTBT's signing ceremony. Whereas Kennedy assiduously courted senators, Trump stonewalled and obfuscated. The Trump administration ignored congressionally mandated studies on the potential implications of letting New START expire.[43] It botched and delayed the release of the 2019 annual arms control compliance report, whose substance top lawmakers charged as being politicized and cherry-picked. In a disparaging letter to the administration, the chairs of the national security committees in the House asserted, "[i]t is not possible for Congress to be informed . . . when an Administration submits a mandated report to Congress that selectively ignores facts or injects non-factual information about certain threats to our country."[44] In another evasion of congressional prerogative, the Trump White House defied a requirement that the president give Congress 120 days' notice before initiating the withdrawal process from the Open Skies Treaty, prompting the chair of the House Foreign Affairs Committee to charge the administration with "knowingly breaking the law."[45]

Public congressional hearings on arms control also dropped off under the Trump administration. In his final two years in office, President Trump jettisoned two longstanding arms control and international security accords—the INF and Open Skies Treaties—and unveiled a new vision of arms control with Russia. Yet, despite this flurry of activity, the SFRC, the Senate committee entrusted with overseeing arms control issues and treaties, held only two hearings on Russia policy during the entirety of this period.[46] The Covid-19 pandemic, of course, has disrupted the normal rhythms of legislative activity, but the infrequency of hearings and lack of consultation fit the broader pattern of the Trump administration's stifling congressional oversight on foreign as well as domestic matters.

Charged with setting the hearing agenda and sending arms control-related legislation to the floor, the SFRC leadership during the last Congress also bore some responsibility. Senator Jim Risch (R-ID), who assumed the committee's chairmanship in January 2019, shied away from conducting oversight hearings and making the SFRC a public forum for debating President Trump's arms control policy.[47]

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42. Alan Cranston, "How Congress Can Shape Arms Control," in *Congress and Arms Control*, Alan Platt and Lawrence D. Weiler, eds. (New York: Westview Press, 1978), 244.
43. *National Defense Authorization Act Fiscal Year 2020* (P.L. 116-92), Section 1237, December 20, 2019.
44. "Schiff, Engel, and Smith Demand Briefing and Documents On Arms Control, Verification, and Compliance Report," Congressman Adam Schiff, May 16, 2019, https://schiff.house.gov/news/press-releases/schiff-engel-and-smith-demand-briefing-and-documents-on-arms-control-verification-and-compliance-report.
45. *National Defense Authorization Act Fiscal Year 2020*, Section 1237; and David E. Sanger, "Trump Will Withdraw From Open Skies Arms Control Treaty," *New York Times*, May 21, 2020, https://www.nytimes.com/2020/05/21/us/politics/trump-open-skies-treaty-arms-control.html.
46. "The Future of U.S. Policy Towards Russia," Hearing before the Senate Foreign Relations Committee, December 3, 2019, https://www.foreign.senate.gov/hearings/the-future-of-us-policy-towards-russia-11-20-19; and "The Future of Arms Control Post-Intermediate-Range Nuclear Forces Treaty," Hearing before the Senate Foreign Relations Committee, May 15, 2019, https://www.foreign.senate.gov/hearings/the-future-of-arms-control-post-intermediate-range-nuclear-forces-treaty.
47. Betsy Woodruff Swan and Andrew Desiderio, "Top aide: Senate chairman drops effort to secure Pompeo Testimony," *Politico*,

The SFRC's willingness to lie dormant and defer to the president provided the administration cover to make unilateral arms control decisions without meaningful congressional consultation and input. Moreover, these dynamics splintered the committee along party lines, transforming the SFRC into an arena for partisan skirmishing rather than one for substantive debate.[48] And finally, an inactive SFRC gave the SASC freer rein to dominate the congressional debate on how to approach the strategic competition with Russia and China.

The SFRC's inactivity and polarization, at a time of disruption to U.S. arms control efforts, contrast sharply with the activism and bipartisanship of the Fulbright years, when the committee played a leading role in shaping nuclear policy. Indeed, the juxtaposition between Fulbright and Risch is a testament to the power of the SFRC chair, as well as the importance of the chair's arms control philosophy and relationship with the executive branch, in setting Congress's overall stance on arms control. These various forces, from the Trump administration's evasion of congressional authority to a hobbled SFRC, have deprived Congress of the tools it generally relies on to influence arms control policy. Senator Bob Menendez (R-NJ), the ranking member on the SFRC, captured this sentiment in the aftermath of the Trump administration's decision to withdraw from the INF Treaty: "I urge all of my colleagues to focus not just on the substance of the President's decision but also on the process. INF is not alone – it is one of several treaties that the President has jettisoned without any input from the Senate. He is eroding the constitutional powers and institutional prerogatives of this body, and we cannot be silent."[49]

CONCLUSION

Congress's influence on arms control policy is by nature diffuse. In a body of 535 lawmakers, views and priorities differ, and consensus is reached only through compromise and public debate. The intense partisanship that defines today's political environment, however, has undermined consensus and substantive debate, fragmenting further Congress's influence at a time when arms control stands at a critical juncture. With Congress sidelined, the Trump administration acted largely unchecked as it withdrew from arms control treaties, increased nuclear weapons funding, and hurtled the United States into a period of greater strategic volatility.

Looking forward, the domestic impediments to arms control may grow even more insurmountable, adding to the challenges that it already faces on the international front. Deep partisan differences at home may deter presidents from entering into arms control treaties for fear that a negotiated agreement will meet its end in the Senate. Thus, the executive branch may pursue less formal efforts, such as non-binding political commitments or unilateral steps, that achieve the aims of arms control while sidestepping congressional obstacles. But without firming up a domestic constituency and with the frequent, sharp swings in U.S. electoral politics, such efforts risk being short-lived. And so, paralyzed by partisanship, Congress may soon no longer function as a ballast in stabilizing U.S. arms control policy, unable either to counter presidential initiatives that depart radically from the norm or to keep U.S. efforts moving forward on a coherent path.

June 7, 2020, https://www.politico.com/news/2020/06/07/senate-risch-drops-effort-pompeo-testimony-306377.

48. "Menendez Publishes Footage Of Restricted Committee Business Meeting," Senate Committee on Foreign Relations, May 21, 2020, https://www.foreign.senate.gov/press/ranking/release/video-menendez-publishes-footage-of-restricted-committee-business-meeting; and Andrew Desiderio, "Dems urge Senate Foreign Relations chair to seek Pompeo's testimony," *Politico*, June 11, 2020, https://www.politico.com/news/2020/06/11/senate-democrats-foreign-affairs-chair-mike-pompeo-testimony-313324.
49. "Menendez On INF Withdrawal," Senate Foreign Relations Committee, February 7, 2019, https://www.foreign.senate.gov/press/ranking/release/menendez-on-inf-treaty-withdrawal.

Assure to Deter

Planning U.S. Bomber Deployments for Extended Deterrence in the Second Nuclear Age

Zack Ziegler[1]

INTRODUCTION

"It takes only five per cent credibility of American retaliation to deter the Russians, but ninety-five per cent credibility to reassure the Europeans."[2] Denis Healey, British secretary of state for defense from 1964 to 1970, famously pointed to the paradox of establishing a U.S. nuclear umbrella in Europe: assurance is even more critical than deterrence. U.S. Strategic Air Command (SAC) and Cold War nuclear experts deployed hundreds of nuclear bombers and even a North Atlantic Treaty Organization (NATO) nuclear weapon sharing agreement to underpin an age of unprecedented multilateralism, peace, and prosperity. In fact, the U.S.-led nuclear alliance was so successful that it contributed to the collapse of the Soviet Union and ushered in three decades of a U.S. unipolar order. However, in 2020 U.S. nuclear deterrence is challenged not just in Europe but in the Indo-Pacific and the Middle East as well. In what Paul Bracken first dubbed the "Second Nuclear Age," actors such as Russia, China, North Korea, and Iran have made nuclear weapons a central part of their strategy to challenge U.S. power and convince their neighbors that the age of U.S. defense is over.[3] In response, the 2018 U.S. Nuclear Posture Review (NPR) sounded a klaxon for extended deterrence that reflects twenty-first century challenges and a multipolar world. While the 2018 NPR provides broad methods such as "military exercises" and efforts to "improve our shared understanding . . . of deterrence requirements," it is incumbent on U.S. Strategic Command (USSTRATCOM) to translate the elemental success of NATO and apply ally priorities to the operational planning, execution, and evaluation of extended deterrence.

Specifically, re-structuring nuclear-capable bomber deployments is central to this modernization. U.S. European Command (USEUCOM) reaps the benefits of NATO and its foundation as a nuclear

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2. Denis Healey, *Time of My Life* (London: Methuen Publishing Ltd, 2015), 243.
3. Paul J. Bracken, *The Second Nuclear Age: Strategy, Danger, and the New Power Politics* (New York: St. Martin's Griffin, 2013).

assurance. U.S. nuclear weapons forward-deployed to Europe and NATO's dual-capable aircraft (DCA) are central to U.S. extended deterrence in Europe.[4] Nonetheless, U.S. bomber deployments serve a critical role in scaling this otherwise constant deterrent to the evolving political-military environment. U.S. Indo-Pacific Command (USINDOPACOM) and U.S. Central Command (USCENTCOM) areas of responsibility (AORs) have much fewer tangible assurances against nuclear attack and require astute management of the nuclear triad if the United States is to stem nuclear proliferation and regional conflict in the twenty-first century. Nuclear-capable bombers stand out in their ability to assure when compared to intercontinental ballistic missiles (ICBMs) and nuclear submarines.[5] The bomber crews' ability to operate freely and visibly in and around allied nations serves as a banner of nuclear assurance that is unattainable for static missiles or discrete submarines. As such, an intentional restructure of bomber deployments that directly addresses ally assurance priorities at the operational level will pay large dividends for U.S. extended deterrence. First, bomber planners should shift to an "assure to deter" strategy that recognizes it is both more effective and realistic to incorporate ally priorities than guess at deterring those of an adversary. Second, USSTRATCOM should embrace the 2018 NPR's call to "strengthen the integration of nuclear and non-nuclear military planning" by coordinating with allies at the operational level on three key areas: presence, integration, and communication.[6] Lastly, the U.S. Air Force must invest in 100 to 200 B-21 Raiders, a twenty-first-century stealth bomber expected in 2025, with assurance at the forefront if the United States is to deter potential adversaries and hedge against an uncertain future.

PLANNING BOMBER DEPLOYMENTS TO ASSURE ALLIES WILL DETER POTENTIAL ADVERSARIES

Once nuclear capable bombers cross into allied airspace, the environment shifts from deterring an attack on the homeland to extending deterrence to U.S. allies. This shift should reflect a change in focus and methods, particularly toward assurance. At home, capability is the bedrock of deterrence. Potential adversaries must consider whether their strategic or tactical capabilities outweigh those of the United States in order to achieve a successful attack. For the bomber leg, deterrence includes safe and effective nuclear generations; reliable nuclear-inert weapon system tests; advanced tactics and technologies; and flexibility to deliver a counterblow after an attack. However, in accordance with U.S. doctrine, extended deterrence is demonstrating U.S. willingness to use this nuclear capability to protect an ally—otherwise known as assurance.[7] While each potential adversary mentioned in the 2018 NPR (Russia, China, North Korea, and Iran) is unique, one ambition is similar: the desire to overpower their neighbors. While Europe, the Indo-Pacific, and the Middle East pose unique strategic and tactical challenges, the assurance and deterrence relationship remains the same. Planning and executing bomber deployments with the primary objective of assuring allies will have the dual

4. "NATO's Nuclear Deterrence Policy and Forces," NATO, May 11, 2020, https://www.nato.int/cps/en/natohq/topics_50068.htm.
5. The U.S. nuclear arsenal consists of three "legs," each with unique deterrence and assurance advantages: intercontinental ballistic missiles (ICMBs), nuclear submarines, and nuclear bombers. Currently the U.S. nuclear bomber leg consists of 76 B-52s capable of launching nuclear-tipped air-launched cruise missiles (ALCMs) outside of enemy air defenses and 20 B-2 stealth bombers capable of dropping gravity nuclear weapons deep behind enemy lines. The U.S. Air Force also consists of 66 supersonic B-1 Lancers that were originally designed for low-level nuclear attack against the Soviet Union. After New START, the United States agreed to convert all B-1s to a conventional only mission. B-1s play a strong role in demonstrating U.S. global strike alongside the nuclear-capable B-2s and B-52s.
6. Department of Defense, *Nuclear Posture Review* (Washington, DC: 2018), vii, https://dod.defense.gov/News/SpecialReports/2018NuclearPostureReview.aspx.
7. Curtis E. Lemay Center for Doctrine Development and Education, *Annex 3-0 Operations and Planning: Practical Design: The Coercion Continuum* (Maxwell Air Force Base, Alabama: Air University, 2016), https://www.doctrine.af.mil/Portals/61/documents/Annex_3-0/3-0-Annex-OPERATIONS-PLANNING.pdf.

benefit of boosting an ally's power and convincing a potential adversary that its neighbor's coalition of power is too great to coerce.

While the United States regularly coordinates extended deterrence with its allies at the strategic level, there is much to be gained at a deeper operational level. Shifting to an assurance-first mindset will unlock the full potential of a USSTRATCOM organizational structure poised for extended deterrence. Currently, deployment planners spend significant resources and energy on a red herring: attempting to demonstrate extended deterrence without ally operational involvement. The planning hub for any bomber deployment is USSTRATCOM/J35 (Operations Plan Division) at Offutt Air Force Base, Nebraska. A team of 10 government civil servants work tirelessly to coordinate with their Geographic Combatant Command (GCC) counterpart to meld the USSTRATCOM commander's objectives with the GCC commander's campaign plan.[8] USSTRATCOM and GCC campaign objectives are often broad, as to increase the planner's latitude to respond to current events. Therefore, J35 and the respective GCC spend the lion's share of their effort using their personal understanding to design operational missions that reflect current events and STRATCOM-GCC broad intents. After establishing dates, locations, and proposed missions, J35 coordinates with Air Force Global Strike Command (AFGSC), which is tasked to train and equip U.S. bombers and ICBMs. AFGSC then coordinates with the respective bomb wing to execute logistical and tactical requirements for the assigned deployment. At all levels of the planning process, secrecy is treated as paramount to maintaining the element of surprise against a potential adversary. In fact, allies are typically notified only a month in advance of U.S. intent to involve them. As such, an ally typically only has the opportunity to make minor requests or reject the mission entirely. Ironically, potential adversaries often know of U.S. bomber deployments even before U.S. allies. While bomber deployment planning remains in a classified vacuum at higher echelons, the logistics required to move hundreds of personnel and heavy equipment are a neon sign to even mediocre intelligence services.

After the deployment, lessons learned return to the secret corners of USSTRATCOM. A team of 25 government civil servants at J73 (Assessments, After Action and Red Team Division) grade individual operations and the bomber deployment as a whole on a -9 to +9 scale of deterrence and assurance effectiveness. J73 personnel pull from a large database of classified and open-source reports to determine with varying levels of confidence whether a potential adversary was deterred or an ally was assured. A natural product of adversary actions is that deterrence reports often depend on analyst interpretation. While one analyst may see an adversary's air intercept as a positive sign of deterrence, another may interpret it as an opportunity for the adversary to gain realistic training or gather intelligence. Evaluating assurance is similar. Analysts use the same database to make assessments with varying confidence. Due to perceived operational security, at no point are J73 analysts afforded the opportunity to request feedback from the ally themselves. In short, evaluations of deterrence are at best an educated guess and those of assurance unnecessarily concealed. However, allowing USSTRATCOM/J35-J73 and their GCC counterparts to directly coordinate operational elements of assurance with U.S. allies will unlock their full potential and add a much-needed boost to extended deterrence.

8. In addition to commands with a functional mission such as USSTRATCOM, the U.S. Department of Defense geographically delineates command and control of military forces in peace and war between six geographic combatant commands (GCCs): Africa Command, Central Command, European Command, Indo-Pacific Command, Northern Command, and Southern Command.

COORDINATING KEY ELEMENTS OF ALLY ASSURANCE: PRESENCE, INTEGRATION, AND COMMUNICATION

Instead of shedding resources in an attempt to directly deter a potential adversary with uncertain results, this article suggests enabling deployment planners to gather ally priorities on an annual basis. This operational multilateralism will increase ally assurance while deterring the regional ambition of potential adversaries. Across Europe, the Indo-Pacific, and the Middle East, ally priorities during bomber deployments fit within three categories: presence, integration, and communication. After organizing B-2 bomber deployments at the unit level, interviews with allied military officers, and an in-depth comparative analysis, it became apparent to the author that these elements encompass the spectrum of ally concerns but also that specific connotations differ from one ally to the next. Armed with a list of specific ally priorities during U.S. bomber deployments, J35 and their GCC counterpart can direct their effort to applying STRATCOM and GCC goals across the region instead of struggling to infer the desires of various foreign populations.

PRESENCE

The ability of nuclear-capable aircraft to be present on foreign soil or operate across a region is a unique capability that underlies all other factors of assurance but must be balanced by ally priorities and existing resources. While a coalition of dual-capable aircraft and a nuclear weapon sharing agreement remain the bedrock of assurance in NATO, allies in the Indo-Pacific and Middle East rely on the deployment of U.S. bombers to meet similar levels of presence. ICBMs and submarines act as deterrents for potential adversaries but are inherently weaker forces of assurance due to their inability or limitations in foreign presence. In this regard, ICBMs and submarines are tied to a more difficult "deter to assure" strategy. The capability of ICBMs to attack within minutes forces an adversary to avoid miscalculating action against the United States and its allies that would result in their own destruction. Likewise, the survivability of submarines deters an adversary from wrongly assuming it could cripple the United States without retaliation. Foreign port calls for nuclear capable submarines may incur direct assurance benefits but have a relatively smaller impact since they are limited to offshore activities. The unique capabilities of ICBMs and submarines play a role in assuring allies, but such assurances are dependent on communicating U.S. resolve to use nuclear force in defense of an ally.

Fortunately, the foreign presence of nuclear-capable bombers addresses this communication gap so long as it addresses ally concerns and available resources. Hosting nuclear-capable bombers on ally soil is a clear sign of U.S. resolve and coalition power, which makes it likely to be an ally's first deployment priority. However, deploying bombers to air bases of every U.S. ally is neither realistic nor affordable. Planners can balance this priority with other competing interests by polling an ally's priority for regional presence. The author interviewed key stakeholders from a number of U.S. partners in Europe, the Indo-Pacific, and the Middle East who were unanimous in their first priority: having a U.S. bomber presence on their soil. However, their priority for regional presence was markedly different and nuanced. For example, Australian military liaisons and analysts emphasized the role U.S. bombers play in demonstrating commitment to Southeast Asia as a whole. Thus, deploying bombers to another Southeast Asian nation will assure Australia as well—a two-for-one bargain. However, South Korean military liaisons and analysts show nearly zero interest in regional presence at their own expense. In fact, planners unaware of the region's history would be surprised that U.S.-Japanese bilateral cooperation (without South Korean coordination or involvement) subtracts from South Korean-U.S. relations.

Nowhere are the dynamics of regional presence more important than the Middle East. Iran's nascent nuclear program makes it one of the most critical and achievable arenas of extended deterrence. Should Iran obtain nuclear weapons capabilities, few doubt that regional dynamics will go from bad to worse, with either a nuclear arms race, nuclear mishap, or conflict on a scale unseen since World War II.[9] "Saudi Arabia does not want to acquire any nuclear bomb, but without a doubt if Iran developed a nuclear bomb, we will follow suit as soon as possible," declared Saudi's Crown Prince and de-facto ruler Mohammed bin Salman in 2018.[10] Now is the time to establish effective extended deterrence in the Middle East that convinces Iran a nuclear weapons program is futile and likewise that its neighbors have no need for such a program. Therefore, it is also time to establish effective assurance. Attempting to assure allies in the Middle East without asking for their priorities is likely to be counterproductive. For example, stationing U.S. troops in Saudi Arabia during and after the Gulf War was a chief reason Osama bin Laden turned his ire against the United States.[11] While Saudi Arabia is likely to be a key focus of any assurance campaign, deploying U.S. nuclear-capable bombers to the "land of the Two Holy Mosques" is likely to distance a region with a Muslim majority and a perception of Western exploitation. Likewise, out of ease, U.S. bombers are likely to be deployed alongside a large U.S. conventional presence at Al Udeid Air Base in Qatar or Al Dhafra Air Base in the United Arab Emirates (UAE). However, the Arab Spring altered the political-military map of the Middle East, creating a difficult environment for USSTRATOM planners to navigate. In 2020, tensions have grown between Qatar and its ally Turkey and Saudi Arabia, the UAE, and Egypt. Like U.S.-South Korean-Japanese relations, U.S. bomber deployments to Qatar, the UAE, or Saudi Arabia without the other side's knowledge is likely to have a counterproductive effect on assurance.

Nonetheless, mutual regional assurance is achievable and should be the aim of bomber planners once aware of ally presence priorities. For example, Syria has quickly become the front line of both European and Middle Eastern regional power. U.S. bomber presence in and around Syria is likely to assure various allies such as Israel, Jordan, Iraq, Saudi Arabia, and Turkey that U.S. power in the region surpasses the regional ambitions of Russia or Iran. U.S. bomber presence in the Baltics assures nearly all NATO members that contribute their own forces to four battalions as part of NATO's Enhanced Forward Presence.[12] Assurance is thus most impressionable when bomber presence is coupled with ally and U.S. conventional integration.

INTEGRATION

> "Combatant Commands and Service components . . . will plan, train, and exercise to integrate U.S. nuclear and non-nuclear forces to operate in the face of adversary nuclear threats and employment. The United States will coordinate integration activities with allies facing nuclear threats and examine opportunities for additional allied burden sharing of the nuclear deterrence mission."[13]
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> — *Nuclear Posture Review*, 2018

9. "بعد أم لا - بودكاست الجزيرة," Al Jazeera, August 26, 2020, https://podcast.aljazeera.net/bad-ams-podcast.
10. Stephen Kalin and Parisa Hafezi, "Saudi Crown Prince Says Will Develop Nuclear Bomb If Iran Does: CBS TV," Reuters, March 15, 2018, https://www.reuters.com/article/us-saudi-iran-nuclear/saudi-crown-prince-says-will-develop-nuclear-bomb-if-iran-does-cbs-tv-idUSKCN1GR1MN.
11. Lawrence Wight, *The Looming Tower: Al-Qaeda and the Road to 9/11* (New York: Vintage Books, 2018).
12. "Enhanced Forward Presence (EFP)," North Atlantic Treaty Organization, 2020, https://lc.nato.int/operations/enhanced-foward-presence-efp.
13. Department of Defense, *Nuclear Posture Review*, viii.

In an "assure to deter" strategy, integrating U.S. nuclear bombers with ally and U.S. conventional forces abroad compounds the assurance of presence by tipping power away from potential adversaries and toward allies in the region. Specifically, conventional-nuclear integration (CNI) plays a central role in extending deterrence against what the 2017 National Security Strategy defines as "nuclear attack, non-nuclear strategic attacks, and large-scale conventional aggression."[14] Large conventional deployments such as NATO's Enhanced Forward Presence in the Baltics and U.S. bases in South Korea, Japan, and Qatar "play essential deterrence roles, but do not provide comparable deterrence effects—as is reflected by past, periodic, and catastrophic failures of conventional deterrence to prevent Great Power war before the advent of nuclear deterrence."[15] Thus, with the return of great power competition in the twenty-first century, nuclear-capable aircraft add a critical component (not achievable by other legs of the triad) to extended deterrence when integrated with ally and U.S. conventional forces facing large-scale aggression. For example, would Russia have overtaken Eastern Ukraine if it were patrolled by nuclear bombers? Recognizing this crucial role, bomber experts must proactively plan for assurance from both home and abroad as well as identify areas of under- and over-assurance where the United States can encourage allies to contribute to a coalitional regional deterrent.

A nuclear umbrella is only useful if it does not have holes. As multiple aspiring powers use nuclear weapons to expand their regional influence, the United States' aged nuclear umbrella is being tested in breadth and strength. In the immediate post-Cold War era, the relatively overwhelming power and resources of the United States allowed bombers to quickly react to flareups in regional hot spots such as the Taiwan Strait or Korean Peninsula. But, in accordance with the 8th Air Force motto, "deterrence through strength, global strike on demand"; demand in 2021is higher than ever.[16] Incursions by adversaries such as the 2014 invasion of Ukraine, Chinese military basing in international waters, North Korean missile launches over Japan, and Iranian outposts in Iraq, Syria, and Yemen cause allies to question the credibility of U.S. defense.[17] These flareups are quickly developing into flames that will outstretch U.S. assurance if not managed correctly. An increase in threats with a relatively smaller fleet has already caused bomber planners to transition from continuous bomber presence at key locations such as Guam to periodic presence at various locations across Europe, the Indo-Pacific, and the Middle East.[18] While bomber planners wait for the arrival of a sufficient number of B-21 stealth bombers to meet the increased demand for assurance, they must efficiently manage the flexibility of global strike to empower U.S. ally regional deterrence.

Flying nuclear capable bombers on long-duration flights out of the United States to integrate in conventional exercises abroad adds decisive assurance for allies facing large-scale conflict. These long-duration bomber missions have several deterrence, assurance, and practical benefits. In terms

14. Department of Defense, *National Security Strategy of the United States of America* (Washington, DC: 2017), 30, https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf.
15. Department of Defense, *Nuclear Posture Review*, vi.
16. The 8th Air Force is responsible for all bombers within the U.S. Air Force. "8th Air Force/J-GSOC," Air Force, https://www.8af.af.mil.
17. "Ukraine Crisis: Timeline," BBC News, November 13, 2014, https://www.bbc.com/news/world-middle-east-26248275; "China Island Tracker," Asia Maritime Transparency Initiative, https://amti.csis.org/island-tracker/china/; Missile Defense Project, "North Korean Missile Launches & Nuclear Tests: 1984-Present," Missile Threat, CSIS, April 20, 2017, last modified June 12, 2020, https://missilethreat.csis.org/north-korea-missile-launches-1984-present/; and "Case Studies in Iranian Expansion Across the Middle East," CSIS, May 15, 2019, https://www.csis.org/programs/transnational-threats-project/case-studies-iranian-expansion-across-middle-east.
18. Beth Markos, "Big Changes Are Coming to Air Force Bomber Missions. Here's Why.," Military.com, June 11, 2020, https://www.military.com/daily-news/2020/06/11/big-changes-are-coming-air-force-bomber-missions-heres-why.html.

of deterrence, they demonstrate an unmatched U.S. ability to rapidly and simultaneously reach multiple corners of the globe. Coincidentally, they also allow bombers to achieve levels of presence, integration, and communication that are crucial to assurance without the costly logistical footprint of deploying a squadron abroad. And in practical terms, long-duration missions of global integration are perhaps the very best crew training but are dependent on prior coordination with an equally overtasked tanker fleet. Therefore, from home station, bomber planners should strive to integrate nuclear-capable bombers in large conventional exercises with large ally participation. Perhaps the most obvious examples of these are NATO's Trident Juncture involving 31 nations, Jordan's Eager Lion involving 28 nations, or the ASEAN-U.S. Maritime Exercises in the South China Sea, which involves all 10 allies of ASEAN.[19] Moreover, bomber planners should tailor integration efforts to bomber characteristics. For example, the traditional B-52 bomber is primed for direct integration with regional allies on the front lines of potential adversaries. At nearly 70 years old and with a total of 744 ever built, the BUFF (Big Ugly Fat Fella) is one of the most iconic symbols of nuclear power in the world. Alongside allies and parked at large international air shows, it is a loud reminder of U.S. nuclear assurance. In contrast, the 20 $2.2 billion B-2s are not only limited in number but must be deployed to protect their stealthy radar signature. As such, headquarters often attempt to directly employ B-2s at short notice, unaware of key capabilities and limitations. Advanced planning for B-2 integration will allow B-2 experts the appropriate opportunity to balance assurance requirements with long-term stealth capabilities.

The advantage of bomber deployments is that the aircraft can operate throughout the region as a whole. These deployments are one of the greatest opportunities to act on the 2018 U.S. National Defense Strategy's charge to "strengthen and evolve our alliances and partnerships into an extended network capable of deterring or decisively acting to meet the shared challenges of our time." This established alliance network remains a "durable and asymmetric strategic advantage that no competitor or rival can match." Deployed bombers can strengthen this network by boosting allied conventional capacity. For example, the F-35 represents a major leap in capability for 11 major European, Indo-Pacific, and Middle East allies.[20] Its combination of stealth, electronic attack, weapons, and communications make it the "quarterback" of any coalition fight.[21] Bomber integration with emerging ally F-35 units in the 2020s is a good bet for assurance. While stealth bombers remain out of the military and economic reach of allies, integration with these stealth fighters has the dual impact of assuring allies and emphasizing their role in coalition strikes should extended deterrence fail. Moreover, U.S. bomber integration with dual-capable NATO F-35s will offer a unique scalable option for NATO deterrence and assurance. A $2.2 billion B-2 bomber flying alongside the F-35 is a persuasive reminder to NATO members and Russia alike that the alliance remains the most formidable and flexible nuclear partnership on the planet. Nonetheless, bomber planners should not limit integration to allies with exquisite aircraft. The Baltic countries of Lithuania, Estonia, and Latvia, for example, have relatively small air forces but have made NATO integration a cornerstone to their security. Each has invested in niche capabilities such as special operations, tactical air control, and

19. Megan Friedl, "U.S. Joins NATO's Trident Juncture Exercise," U.S. Department of Defense, October 18, 2018, https://www.defense.gov/Explore/News/Article/Article/1666272/us-joins-natos-trident-juncture-exercise/; Sara Yoke, "Eager Lion Exercise a 'Keystone Event' in U.S.-Jordan Partnership, Integration," U.S. Central Command, May 11, 2017, https://www.centcom.mil/MEDIA/NEWS-ARTICLES/News-Article-View/Article/1179543/eager-lion-exercise-a-keystone-event-in-us-jordan-partnership-integration/; and "ASEAN-U.S. Maritime Exercise Begins in Thailand," U.S. Mission to ASEAN, September 3, 2019, https://asean.usmission.gov/asean-u-s-maritime-exercise-begins-in-thailand.
20. "The Centerpiece of 21st Century Global Security," F-35 Lightning II, Lockheed Martin, 2020, https://www.f35.com/global.
21. "Multi-Mission Capability for Emerging Global Threats," F-35 Lighting II, Lockheed Martin, 2020, https://www.f35.com/about/capabilities.

mechanized infantry.[22] No matter how small, integrating with key capabilities can tip the balance of power in the most vulnerable regions. "Our allies and partners provide complementary capabilities and forces along with unique perspectives, regional relationships, and information that improve our understanding of the environment and expand our options."[23]

Likewise, by integrating nuclear-capable bombers with allied conventional assets, bomber planners can address areas of under- and over-assurance. Nuclear proliferation can occur when an under-assured ally seeks a dangerous independent deterrent (a nuclear weapons program being the worst) that heightens the prospect of regional conflict. After transitioning to an "assure to deter" mindset, USSTRATCOM/J73 can serve bomber planners by highlighting key areas of under-assurance that deserve attention. For example, what are Japanese and South Korean reactions to recent North Korean missile and nuclear tests? Are they investing in forces that complement or duplicate U.S. deterrence? What level of presence, integration, and communication is necessary to assure them of their defense? Over-assurance occurs when an ally over-escalates against an adversary or in contrast becomes defenseless. An ally emboldened by U.S. nuclear defense may be susceptible to over-escalating a conflict and dragging the United States into war. J73 should highlight areas of potential over-assurance that could lead to greater conflict. The Middle East may be such a case. For example, would U.S. bomber integration with Israel or Saudi Arabia be counterproductive? Would it embolden the allies to start a war with Iran, knowing the United States would come to their defense? The opposite is also true of over-assurance. Is an ally so convinced of U.S. security that it is becoming defenseless? Such over-assurance stretches valuable U.S. resources and emboldens adversaries. The clearest examples are NATO members who fail to meet minimum levels of defense spending. Highlighting such allies should discourage U.S. bombers from unilateral action but encourage them to integrate with an ally's conventional forces.

COMMUNICATION

If a bomber lands in Europe but Europeans never see it, did it land in Europe? Whether at home or abroad, bomber experts and public affairs (PA) teams can communicate presence and integration through media to assure allies of their defense. Communication is likely the weakest leg of the operational assurance factors. Once they arrive on foreign territory, bombers have a tendency to return to international waters, land to welcome U.S. visitors, and publish English-only articles on military websites. Instead, planners and PA teams can increase assurance by winning an ally's presence of mind and combining timely events to timeless commitments.

Bomber PA teams are an overlooked asset in the competition for soft power and ally presence of mind. Harvard professor Joseph S. Nye Jr.'s assertion that soft co-optive power will dominate the post-Cold War order has become a fact in 2020. Nye contended that: "Given the changes in world politics, the use of power is becoming less coercive . . . . Soft co-optive power is just as important as hard command power. If a state can make its power seem legitimate in the eyes of others . . . it may be spared the costly exercise of coercive or hard power."[24] Nye's soft co-optive power is precisely the

22. "International Co-Operation," Estonian Defence Forces, February 12, 2020, https://mil.ee/en/defence-forces/international-co-operation; "Military Capabilities," Aizsardzības ministrija (Latvian National Armed Forces), https://www.mod.gov.lv/en/nozares-politika/comprehensive-defence/military-capabilities; and "Defence Policy," Ministry of National Defence Lithuanian Armed Forces, July 22, 2016, http://kam.lt/en/defence_policy.
23. Department Of Defense, *Summary of the 2018 National Defense Strategy of The United States of America: Sharpening the American Military's Competitive Edge* (Washington, DC: January 2018), 8, https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf.
24. Joseph S. Nye, "Soft Power," *Foreign Policy*, no. 80 (1990): 153, doi:10.2307/1148580.

makings of U.S. extended deterrence in the Second Nuclear Age. Bomber crews and PA teams have the rarest of opportunities to use unmatched military hardware to extend U.S. soft power to advance peace and avert war.

PA teams can creatively employ the internet and social media from home or abroad to assure allies. While the military-military relationships of states may be strong, their citizens may be less assured or aware of the importance of U.S. extended deterrence. Therefore, the inability to assure the citizens of ally states can quickly result in a drift or reversal that undermines U.S. extended deterrence as a whole. While ally communication priorities should offer insight on means of traditional communication (e.g., newspapers, television, and radio stations), the internet has become a universal access point. The Information Age has drastically increased the role of soft power and shifted key elements of competition from the battlefield to the internet. The internet both facilitates and complicates ally awareness of bomber deployments. It facilitates by opening an unprecedented number of channels for foreign citizens to view and participate in bomber deployments. If a PA team were to post a picture on Instagram of U.S. B-2s and British F-35s flying over the White Cliffs of Dover with the hashtags "#NATO" and "#Defense" in multiple languages, it would not only be accessible to American and British citizens but also to Poles, Ukrainians, and Russians.[25] Nonetheless, the internet is also a contested environment. Viewers have the freedom to reuse content in their own language and for their own purposes. For example, the government-owned Russian Sputnik Arabic news channel distorted a mission the author flew as "American Bombers Train to Start Nuclear War" and added false information such as B-2s intentionally evading civilian air traffic control.[26]

To counter distortion, bomber teams can address allies and potential adversaries on their own turf and in their own language. While STRATCOM, GCC, or bomb-wing websites may rally troop morale, it is unrealistic to assume that many Japanese, Polish, Saudi, Russian, Chinese, or Iranian citizens regularly visit U.S. military websites. Instead, they are increasingly likely to access information via social media in their own language. Specifically, PA teams should focus on social media platforms prime for link building—those that allow users to access a photo or message via keywords and easily share that photo or message to a growing audience. Presently, Instagram and Twitter are two such platforms that are either widely used abroad or have indigenous parallels such as China's Weibo. Each offers a discover (Instagram) or search (Twitter) function on their front page for users to regularly view posts outside of their network. By contrast, Facebook is more insular. While Facebook may be the most prolific social media platform in a state, a user's content largely emerges from one's immediate "Friends," and its search prioritizes an immediate network. In short, a U.S. military photo or message highlighting a bomber's role in extended deterrence is more accessible to worldwide netizens on link-building platforms such as Twitter and Instagram.

However, language also plays a large role in accessibility. While English was the first language of the internet, its share of content has drastically decreased. In the mid-1990s, English made up 80 percent of online content, but in 2020, it only accounts for 26 percent. While English content continues to spread on the internet (742 percent growth in the past 20 years), it is quickly becoming outpaced by others (9,348 percent increase in Arabic, 2,650 percent increase in Chinese, and 3,653 percent increase

25. "Can You Guess Where in the World the #USAF and @Royalairforceuk Are Training in This Iconic Photo?," Instagram, posted by U.S. Air Forces Europe and Africa, September 3, 2019, https://www.instagram.com/p/B18Fi6uiyQq/?igshid=3taiqbez47rp.
26. "قاذفات ألامريكية-حاملة-الصين-تدرب-على-هجوم-نووي," Sputnik Arabic, June 29, 2018, https://arabic.sputniknews.com/military/201806291033421101-قاذفات-ألامريكية-حاملة-الصين-تدرب-على-هجوم-نووي/.

in Russian).[27] Therefore, even if a bomber PA team chooses the best social media platform and crafts the perfect statement of U.S. assurance, it is inherently blocked from reaching its intended audience through its use of English. Fortunately, in 2009 the U.S. Air Force recognized the need for "language enabled Airmen . . . [who] can better support the application of airpower through meeting the National Defense Strategy pillars of strengthening partnerships and interoperability." The Language Enabled Airmen Program (LEAP) consists of approximately 3,000 airmen in 95 languages, many of whom maintain "professional working proficiency" (ILR Level 3) or higher.[28] The mission of PA teams and LEAP airmen converge perfectly on extended deterrence. PA teams should employ LEAP to translate posts and keywords to targeted languages for maximum dissemination and assurance. By simply adding "#OTAN" (French for NATO), "#ةيامح" (protection in Arabic), or "#평화" (peace in Korean) to a social media post, PA teams open a line of communication to foreign citizens in need of U.S. assurance.

Moreover, bomber planners and PA teams can enhance the soft power of American extended deterrence by making a bomber's presence undeniable and maximizing U.S. and ally integration. The English saying "a picture is worth a thousand words" is extremely true for U.S. bombers and ally assurance, but PA teams must act smartly so these words are not twisted. When a B-2 or B-52 lands at RAF Fairford in England, it becomes a hot bed for amateur photographers (affectionately known as "bird watchers"). Typically, it begins when one or a handful of bird watchers tweets an inbound bomber location or posts a geotagged picture. Soon hundreds of bird watchers across the United Kingdom descend on the typically inactive base and flood the internet with eye-popping photos. Organically, bird watchers epitomize the unique role bombers play in communicating nuclear assurance. By their posts, they validate both the bombers foreign presence and British welcome. PA teams would be wise to take note. Out of convenience, military photos are usually taken from airborne tankers on established air refueling tracks at a distance from population centers. These pictures are by nature indistinguishable; the viewer has little way, other than by trust, to know if the photo is from the South China Sea or the Atlantic Ocean. The extra effort to capture a B-2 or B-52 photo over key landmarks will both validate U.S. bomber presence and coalesce foreign national pride. Similarly, photos with ally forces yield the positive effects of integration. Even if over the desert, Jordanian F-16s on the wing of a B-52 add both undeniable presence and coalitional power to an otherwise stock photo. In all cases, communication priorities will benefit from direct allied input. Such input will help PA teams and planners avoid cultural and political sensitivities while also leaving room for changes in sentiment, as was indicated by Japan inviting the B-2 nuclear bomber to its airshow in 2017.[29]

Lastly, a PA team should use the timely means above to assure allies of timeless U.S. commitments to defense. Even the best photos can be lost in translation without proper comment. While a bird watcher may capture an awe-inspiring photo of the stealthy B-2, without context it is powerless. It is unrealistic to expect foreign viewers to have knowledge of the nuclear triad, security commitments, or the role of bombers. Instead, it is the role of PA teams to generate soft power by combining a photo with its purpose. PA teams should directly refer to security commitments such as NATO, the U.S.-South Korea Mutual Defense Treaty, freedom of navigation in the South China Sea, or the

27. "Top Ten Internet Languages in The World - Internet Statistics," Internet World Stats: Usage and Population Statistics, March 31, 2020, https://www.internetworldstats.com/stats7.htm.
28. "Fact Sheet – Language Enabled Airmen Program," Department of the Air Force, May 2018, https://www.airuniversity.af.edu/Portals/10/AFCLC/documents/library/LEAP%20Fact%20Sheet.pdf?ver=2018-11-01-151005-460.
29. Jesse Johnson, "U.S. Sends Nuclear-Capable B-2 Stealth Bomber on Mission in Pacific Ahead of Trump Visit to Asia," *Japan Times*, October 29, 2017, https://www.japantimes.co.jp/news/2017/10/29/asia-pacific/u-s-sends-nuclear-capable-b-2-stealth-bomber-mission-pacific-ahead-trump-visit-asia/.

prevention of a nuclear Iran. Such clear messaging avoids any inference on the part of the viewer and guards against adversaries hijacking U.S. efforts for their own goals. PA teams should also consider overlaying unobtrusive messages that travel with the photo when shared and prevent tampering by adversaries. Likewise, prior coordination with allies allows opportunities for joint messaging. Attaching the quotes of allied leaders to bomber photos parades the coalitional power that underlies U.S. extended deterrence.

EMPLOYING THE RAIDER TO ASSURE

How the U.S. Air Force designs and produces the B-21 Raider in the next decade will either empower or restrain U.S. extended deterrence in the twenty-first century. The B-21 is the Air Force's stealth bomber follow-on to its current fleet of B-2 Spirits. The B-2 is currently the world's only stealth bomber and the only asset capable of penetrating an adversary's air defenses to release an unmatched array of conventional and nuclear weapons. This awe-inspiring feat of aviation is therefore one of the United States' most valuable tools of extended deterrence but also one of its greatest tools in large-scale conflict. Currently, planners rely on stealth experts at Whiteman Air Force Base in Missouri to balance the risk of espionage with the advantages of flying the B-2 abroad during peacetime. The B-21 team must design a stealth bomber to win in any twenty-first century conflict, but they must not forget a bomber's primary objectives is to deter and assure.[30] Failing to design the B-21 to operate freely during peacetime will inherently limit its access to airspace critical for extended deterrence and leave a dangerous void as the B-52 and B-1 fleets retires. No matter how large the fleet, the B-21 would be limited to integrating with allies on the fringes during a time when allies must lean on a more distant United States or capitulate to a coercive neighbor.

The number of B-21s produced will also have a direct impact on the United States' ability to extend its nuclear umbrella in the twenty-first century. After the fall of the Soviet Union, the U.S. Air Force reduced plans for 135 B-2s to 21. This reduction may have fit the post-Cold War unipolar order, but it is not sufficient for today's growing multipolar nuclear world. Producing a minimum of 100 B-21s and maintaining a fleet of 175 to 200 bombers is central to reversing the trend of periodic presence.[31] This revival of the bomber fleet will have the dual effect of assuring endangered allies across multiple regions and countering multiple adversaries. The small B-2 fleet is regularly forced to make hard choices between home station deterrence capabilities and the limitless requests of GCCs. By consequence, critical opportunities for extended deterrence in Europe, the Indo-Pacific, and the Middle East are missed. A revived B-21 fleet spread across multiple bases will advance homeland deterrence capabilities while simultaneously assuring allies across the globe. Continuous U.S. bomber presence will have the benefit of empowering multiple regional allies and permitting the United States to strike adversaries on one tank of gas if deterrence fails.

RECOMMENDATIONS FOR AN "ASSURE TO DETER" BOMBER DEPLOYMENT PLANNING STRUCTURE

Ask the allies. The primary operational hindrance to the current bomber deployment planning structure is a lack of ally input. Nevertheless, bomber planners cannot gather ally assurance priorities if they do not know who to ask. Europe is likely the most straightforward. NATO's Nuclear Planning

30. Department of Defense, *Nuclear Posture Review*.
31. James Drew, "USAF Global Strike Chief Seeks Beefed-up Bomber Force," Flight Global, February 26, 2016, https://www.flightglobal.com/usaf-global-strike-chief-seeks-beefed-up-bomber-force/119798.article.

Group (NPG) is the "senior body on nuclear matters" and is a forum in which 29 NATO member countries "can participate in the development of the Alliance's nuclear policy and decisions on NATO's nuclear posture, irrespective of whether or not they themselves maintain nuclear weapons." The NPG's Staff Group is composed of members of all participating countries that meet at least once a week.[32] STRATCOM/J35 and EUCOM/J35 should work with the NPG Staff Group to gather annual assurance priorities. Ideally, individual member states should provide priorities, as should the alliance itself. Member states who voice their individual priorities may illicit more candid responses and provide more direct understanding for bombers deployed in and around the respective state. Likewise, joint annual priorities from the NPG will inform STRATCOM and EUCOM campaign plans as a whole. In the Indo-Pacific, the bilateral nature of U.S. security agreements makes this task more difficult but no less important. The United States should continue to seek a multilateral approach to extended deterrence in the Indo-Pacific, but historical mistrust is likely to make joint assurance priorities from South Korea and Japan difficult. Fortunately, Japan, Australia, and South Korea hold liaison offices across the hall at STRATCOM. J35 should request specific annual assurance priorities from these liaison officers (LNOs) as well as employ U.S. Indo-Pacific Command's J92 Strategic Partnerships office to coordinate with allies in danger of Chinese aggression, such as Taiwan, the Philippines, and Singapore.[33] Gathering assurance priorities in the Middle East is less straightforward but likely the most important. The CENTCOM office for Mission Information Support Operations (MISO) provides the Department of Defense with "high impact and low cost investment to deter aggression, counter destabilizing behavior, and decrease the potential need for direct action" and can assist STRATCOM/J35 with priorities and LNOs.[34]

How do resources and ally assurance priorities overlap? Fueled with a list direct from the allies, bomber planners can prepare bomber home station missions and deployments in advance by maximizing the overlap of resources and ally priorities. Long-duration missions from the United States should reflect timely resources and large overlaps in ally assurance. For example, an unannounced flyby of airshows such as Britain's Royal International Air Tattoo (RIAT), the Dubai Airshow, or the Singapore Airshow are rare events that reflect the presence, integration, and communication key to ally assurance and demonstrates U.S. nuclear security to thousands.[35] In a similar manner, long-duration bomber missions that integrate with U.S. forces such as an aircraft carrier movement have the ability to demonstrate overwhelming conventional and nuclear power. Lastly, bomber planners should integrate into large conventional regionally based exercises such as BALTOPS, RIMPAC, and Eager Lion to provide necessary nuclear assurance to the intended extended deterrence.[36] On the other hand, bomber deployments on foreign soil offer greater opportunity to address specific ally priorities. Bomber planners can prep by determining how an ally's resources contribute to a coalitional extended deterrent. The dual-capable F-35s offer a unique opportunity to add to the assurance of periodic bomber deployments and the permanent assurance of NATO's

32. "Nuclear Planning Group (NPG)," North Atlantic Treaty Organization, May 27, 2020, https://www.nato.int/cps/en/natolive/topics_50069.htm.
33. "J92/J95 Strategic Partnerships/Public Diplomacy," U.S. Indo-Pacific Command, https://www.pacom.mil/Contact/Directory/J9/Strategic-Partnerships/.
34. "Operations and Exercises," U.S. Central Command, https://www.centcom.mil/OPERATIONS-AND-EXERCISES/.
35. RIAT is the world's largest military air show. The Dubai Airshow is the largest in the Middle East, and the Singapore Airshow is the largest in East Asia.
36. BALTOPS is NATO's largest annual exercise in the Baltics, involving 18 nations in 2019. Rim of the Pacific (RIMPAC) is the largest international warfare exercise and is held biennially. Eager Lion is the largest military exercise in the Middle East, held annually in Jordan and consisting of 18 nations.

nuclear weapons sharing agreement.[37] While a continual source of assurance, NATO's nuclear weapons sharing agreement can dwindle in the public consciousness as it moves out of sight and out of mind. Press releases that tie the nuclear sharing with the integration of F-35 and U.S. bombers is perhaps the greatest opportunity for extending nuclear assurance in the minds of Europeans beyond periodic U.S. bomber deployments.

Likewise, bomber planners should maximize assurance by overlapping ally priorities and minimizing fault lines. As discussed in the section on presence, polling ally priorities for regional presence is helpful for maximizing overall assurance. Bomber operations in Southeast Asia may have the dual effect of assuring the Philippines as well as Australia, while bomber integration with NATO's Enhanced Forward Presence in the Baltics may assure all four Baltic states and NATO countries contributing forces to the region. Nonetheless, it is realistic to assume that bombers will not be able to operate in all ally countries during a deployment. Using the same contacts for ally assurance priorities, bomber planners can coordinate ally events at bomber deployment locations with effective media to cover gaps in assurance. Ally assurance priorities help avoid ally fault lines while providing opportunities for increased cohesion. For example, overlapping South Korean and Japanese priorities should be weighted heavily. When diverging priorities cannot be avoided, they should be executed reciprocally and transparently.

What are the STRATCOM and GCC timely assurance objectives? Instead of broad statements, STRATCOM and GCCs should build specific, measurable, achievable, and timely (SMART) objectives that tailor assurance to respective regions during the upcoming fiscal year.[38] SMART objectives will reflect areas of under-assurance but also discourage over-assurance through ally burden sharing. While all ally assurance priorities should be considered, it is understandable that some are more crucial to U.S. extended deterrence. More weight should be given to allies facing the most direct threat of large-scale conflict (the Baltics, the Arabian Gulf, Northeast Asia, and the South China Sea, for example). Nonetheless, key allies such as the United Kingdom and Australia who often act as force multipliers in the region should receive special attention to synchronize efforts. STRATCOM and EUCOM's top 2021 objective might be: "deployed B-52 and B-2 squadrons host the NATO Nuclear Planning Group at deployed locations and issue a joint press release on social media platforms in all NATO member languages (to include Russian and Ukrainian) that emphasizes joint commitment to Article 5 and is accompanied by airborne B-52 and B-2 photos with at least one ally at recognizable locations during Baltic Enhanced Forward Presence and Norway's Trident Juncture."[39] J35 should disseminate STRATCOM-GCC objectives as well as key ally assurance priorities to AFGSC and bomb wings alike before the fiscal year for immediate planning. Bomb wings should focus on objectives but utilize specific ally priorities to extend assurance where possible.

Maximize presence, integration, and communication within acceptable risk. Regardless of headquarter intentions, bomber assurance is executed and thus succeeds or fails at the bomb-wing

37. F-35s are capable of releasing conventional weapons and nuclear B61 weapons as part of the U.S.-NATO nuclear sharing agreement. "Nuclear Disarmament NATO: U.S. Nuclear Weapons on the Territories of 5 NATO States," Nuclear Threat Initiative, June 28, 2019, https://www.nti.org/analysis/articles/nato-nuclear-disarmament/.
38. "Writing SMARTer Objectives," Defense Civilian Intelligence Personnel System, Department of the Army, October 2011, http://www.dami.army.pentagon.mil/site/dcips/docs/Lifecycle/ER/Writing%20SMARTer%20Objectives%20Fact%20Sheet.pdf.
39. Exercise BALTOPS is the largest annual NATO exercise in the Baltics and in 2019 included 18 nations, 50 ships, two submarines, three dozen aircraft, and 8,600 personnel. Megan Eckstein "U.S., NATO Want Expanded BALTOPS Exercise to Show Commitment to European Security," USNI News, June 19, 2019, https://news.usni.org/2019/06/19/u-s-nato-want-expanded-baltops-exercise-to-show-commitment-to-european-security. NATO's Enhanced Forward Presence consists of four continuous multinational battlegroups in Estonia, Latvia, Lithuania, and Poland. "NATO's Enhanced Forward Presence," NATO, March 2019, https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2019_04/20190402_1904-factsheet_efp_en.pdf.

level. There is a strong potential disconnect in achievability when passing STRATCOM-GCC objectives to bomb wings, especially those with stealth aircraft. Commanders should assign clearly defined acceptable levels of risk (ALR) to objectives that balance the rewards of extended deterrence with espionage threats to long-term capability. Communicating early will drastically increase success by providing stealth experts the time to plan and reduce risk. An "assure to deter" strategy is a shift in mindset at the bomb wing as well. Wings must find common ground between bomber crews, PA, and security personnel. Crews naturally prioritize warfighting training and capability over assurance. PA teams often prioritize public awareness over security. Security personnel are often the most conservative and typically favor long-term warfighting capability. The three must combine their expertise to maximize strengths of presence, integration, and communication to meet objectives within the established ALR.

Gather feedback and evaluate. If STRATCOM and GCCs build SMART objectives, bomber units will unlikely achieve 100 percent success. During a deployment or long-duration flight, crews should grade objectives and note additional ally assurance priorities met. Unsuccessful objectives should be analyzed according to the Air Force's Desired Focal Point (DFP) method by noting contributing factors and a single root cause that, if solved, would have resulted in the objective's overall success. Bomb wings should send this analysis to bomber planners at other bomb wings, to AFGSC, and analysts at STRATCOM/J73. For example, the deployed B-2 unit might note that the objective above was unsuccessful since weather prohibited Norwegian F-35s and the B-2 from overflight of Oslo. In debrief, crews highlighted that "not scheduling a backup day for STRATCOM-EUCOM's primary objective" was the root cause for failure.

Inform and enhance bomber planning. As in the top objective mentioned above, bomber experts should start a new planning cycle by asking allies for feedback. J73 should coordinate with J35's ally contacts to verify the success or failure of assurance priorities and whether they match the bomb wing's debrief process. Armed with ally and bomb-wing feedback, J73 should grade objectives on the -9 to +9 scale by further investigating key factors discussed in this article, including presence (How did a new location impact overall ally assurance?), integration (Did flying with the new foreign F-35s counter over or under assurance?), and communication (Did the intended audience interact with and positively respond to the social media post? Is another platform more effective?). Combined, J73 can provide (a) overall grades and analysis of STRATCOM-GCC objectives; (b) bomb-wing root causes, contributing factors, and lessons learned; and (c) direct ally feedback. With this information, J35 can weigh more efficiently the next round of ally assurance priorities to build the next year's STRATCOM-GCC objectives. J35 should send AFGSC and bomb wings updated objectives with J73's three-part analysis from the previous year. Such transparency is paramount if planners up and down the process are to increase effectiveness and avoid mistakes.

CONCLUSION

The end of the Cold War did not bring about a world free of nuclear weapons. Instead, it taught U.S. adversaries that nuclear weapons are the best way to exert regional power and disrupt the U.S. alliance system. During this Second Nuclear Age, the United States must design a more efficient strategy if extended deterrence is to survive. While ICBMs and submarines are critical to U.S. deterrence, it is the nuclear bomber fleet that can uniquely assure allies with foreign presence, integration, and communication of U.S. defense. Therefore, bomber planners must embrace an "assure to deter" strategy that recognizes it is more effective to ask for ally priorities than to guess at deterring multiple adversaries. In terms of presence, planners can maximize a finite number

of bombers by determining how an ally views regional security. In terms of integration, bomber planners must use home station missions to integrate in large regional events and deployments to address specific ally concerns. Third, public affairs teams must communicate bomber presence and integration by addressing allies in their own language and on their own platforms to win the twenty-first-century battle for soft power. Embracing this "assure to deter" strategy will enable U.S. Strategic Command (USSTRATCOM) to proactively and transparently plan bomber actions abroad that directly meet ally concerns and convince adversaries their neighbor's coalition of power is too strong to coerce. Likewise, how the Air Force designs and produces the B-21 Raider, its twenty-first-century stealth bomber, is crucial to whether bombers are hindered or equipped to extend deterrence during the Second Nuclear Age. The current U.S. bomber fleet of B-52s, B-1s, and B-2s were designed to penetrate Soviet airspace and drop nuclear weapons, a task which they have fortunately never completed. Nonetheless, bombers served as a primary tool of extended deterrence during the past 75 years of peace and prosperity. Embracing an "assure to deter" planning structure and designing a minimum 100 B-21s for peacetime deployment will allow the United States to extend the peace and hedge against an uncertain multipolar nuclear order.

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