Fit for Purpose?

The U.S. Strategic Posture in 2030 and Beyond

BRAD ROBERTS, EDITOR

Center for Global Security Research
Lawrence Livermore National Laboratory
October 2020

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This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory in part under Contract W-7405-Eng-48 and in part under Contract DE-AC52-07NA27344. The views and opinions of the authors expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC.
ISBN-978-1-952565-06-9 LCCN-2020919310 LLNL-MI-815397 TID-60097

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Introduction

Brad Roberts

The time is ripe to revisit questions about the future of the U.S. strategic posture. Next year, 2021, will bring a new defense strategy review and a return to basic questions of defense policy and posture by a new Congress and perhaps also a new administration. U.S. strategic forces, broadly defined here to include not just nuclear forces but also non-nuclear strategic strike, missile defense, and space and counter-space capabilities, can be expected to play a more prominent role in that process than in the past. This follows from the changing nature of modern warfare, the need to compete with and deter two major power adversaries who put a lot of stock in the strategic dimensions of modern war, and the need to address major concerns about U.S. deterrence strategy articulated in 2018 by the National Defense Strategy Commission.[1]

To help inform the expected 2021 discussion, CGSR convened two workshops in summer 2020. One focused on the nuclear deterrent, including not just the nuclear triad but also the associated capabilities for command and control as well as for extended deterrence. The other explored the non-nuclear elements of the strategic posture and associated questions about how to ensure the needed integration of these disparate elements. Both looked ahead a decade to 2030 and then another decade to 2040. Both also explored developments in the strategic postures of Russia and China on a comparative basis. In follow up to the workshops, we identified some of the most important ideas for further elaboration. This volume is the result.

To help focus our thinking, we posed a simple question: Will the U.S. strategic posture of 2030 be "fit for purpose"? This proved difficult to answer, not least because the question links to so many others.

What is the purpose for which the posture should be "fit"? In 2020, the U.S. strategic posture serves various purposes: insurance against threats to the vital interests of the United States and its allies, deterrence in a multipolar context, the preservation of strategic stability among major powers, extended deterrence to U.S. allies, assurance of various kinds, and as a hedge against geopolitical and technical surprise. These are long-standing national objectives and are unlikely to change by 2030. But there are new U.S. debates about strategic stability, extended deterrence, and assurance that cast some doubt on this judgment.

How should we account for multipolarity? U.S. policy calls for tailoring deterrence. How can its posture best support tailored approaches to at least three nuclear-armed

1 *Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission, November 2018, p1-2.*

competitors as well as other states capable of jeopardizing its vital interests, and those of its allies, by non-nuclear means? U.S. policy also calls for tailoring assurance of allies. How can its posture best support tailored approaches to nearly 40 allies in Europe, East Asia, and the Middle East?

What is the nature of modern war for which strategic tools are needed? And what is their expected role in modern warfare? In 2018, then-chairman of the Joint Chiefs of Staff, General Joseph Dunford, characterized modern war as "transregional, multi-domain, and multifunctional."[2] This stretches the requirements of "fitness" for the strategic posture well beyond what they were in the Cold War, when "strategic" could readily be equated with "nuclear."

How should we account for long-term strategic competition? Is the posture competitive? By what metrics? Will it be in 2030? What are the potential developments in the decade from 2030 to 2040 that might test that competitiveness? These questions invoke consideration of how to gauge the relative gain or loss of strategic advantage. In 2030, U.S. leaders (and the leaders of allied countries) determine whether the United States has gained strategic advantage, held steady, or lost ground relative to Russia and/or China. Leaders in Moscow and Beijing will have answers of their own.

How should we account for the particular requirements of winning, as opposed to those of deterring and competing? Given the nature of modern conflict, "winning" has a dual meaning: to win in time of crisis and war by achieving political outcomes desired by political authorities and to win in "peacetime" by "subduing an enemy" without fighting by competing effectively in "gray zone" conflict.

Finally, how should we think about an "appropriate mix" of capabilities for deterrence and defense in 2030? The term comes from NATO, which has long professed a commitment to such a mix, "at the lowest levels necessary" in the existing security environment. Taking a comprehensive view of the U.S. strategic posture, what is the appropriate mix of tools in the toolkit? The U.S. defense community generally pursues them separately with a conviction that more, and more capable, forces are better. If we were better at seeing the toolkit whole, might complementarities and gaps become more visible, allowing us to pursue a balance of the tools that could be deemed fit for purpose?

In sum, many of the metrics by which to assess whether the 2030 strategic posture of the United States will be fit for purpose are not yet in clear focus. By 2030, the new complexity of this strategic landscape will have become more familiar to us. And the real world will have provided its own tests of the fitness of the posture.

The essays included here explore different facets of this agenda from varied perspectives. The opening three chapters address the nuclear foundation of the U.S. strategic posture. Laboratory Director Bill Goldstein begins with an examination of the role of the U.S. nuclear enterprise in supporting national deterrence requirements,

2 Cited in Paula Thornhill and Mara Karlin, "The Chairman the Pentagon Needs," War on the Rocks (January 5, 2018).

arguing that that role is broader than many think and has evolved significantly over the last decade or two. He and John Harvey strike cautionary notes about the ability of the enterprise to deliver the capabilities required by 2030, given the toxic combination of prolonged under-investment in the weapons complex and barriers to modernized production processes. Sheryl Hingorani then explores the additional burdens on the complex that would follow a geopolitical or technical surprise, arguing that hedge strategies as so far practiced have not yet adequately addressed the risk of strategic surprise.

The next four essays examine non-nuclear elements in the U.S. strategic posture. I take up the missile defense topic, arguing that the United States has come to a crossroads where it must choose between continuing to try to fulfill an old purpose it can no longer fulfill and addressing a new strategic challenge. Dean Wilkening then addresses conventional prompt strike, arguing that hypersonic capabilities can add significantly to the U.S. strategic posture of 2030, so long as we are mindful of potentially destabilizing second-order effects. Ben Bahney addresses space and counter-space capabilities and comes to conclusions similar to Wilkening's. Paul Bernstein then takes up the question of how to ensure the needed integration of the tools in the strategic toolkit, arguing that success can be achieved only with steady incremental progress in tackling numerous obstacles.

The next three essays examine the 2030 U.S. strategic posture in comparative terms. Linton Brooks explores the balance among Russia, China, and the United States in 2030, arguing that the U.S. position will likely have been maintained but not improved. Anya Loukianova Fink sets out likely Russian views of the strategic balance in 2030 and comes to conclusions analogous to those of Linton Brooks (that Russia's position will have been maintained but not improved). Michael Shoebridge puts his focus on China's soft power strategy, arguing that it will make significant advances over the coming decade.

The volume closes with my discussion of conclusions. I would like to express my gratitude to all of the contributors for their investment of time and energy in enabling this discussion. We recognize that the picture presented here is incomplete—that there are many additional facets of this topic that merit deeper exploration. But we have to start somewhere. Please note that the views expressed here are those of the authors and should not be attributed to any institution with which they are or have been associated or to Lawrence Livermore National Laboratory or any of its sponsors.[3]

3 The appearance of external hyperlinks in this volume does not constitute endorsement by the United States Department of Defense (DoD) of the linked websites, or the information, products, or services contained therein. The DoD does not exercise any editorial, security, or other control over the information you may find at these locations.

The Nuclear Security Enterprise in the 21st Century

William Goldstein

During the Cold War, the U.S. nuclear security enterprise was continuously exercised to sustain capability, improve weaponry, and contribute to strategic stability. When the Cold War ended, the enterprise endured a period of lowered priority and under-investment. The result became evident in the decay of infrastructure, loss of production capability, decreased morale, and a lack of common purpose between the two agencies that share responsibility for the nuclear stockpile – the Departments of Defense and Energy (DoD and DOE).

Thirty years on, the evolution of the geostrategic landscape and the reemergence of major power strategic competition are generally recognized to require time-urgent modernization of our stockpile systems, recapitalization of related infrastructure, and a state of resiliency and responsiveness that recognizes the uncertainty of future developments. An ambitious modernization plan is being executed against challenging schedules, with the production complex in the National Nuclear Security Administration (NNSA) constrained in both capacity and capability. It must be noted that success in the current plan would not be possible without the nation's foresight in launching the stockpile stewardship program that has maintained the intellectual core of the DOE's nuclear weapons capability at the three NNSA labs. But synchronization between DoD and DOE on modernization requirements and schedules is also essential and requires elaborate and detailed coordination, a process that hasn't been fully exercised for three decades. Important elements of the production infrastructure are due to come online just in time, with little or no schedule flexibility, and we are largely reconstituting the same set of industrial processes that were in place during the Cold War. Stockpile modernization must be executed while balancing other critical mission elements: sustaining of the current stockpile, and investing in the research and development needed to meet future challenges.

In addition, nuclear deterrence is strongly and increasingly linked to other domains, from counterproliferation to gray zone activities, to contested space and the development of advanced conventional weapons and defenses. NNSA research and development centers contribute a growing array of critical work in these and other rapidly evolving, technologically intense national security areas. Aside from strong adjacencies to the nuclear deterrence mission, this work has played a crucial role in sustaining core competencies when investments in the stockpile were decreasing, and represents a unique, high-leverage resource for successfully competing in today's world.

We remain confident in our prospects for success. This confidence rests on key pillars of leadership focus, innovation, effective partnerships, and sustained investments in our values, our culture, and our capabilities. This chapter briefly reviews

the strategic environment and addresses objectives for the enterprise as well as the existing NNSA plan and the role of the National Labs. A number of challenges are then characterized, followed by a discussion highlighting key imperatives for ensuring success.

Strategic Environment

The changed and changing strategic landscape is apparent in two broad dimensions: geostrategic and technological. The requirements for the U.S. nuclear security enterprise can be derived from a cascade of national policy documents in effect today. The 2017 National Security Strategy is "guided by a return to principled realism… clear eyed about global competition…and acknowledges the central role of power in world affairs."[4] It describes a broad range of threats, foremost strategic challenges from Russia and China, as well as destabilizing aims of North Korea and Iran, and the persistent threat of terrorism. Maintaining deterrence, sustaining and modernizing U.S. nuclear forces and infrastructure, de-nuclearizing the Korean peninsula, denying Iranian pathways to nuclear weapons, and securing nuclear materials and weapons against terrorist access are key priorities in the face of these threats.

The 2018 National Defense Strategy highlights these same aspects of the strategic environment, and in addition addresses challenges to U.S. military advantage due to the increasingly disruptive and multi-domain aspects of warfare, the accelerating speed of technological advancement, and ease of access to commercially available technologies which have military utility.[5]

The 2018 Nuclear Posture Review was initiated by an executive order to "ensure that the United States nuclear deterrent is modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st-century threats and reassure our allies."[6] The resulting report clearly states that great power competition has replaced terrorism as the number one U.S. nuclear security concern.[7] The importance of stockpile modernization is highlighted, and additional supplements to the force structure, such as a Sea-Launched Cruise Missile and a prompt low-yield option, are called for to address the evolving threat context. Critical shortcomings in the production infrastructure are highlighted with increased urgency. Assurance commitments to our allies, as well as to the broad arms control and nonproliferation agenda, are reaffirmed.

The 2019 NNSA Strategic Vision describes the environment as being full of both emerging and enduring threats, as well as challenges magnified by the rapid pace of technology advancement.[8] Nuclear threats are characterized as more diverse and

4 *A New National Security Strategy for a New Era,* White House (December 18, 2017).

5 *Summary of the 2018 National Defense Strategy of the United States of America: Restoring the American Military's Competitive Edge* (October 2018).

6 *Presidential Memorandum on Rebuilding the U.S. Armed Forces,* White House (January 27, 2017).

7 *Nuclear Posture Review, 2018,* Department of Defense (February 5, 2018).

8 *Strategic Vision: Strengthening our Nation through Nuclear Security,* National Nuclear Security Administration (2019).

advanced than ever before, and in a context of increasing volatility and unpredictability. Strong concerns about the proliferation of weapons of mass destruction are raised.

National Objectives for the Enterprise

In the midst of a very complex and uncertain strategic environment, national-level enterprise objectives are relatively constant. First, the nuclear security enterprise must continue to ensure a stockpile of nuclear weapons that is safe, secure, and effective in meeting our deterrence and assurance objectives. This is underpinned by a comprehensive annual assessment for all existing systems, bringing the full suite of scientific tools, computational and experimental capabilities, and our deliberative and red teaming processes to bear. The Program of Record for stockpile modernization through life extension programs, alterations, and modifications must proceed on schedule to ensure no gaps in U.S. nuclear deterrent forces.

Second, the enterprise must actively work toward reducing global nuclear security threats through verifiable arms control agreements that strengthen strategic stability, and through nonproliferation efforts including our extended deterrence and assurance commitments to allies and our obligations under the Nuclear Non-Proliferation Treaty (NPT). Denial of access to nuclear materials, technology, and expertise by rogue states or terrorist organizations is another enduring aspect of global nuclear threat reduction.

Third, we must continuously strengthen and update our capabilities and grow capacity and efficiency to respond in a timely manner to new or changing requirements. Cutting-edge science and research capabilities, production infrastructure recapitalization and a strong defense industrial base, modern techniques for accelerating the pace of our operations, a diverse world-class workforce, and a portfolio of programs and activities that fully exercise all requisite skill sets are the essential elements that make up the posture needed to ensure long-term success.

NNSA Plans

The NNSA complex of labs, plants, and sites plays a key role in achieving the objectives of the enterprise. Over the coming decade it must deploy to the stockpile the life-extended B61-12 nuclear bomb, replacing four variants of the B61 with a single modernized system, compatible with the digital interfaces of future strategic and dual capable aircraft. The W88 Alt370, with replacement non-nuclear and high explosive components, must be fielded. At LLNL we are focused on the W80-4 cruise missile warhead and the W87-1 ICBM warhead, with first production unit dates of 2025 and 2030 respectively. A decision to retain the B83-1, the only remaining megaton class weapon in the U.S. nuclear arsenal, might also require a life extension program for that system. Further ahead, we are preparing for the replacement of the W87-0, and an analysis of alternatives for a Sea-Launched Cruise Missile.

It has been decades since the complex has seen weapon development programs of this scope and magnitude. Yet, here at Lawrence Livermore National Laboratory (LLNL) we are prepared to execute successfully owing to the enterprise-wide investments

made in science-based stockpile stewardship, and owing also to the high-quality workforce we have continued to attract to our mission. Still, new cutting-edge tools and capabilities such as advanced manufacturing and model-based systems engineering must become essential elements of our modern enterprise to realize opportunities for greater efficiency and lower costs. Simply scaling up the historic approaches deployed during the Cold War—when cost, efficiency, and sustainability were relatively unimportant—will require ever increasing, unsustainable budgets to deliver on the growing program of record.

The global nuclear threat today is more diverse and dynamic than ever before. Globalization of the civilian nuclear fuel cycle, and the democratization of technology, lead to dramatically increased proliferation risk, with shortened timelines for establishing nuclear weapons programs. Advanced manufacturing techniques lead to the risk of smaller footprints for these programs, with challenges to effective detection. At LLNL, we are working across the entire threat space: performing threat characterization and analysis, securing materials that figure in the nuclear fuel cycle, developing methods to warn of nuclear proliferation at earlier stages, providing new technologies for treaty monitoring and verification, and strengthening post-detonation forensics to ensure timely and actionable response options. We are bringing to bear our fundamental understanding of nuclear weapons design and development, and deep expertise in nuclear transport pathways, radiation detection, nuclear forensics, and detonation and post-detonation phenomenology. High performance computing, coupled with advanced sensor systems, data science, and machine learning offer the promise of rapid detection of proliferation signatures and greater confidence in our assessments.

Across the enterprise, we are in the midst of a massive recapitalization of the NNSA infrastructure, especially the production facilities and equipment required to deliver on the stockpile modernization commitments. LLNL is using the W80-4 and the W87-1 programs to drive change through our partnerships. We are rethinking the weapon system lifecycle from beginning to end, considering sustainability, manufacturability, schedule requirements, and cost effectiveness from the earliest conceptual stages. We are creating a production enclave at the Lab to additively manufacture polymer parts, reimagining the serial processes by which new parts are developed and produced. By blending research and development (R&D) with production development, we are accelerating learning, decreasing development time, and challenging our weapons scientists to imagine new, agile business processes. This approach also creates small scale *surge* capacity across the enterprise which could be deployed to add real resilience and mitigate the many single point failures in the system.

We are also recapitalizing and upgrading major scientific capabilities, creating a modern campus by building new office and light lab space, upgrading utilities and infrastructure to ensure that next-generation capabilities such as exascale computing can be supported, and transitioning and dispositioning hazardous facilities and equipment. Stronger positioning for critical partnerships with academia and the private sector is underway through the investments we are making in our Open Campus. The

Advanced Manufacturing Lab (AML) is a good example. Dedicated this year, it hosts researchers from nearly a dozen external institutions ranging from Silicon Valley startups to world class universities and large private sector companies.

Ultimately, the NNSA is striving toward an enterprise posture which is "adaptive, agile, responsive, and resilient" to ensure our long-term success in meeting future national security requirements. We have adopted a goal of dramatically decreasing the time required to go from nuclear concept to deployment, if the nation has an urgent need for a new weapon system. We are using cognitive simulation to directly analyze the vast amounts of data we have, including new high-fidelity data we are generating today, as well as historic underground nuclear test data, to train and constrain our models using artificial intelligence and machine learning algorithms. The addition of engineering design optimization tools will enable us to work from concept through product *in silico*, to provide the best integrated solution for any requirement. Increased use of model-based engineering will diminish the need for many of the engineering tests and "cut and try" activities we undertake today. We have expanded our exploration of additive manufacturing across the full suite of stockpile materials and believe this will enable a fundamentally different approach to design, engineering, and production.

The challenges faced by the enterprise at this moment are numerous, and in some ways made daunting by the uncertainty in our environment.

Strategic stability now and into the future requires solutions to a complex, interdependent system of multi-polar, multi-domain challenges across a spectrum of conflict including asymmetric and gray zone scenarios. Nuclear deterrence and assurance now exist in a broader context of advanced technology threats to enabling support systems such as our space assets, as well as direct threats to our force structure. Strategic—perhaps even existential—threats once the sole purview of major powers can now be wielded by rogue and non-state actors due to the increasing digitization and connectivity of not only instruments of war but our economies and societies overall. Real success in the coming decades will require NNSA and the National Labs to work across the interagency, with all major stakeholders and partners, to strengthen the intellectual and analytic capacity for strategic thinking in this era of extreme complexity. Agility in the face of future uncertainty and complexity can be ensured through an appropriately forward-looking portfolio of options for both kinetic and non-kinetic offensive tools, defensive systems and countermeasures, situational awareness, and economic and diplomatic measures, as well as norms and agreements.

Challenges

The challenges faced by the enterprise at this moment are numerous, and in some ways made daunting by the uncertainty in our environment. The hard-won bipartisan consensus on the scope and schedule for stockpile modernization may turn out to be fragile in the face of financial strains caused by the novel coronavirus. The future of

the New START treaty, and the overall approach and specific details of follow-on arms control agreements, could have significant implications for our force structure as well as the political support for stockpile modernization. Adjustments to the Program of Record in the form of schedule deferrals and/or scope reductions in major programs would disrupt the tightly coupled plan we are currently executing for modernizing the stockpile and infrastructure along with the necessary investments in science and the path we are on to grow the next generation of nuclear security experts.

As Russia and China move forward with the modernization of their offensive nuclear forces, as well as their air and missile defense systems, and as regional developments continue to unfold in Europe and Asia, additional requirements for U.S. nuclear deterrence and assurance capabilities could emerge. The investments we are making now in the science and production infrastructure must result in a modern, agile complex, and position us well for meeting future needs. Our approach to the workload we are executing, through the life extension programs as well as the Stockpile Responsiveness Program (SRP), must provide opportunities for new staff to be challenged in ways that build the expertise and judgement required to make critical decisions about the stockpile.

The significant scale and timing of the nuclear weapons program work is superimposed on a large and growing demand for NNSA capabilities to address other national and homeland security needs. Unique skills and expertise, one-of-a-kind facilities, multi-disciplinary teams, the life cycle integration of intelligence-based threat characterization, advanced system concepts, frontier research, and deployed products for strengthening security and stability are foundational capabilities that can and should be used to benefit multiple government agencies.

This unprecedented growth in program deliverables, research initiatives, and infrastructure recapitalization has accelerated the inter-generational turnover of our workforce. As we rapidly staff up to position ourselves for success with the increased workload, we are also implementing succession plans for new leaders to replace retirees. A systematic and purposeful strategy for knowledge transfer, including not just expertise and skills but also the culture and ethos of service in the name of national security, is essential to our success. Effective new employee onboarding, rotational assignments to build broad contextual awareness, and continued reinforcement of the characteristics and principles of a learning organization are additional elements of the strategy for growing the next generation of national security experts.

The rapid pace at which technology is being created and spread, and the attendant risk of strategic disruption and surprise, cannot be ignored. We must retain our world-class status through discovery science and applied research in a variety of areas such as quantum computing, cybersecurity, artificial intelligence and machine learning, robotics and autonomy, advanced manufacturing, biosciences, and biotechnology. Particular attention must be paid to the imperative of performing world-class science, which often requires international collaborations and partnerships, while also ensuring security measures that protect U.S. interests and advantages.

Imperatives for Success

Today's enterprise plans and priorities are driven by the lifetimes of the weapons in the stockpile, and the need to address aging and technology obsolescence on a schedule that ensures no gaps develop in the U.S. nuclear deterrent. While we deliver on this program of record, we must also look beyond the current decade and create an enterprise—the people, the infrastructure, the science, and the culture—that will serve the nation's needs well beyond 2030. Highlighted here are three leadership imperatives for ensuring our success: strong partnerships, cutting edge science, and a world-class workforce.

A number of interagency partnerships are required for success. Continued close cooperation between DOE and DoD must occur at many levels to ensure that the modernization of nuclear delivery platforms and warheads remains fully synchronized and we prevent any capability gaps in the U.S. nuclear deterrent force. Collaboration and information sharing with the intelligence community, though the Joint Strategic Deterrence Review and in other forums, keeps the NNSA community involved in the characterization and analysis of evolving threats and emerging technologies that could have relevance for deterrence effectiveness. It also allows the early identification of options for risk mitigation. Interagency work with the State Department allows for dialogue on arms control alternatives with implications for U.S. nuclear force structure and provides the opportunity to develop enhanced verification and monitoring regimes. Within the NNSA system, strong alliances between the labs, plants, and sites are necessary to optimize the design and manufacturing workflows, and ensure the right suite of complementary and shared capabilities.

The founding legislation for the National Nuclear Security Administration, two decades ago, included as one of the NNSA missions to "support United States leadership in science and technology." This was early recognition of the key role the NNSA enterprise plays in the national innovation ecosystem. The vast suite of experimental and computational facilities and equipment created by the Science-Based Stewardship Program, coupled with the top talent that the men and women of the NNSA enterprise represent, is essential for preventing strategic surprise. This is even more important today, in an era of renewed great power rivalry with Russia and China. Both of these countries have laid out sweeping plans for dominating in key research areas such as artificial intelligence, and both authoritarian regimes have an advantage over the U.S. in terms of their ability to compel private sector entities and academia to collaborate with the government in areas of national security science and technology. The NNSA labs must redouble our efforts to stay on the cutting edge, particularly in potentially disruptive scientific fields and at the seams and intersections amongst disciplines.

We cannot succeed—as a Lab, as an enterprise, or as a nation—without the highest quality people and the best technical minds motivated by our mission. We must continuously strengthen our ability to attract the next-generation workforce and retain our current experts. In some areas this requires continuity, for example,

of purpose, ethos, and values. In other areas, change is required. Our institutions will not be able to excel in the 21st century without modern work approaches that ensure accelerated cycles of learning and embrace the transformational opportunities of new technologies, rather than viewing them solely as a source of risk. And we must find ways of drawing on all available talent by reinforcing a culture of inclusion, where equal access to opportunity is assured for all. We have come a long way, and there is more to do. At this moment, in 2020, we have to intensify our efforts to create institutions where traditionally under-represented groups such as women and minorities can thrive as they contribute to U.S. national security and global stability as part of the NNSA nuclear security enterprise.

Modernizing the U.S. Nuclear Arsenal—The Road to 2030 and Beyond

John R. Harvey

Many of us take as a given that U.S. nuclear forces help prevent major wars and promote strategic stability among the major powers. But these forces are underwritten by a set of exquisite capabilities that also contribute to the deterrence of adversaries and the assurance of allies: the people who design, develop, secure, plan, operate, and maintain nuclear forces and the associated research, development, manufacturing, and operational infrastructures. Over the next few decades this set of capabilities will be tested in very complex modernization programs that will involve the near simultaneous replacement of every leg of the aging triad, a major upgrade to the command and control system that links nuclear forces with presidential authority, and recapitalization of the nation's aging warhead production infrastructure. As former Secretary of Defense Ash Carter said, either we replace aging platforms and systems or we must remove them from service. There is no other choice.

But there is also significant uncertainty about the prospects for the success of this modernization program. To better understand these prospects for success, this chapter sets out to explore the following key questions:

- What is the existing modernization plan for U.S. nuclear forces?
- What factors might obstruct success?
- Might new requirements emerge?
- What impact might alternative arms control futures have on modernization?

The chapter begins with a review of the Triad modernization programs now underway. Next, it examines three major risks to successful modernization: program execution risk, risk to continued bipartisan support for modernization, and risk from evolving threats and technological surprise. Lastly, it explores the implications of "modern conflict" and of arms control for U.S. nuclear posture and programs.

Triad Modernization

The first order of business is sustainment: ensuring that today's nuclear triad, U.S. dual-capable fighter bombers, and associated nuclear command and control (NC2) remain operational until modern replacements are available. The major replacement programs underway in the Department of Defense (DoD) include:

- Modernize the sea-based deterrent with a new Columbia-class ballistic missile submarine (SSBN) to replace the Ohio-class submarines deployed since the 1980s

- Develop a follow-on Inter-Continental Ballistic Missile (ICBM)—the so-called Ground-Based Strategic Deterrent (GBSD)—to replace the aging Minuteman III
- Move forward on fielding a new B-21 strategic bomber
- Field a Long-Range Stand Off (LRSO) missile to replace the current air-launched cruise missile
- Ensure continuing ability to meet deterrence commitments to allies with a nuclear-capable F-35 Joint Strike Fighter
- Begin a program to develop and field, in the next decade, a nuclear-armed submarine-launched cruise missile (SLCM)
- Field a "next-generation" NC2 system that is responsive to both advancing threats and the evolving vision for modern conflict

In close parallel, there are many programs underway in the National Nuclear Security Administration (NNSA):[9]

- Meet planned schedules for four warhead Life Extension Programs (LEPs)—the B61-12 bomb, the W76-1 (now complete) and W88-alt SLBM warheads, and the W80-4 warhead for LRSO
- Field a low-yield warhead for the Trident D-5 Submarine Launched Ballistic Missile (SLBM)
- Plan to retain the B83 bomb in the nuclear stockpile
- Accelerate by one year the W78 ICBM warhead LEP
- In partnership with DoD, start work on a next Navy SLBM warhead—the Mk7/W93
- Advance concept and feasibility studies for a modern nuclear SLCM warhead
- Provide enduring capability and capacity to produce plutonium pits at a rate of no fewer than 80 pits per year by 2030
- Restore safe and environmentally-sound manufacture of highly enriched uranium (HEU) components at the Y-12 plant
- Ensure the necessary reactor capacity and availability of sufficient unobligated low-enriched uranium (LEU) to produce an adequate supply of tritium for nuclear warheads
- Ensure continuity in U.S. capability to develop and manufacture secure, trusted rad-hard microelectronic systems beyond 2025 to support stockpile modernization
- Maintain/enhance the personnel, computational, experimental, and test capabilities needed to assess annually the safety and reliability of the nuclear weapons stockpile as well as to design, develop, and produce modern nuclear warheads as needed in the future

9 For further information, see *Nuclear Posture Review 2018* (Washington, DC: Department of Defense, Office of the Secretary of Defense, February 2018).

There are three major risks to successful completion of this intensive modernization effort.[10]

Program Execution Risk

First is program execution risk. Slips in individual programs, coupled with serious shortfalls in the aging warhead production infrastructure, can degrade deterrence from not having forces available sufficient to meet targeting needs. The entire work program reflects a modernization challenge not experienced in over 40 years, since the days of the Cold War, and we should anticipate significant technical and programmatic challenges in completing it on time and cost. Several factors contribute to increased risk. Previous delay in initiating programs has left no margin for error in fielding these systems on current schedules. Very importantly, these programs are not stovepipes but highly interconnected. For example, the retirement of the ALCM carried by B-52, the production ramp-up of the LRSO which replaces ALCM, the deployment of the B-21 bomber which will also deliver LRSO, and NNSA's program to field the LRSO warhead must all be synchronized. Problems or delays in one program will reverberate through the others causing additional delays and increased cost.

Some modernization—bombers, cruise missiles, satellite systems—can rely on a robust research and development (R&D) and manufacturing base built up over years from related activities in the commercial sector, from other non-nuclear DoD programs, or from both. For other nuclear-unique systems—solid rocket motors, reentry systems, means for SLBM underwater launch, and rad-hard electronics—the tech base is less mature. As found out from painful past experience, programs may need to re-learn, or adapt, production processes not used in decades, which can add complexity to these efforts as well as cost and schedule risk.

Some in DoD who oversee nuclear modernization believe that the greatest challenge will be during the period starting the end of this decade when the transition of aging delivery systems to their modern replacements begins. This highlights a key point for managing risk; specifically, as modernization proceeds, adequate resources must be devoted to sustaining existing forces until such time as they can be replaced. Stellar program execution over many years by highly-qualified and seasoned acquisition officials will be essential. To avoid a degraded deterrence posture, aggressive measures, with some inherent risk in themselves, may be needed to extend even further the life of current systems to "cushion" potential delays in their replacements, or accelerate a well-performing program for one delivery system to hedge delays in another.

Very importantly, acquisition oversight must view nuclear modernization not as individual stovepiped programs but as an integrated whole that cuts across both DoD and NNSA programs and is managed as such. Only with this type of integrated

10 For further information on the modernization program, see *U.S. Strategic Nuclear Forces: Background, Developments, and Issues* (Washington, DC: Congressional Research Service, updated April 27, 2020).

oversight can appropriate tradeoffs be made, such as adjusting funding or iterating requirements within or among individual programs to manage acquisition program risk, for example.

As a possible model, in 2018 U.S. Strategic Command was assigned to be the day-to-day lead for NC2. Its job is to develop overall NC2 requirements, serve as the lead systems' architect, and oversee (but not execute) sustainment and modernization programs supporting that architecture. This is a very welcome development and long overdue. Over 100 NC2-related acquisition programs are being managed, and systems operated and maintained, by three services and a defense agency with infrequent (and often inadequate) high-level coordination among them. While it is still too soon to tell whether this experiment will succeed, we should pay close attention to STRATCOM's progress on NC2 in seeking to establish comparable integrated oversight for nuclear modernization.

Risk to Bipartisan Consensus on Modernization

A second risk is to continuing a bipartisan consensus on modernization. Early in his second term, in part due to Putin's reckless behavior in Crimea and elsewhere, President Obama moved out aggressively on nuclear modernization and received strong support from Congress. There were two reasons for this. First, he mollified the Left's distaste for modernization by giving voice to a long-term aspiration for eliminating these weapons (but not in his lifetime!) by avoiding modernization programs involving new warheads or fundamentally new military capabilities, and by moving forward on the New START treaty with Russia. Second, he captured the Right by agreeing to fund modernization at a higher level than originally intended in return for support from Senate Republicans on New START ratification.

The Trump team put together a nuclear review and associated modernization program for nuclear forces that drew on much of what it inherited from Mr. Obama. The 2018 NPR is thoughtful, balanced, and in the mainstream of U.S. nuclear policy as it has evolved in the eight decades of the nuclear age.[11] As a result, bipartisan support in Congress for nuclear modernization continued for Mr. Trump's first three budget requests. In the run-up to passage of the FY20 National Defense Authorization Act (NDAA), for example, there were few major disputes on nuclear programs between the Democrat-controlled House and the Republican-controlled Senate. Remaining areas of contention involved (1) whether to slow down GBSD, the replacement program for Minuteman III, by cutting its funding, (2) whether to cut funding for two NNSA programs (warhead pit production, the W87-1 LEP) that support GBSD, (3) whether to field a low-yield warhead for Trident, (4) whether to proceed on a study for a new nuclear SLCM, (5) whether to adopt a "no first use" policy, and (6) whether to retire the B83 bomb. In the final bill, passed by both Houses, all issues in dispute

11 John R. Harvey, Franklin C. Miller, Keith B. Payne, and Bradley H. Roberts, "Continuity and Change in U.S. Nuclear Policy," Real Clear Defense (February 7, 2018).

were resolved, and nearly all of the associated funding restored consistent with the President's request. Although not yet settled (as of July 2020), there is reason to be optimistic that the FY21 authorization and appropriations bills will continue to reflect strong bipartisan support for nuclear modernization.

The big question is whether, over the two decades that modernization plays out, successive Presidents will be able to persuade successive Congresses to continue necessary bipartisan political and financial support. Consensus is fragile and can easily be damaged. Modernization will be attacked as unaffordable and, yes, $1 trillion over 30 years is not cheap.[12] But the cost argument has not received much traction so far. Both the Obama and Trump administrations made clear that nuclear forces are America's #1 national security priority. Moreover, nuclear sustainment and modernization will consume less than 7 percent of the annual defense budget, declining to 3 percent as modernization winds down. Given its high priority as expressed by two very different Presidents from two very different administrations, and the relatively small fraction of the defense budget consumed, many see modernization as both essential and affordable.

Bipartisan support for nuclear modernization has traditionally been linked to continued bipartisan support for arms control. Recall the dialogue between Mr. Obama's team and Senator Jon Kyl that led to both Republican support for New START ratification and increased funding for modernization.[13] Despite positive words about arms control in the 2018 NPR, there is a perception among some, based on recent reports suggesting its resistance to New START extension and possible interest in a resumption of underground nuclear testing, that the Trump team is actually hostile to arms control.[14] Irrespective of who is elected president next November, the fate of modernization in future Congresses may well hinge on conveying a different message; that is, arms control and related initiatives complement U.S. nuclear forces in helping to manage global nuclear threats.

On this last point, so long as Russia continues to comply, a key proviso, U.S. support for New START extension to me is a "no brainer." This is so not primarily for its purported benefits for strategic stability (of which there are some), or for its role advancing U.S. nonproliferation goals (highly arguable), or to assure allies (valuable), or for the transparency it provides into each other's nuclear weapons programs (highly useful). Rather, it is primarily to support the modernization program. New START extension and continued support by both parties for modernization should be a package—not one without the other.

12 In 2017 the Congressional Budget Office estimated that the cost of maintaining the nuclear deterrent and modernizing it over three decades would total $1.2 trillion in 2017 dollars, of which more than $800 billion would go to operate and sustain the nuclear forces and about $400 billion to modernize them. U.S. Congressional Budget Office, Approaches for Managing the Cost of U.S. Nuclear Forces, 2017-46 (October 2017).

13 Brian P. McKeon, "Recalling the Senate Review of New START," *Arms Control Today* (October 2019).

14 As one illustration, see Joshua Rovner, "Has the United States Abandoned Arms Control?" War on the Rocks (June 2, 2020).

Consideration should also be given to renewed efforts to engage Russia on other initiatives that are in U.S. security interests including reducing the large disparity in non-strategic nuclear weapons, reining in certain of Russia's exotic modernization programs (discussed later), and a more productive dialogue on strategic stability. As Mr. Obama learned, this may turn out to be another dead end with Russia. Still, such efforts, even if unrealized, would demonstrate "good faith effort" and as a result strengthen bipartisan support for modernization.

Finally, other than as a stall tactic, it is unclear what is to be achieved by pressing China to join the dialogue with Russia that one might hope could lead to New START extension. The last two administrations sought to avoid providing incentive for a Chinese nuclear build-up as part of a "sprint to parity." It is simply not credible that, by engaging China in tri-lateral arms control dialogue, the United States could somehow "lock in" the current disparity in forces. Much more likely, China would press for equal limits on forces, which of course is not a desired outcome for the United States. The end result—likely deadlock—in itself could incentivize China's sprint. It may make sense to advance a dialogue with China on strategic stability, transparency, or related issues, rather than to focus on limits on forces.

Risk from Evolving Threats

Third is the risk from evolving threats. The modernization program underway is not creating more nuclear weapons with exquisite new military capabilities. It is simply replacing what we have today with modern variants. Is such a program sufficient to address threats that will evolve significantly over the 50-70 years that these systems are to remain in the field? More succinctly, is the force we are rebuilding the force we need for 2030 and beyond? To answer this question, a central focus must be the return to great power competition and, specifically, the evolution of the threat posed by Russia.

Russia is not the only driver for the $1 trillion that will be spent over the next 30 years to sustain and modernize nuclear forces, but it is the most important one. Russia's open contempt for the post-Cold War security order, its illegal occupation of Crimea, its ongoing war with Ukraine, its nuclear threats to U.S. allies, its deployment of a land-based cruise missile in abject violation of the INF Treaty, its modernization programs for exotic new nuclear weapons, and the surging role of nuclear weapons in its overall security posture all suggest the persistence of dangers for which the U.S. nuclear deterrent is relevant.[15] Very importantly, there is concern that a limited-first-use, "escalate to win" nuclear strategy had gained prominence in Russia's nuclear doctrine as reflected in military exercises and aggressive modernization programs for tactical nuclear weapons.[16] Indeed, the low-yield Trident and nuclear SLCM programs

15 This does not exhaust the list of deeply troubling Russian behaviors. We should not forget Russia's use of radiological and banned chemical weapons to murder expatriots who have lost favor, its support to the atrocities carried out in Syria, and its interference in the political process and elections both in Europe and the United States.

16 *Nuclear Posture Review 2018.*

are U.S. initiatives designed specifically to bolster deterrence to Russian limited first-use.

Russia's nuclear forces and their modernization must, of course, be a factor in considering needed U.S. nuclear modernization. Other important factors include the emerging vision for modern conflict, what else is needed to deter limited nuclear first use by an adversary, and the implications of technological surprise, and not just from Russia. All are interconnected.

Russia's Nuclear Modernization

Russia's nuclear modernization involves: (1) routine, anticipated modernization to replace aging warheads and delivery systems, (2) programs to modernize tactical nuclear weapons in numbers that bear no relationship to what conceivably could be required in terms of plausible military sufficiency, and (3) development, test and production of what some call "exotic" new types of nuclear weapons. On this last point, Mr. Putin reported in March 2018 that Russia had initiated development programs for several new systems:[17]

- A nuclear-armed, maneuvering hypersonic glide vehicle carried by a ballistic missile
- A nuclear-powered, nuclear-armed cruise missile of "unlimited" range
- An air-launched ballistic missile purportedly to target ships
- A hypersonic cruise missile to attack ships or ground targets
- A deep-diving, fast, unmanned, multi-megaton, nuclear-armed underwater vehicle
- An SS-18 follow-on ICBM with modern features to penetrate missile defenses

Some of this modernization is designed to penetrate missile defenses and may well be based on a concern that the United States could rapidly upgrade a defense designed to counter the North Korean threat to one able to counter a much larger launch. Because the United States has no plans to field such a system, such modernization is relatively benign from a U.S. perspective.

Some modernization, specifically the multi-megaton underwater drone, would achieve a level of death and destruction that can already be achieved with Russia's existing ballistic missile forces. This raises speculation that the program is not real but part of a disinformation campaign to shape allied publics' views, and the views of governments, that Russia is to be feared and reckoned with as a great power. It's not a program that alters U.S. modernization plans.

Some modernization may provide new capabilities that could impact crisis stability. A few hypersonic glide re-entry vehicles (RVs) or hypersonic land-attack cruise missiles, if their in-flight trajectory and maneuvering goes undetected, pose a rapid, no-notice decapitation threat to U.S. national command authority (NCA). The nuclear-powered subsonic cruise missile could provide a comparable threat (although all of the deaths

17 Remarks by the President to the Federal Assembly of Russia (March 1, 2018).

caused so far from that system are Russian). As will be discussed shortly, U.S. plans for upgrades to its early warning system must take these programs into account.

Finally, some of Russia's new "exotic" nukes, if fielded, will augment existing nuclear forces with systems that are not counted under New START. This raises questions about whether Russia's efforts are intended to achieve numerical superiority and what the United States might need to do in response.

Russia's nuclear modernization also includes modernization of the nuclear-tipped missile defense interceptors deployed around Moscow. This too raises important questions about the future effectiveness of U.S. nuclear forces, as such modernization may call into question the ability to credibility threaten retaliation with ballistic systems.

Emerging Vision for "Modern Conflict" and Implications for the U.S. Nuclear Posture

The emerging vision for so-called modern conflict also has implications for the future effectiveness of the U.S. nuclear posture. During the Cold War, the most plausible scenario for nuclear war involved escalation of a conventional conflict to the nuclear level. Many believed that conventional war in Europe or Asia could leave the U.S. homeland relatively unscathed—thus the assumption of many that escalation to the nuclear level, if it occurred, would evolve with fully-alert nuclear forces and a fully functioning NC2 system (that is, not degraded by strikes during the conventional phase). A surprise attack was viewed as possible, albeit not likely, and U.S. forces were postured for resilience to that threat by keeping several SSBNs at sea at all times.

Today, we must anticipate a much more dynamic security environment featuring multiple, potential sources of conflict with peer competitors, and with the emergence of nuclear-armed regional states. More varied and complex conflict scenarios may be encountered which are potentially more stressing to forces and NC2 than traditional Cold War threats.

Four developments are driving these considerations—one political and three military-technical. First, coupled with Russia's actions under Putin undermining the post-Cold War security order, is a seeming (and troubling) trend of increasing salience in Russian doctrine of limited first use of nuclear weapons, e.g., to solidify gains achieved in regional conventional conflict. Russia's leaders may well believe that such limited use could achieve key political-military objectives short of escalation to global nuclear holocaust; other potential nuclear-armed adversaries may share this view.[18] Second are increasing capabilities for kinetic attack on satellite systems, and not just from Russia or China. Third are increasing foreign capabilities for precision global

18 This is a controversial judgment. In my assessment, the debate in the Western expert community about whether Russia has a formal escalate-to-deescalate nuclear doctrine is of less interest than the fact that such a strategy, employed in the fog of war, is not implausible and hence requires the United States to address how best to deter it. See Dave Johnson, *Russia's Conventional Precision Strike Capabilities, Regional Crises, and Nuclear Thresholds*, Livermore Paper No. 3 (Livermore, CA: Center for Global Security Research, 2018).

conventional strike. Fourth, and what may be most stressing, is the potential for cyberattack on critical command and control assets.

The transition from conventional to nuclear conflict could evolve much differently than we anticipated during the Cold War, and in ways in which portions of our legacy nuclear posture may be ill-suited to address. The conventional model for escalation—a step-by-step progression from peacetime to crisis to regional then global conventional conflict to nuclear use—may no longer be valid.[19] Rather, escalation to a large-scale nuclear strike may involve a set of discrete actions that blend together in unexpected ways:

- Peacetime cyber surveillance and offensive cyber operations
- Unattributed hybrid operations in run up to crisis (as seen in Russia's war with Ukraine)
- Information operations in run up and during crisis
- Covert sabotage of critical installations
- Cyber/kinetic attack on space assets including NC2 space assets
- Regional conventional conflict
- Precision global conventional strikes on strategic targets
- Limited/regional nuclear use involving few casualties [electromagnetic pulse (EMP), demonstration shot]
- Limited/regional nuclear use on ground targets with moderate casualties

Consider a regional conflict that escalates to a global conventional-only phase in which U.S. nuclear forces and NC2 are degraded initially by cyber and anti-satellite attacks and later by long-range precision conventional strikes on military forces. An attack on an Advanced EHF satellite to degrade tactical communications in a conventional conflict would also degrade nuclear communications provided by that same satellite. Escalation to limited nuclear could feature space use of nuclear weapons to produce high-altitude EMP, but few immediate casualties on the ground, along with more widespread non-nuclear attacks on general purpose command and control assets. Escalation to a large nuclear attack with multiple detonations on U.S. territory—i.e., the Cold War scenario—could thus begin with severely degraded NC2.

To deal with 21st century conflict scenarios, the United States will need an NC2 system that can survive sustained conventional attack as well as the ability to plan and conduct nuclear strikes in coordination with ongoing conventional operations. Legacy NC2 was optimized for rapid execution of what some call the Cold War's "multiple choice test": which of four strike options should the President choose? The required information and communications bandwidth was modest. In conflicts where nuclear use initially may be quite limited, a President will seek a much broader set

19 John Warden, *Limited Nuclear War: The 21st Century Challenge for the United States,* Livermore Paper No. 4 (Livermore, CA: Center for Global Security Research, 2018).

of consultations with senior advisors, allied, and possibly adversaries—the "essay test"—requiring more reliable, secure two-way communications pathways to support adaptive nuclear planning, decision-making conferencing, and flexible execution. Demand for high quality voice, video, and data transmissions that are resilient to stressed nuclear environments and adversary exploitation will greatly exceed those capabilities developed for the Cold War. Such communications capabilities must be available whether the President is at the White House, on the move, at a trip location, or undisclosed site.

Early warning will become increasingly challenging. As Russia and China deploy nuclear- and conventional-armed hypersonic cruise missiles and hypersonic glide vehicles, they will be able to threaten strikes with weapons that are extremely difficult to track, characterize, and intercept. A collection of warning satellites and radars optimized for detection and tracking of ballistic missile trajectories may struggle with fast, maneuverable hypersonic systems. Certain key assets, including those that support NC2, may become more vulnerable to preemption or decapitation. U.S. modernization of early warning systems to detect and characterize attacks rapidly, therefore, must account for a full complement of adversary means for strategic strike.

- ***Keeping the U.S. nuclear modernization on track for the two decades that modernization will play out remains a key technical and political challenge.***
- ***There is little flexibility to absorb further triad modernization delay without affecting robust nuclear deterrence in future years.***

Russia, China, and others are developing sophisticated counter-space, cyber, and long-range conventional strike capabilities that can potentially corrupt, disrupt, or even destroy satellites that support U.S. NC2.[20] They are also pursuing sophisticated offensive cyber warfare capabilities that threaten the security and reliability of secure communications pathways and could be used to disrupt other NC2 systems and infrastructure.[21] Adversaries have more numerous and capable long-range conventional strike systems that can hold at risk key NC2 nodes, including radars, ground stations, and fixed command posts. All must be accounted for in U.S. modernization.

These various developments also raise questions about the future survivability of delivery platforms. The United States has long valued the inherent survivability of ballistic missile submarines at sea and has spent wisely for decades to stay on top of any technological developments that could conceivably put those assets at risk. With regard to aircraft, once aloft and outside integrated air defense zones, U.S. bombers,

20 *Nuclear Posture Review 2018,* p57.

21 David A. Deptula, William A. LaPlante, and Robert Haddick, *Modernizing U.S. Nuclear Command, Control, and Communications* (Arlington, VA: Air Force Association, February 2019), p27. See also Page O. Stoutland and Samantha Pitts-Kiefer, *Nuclear Weapons in the New Cyber Age: Report of the Cyber-Nuclear Weapons Study Group* (Washington, DC: Nuclear Threat Initiative, September 2018).

NC2 aircraft, and aircraft supporting national leadership were thought to be survivable for an extended period. We need to rethink this. Technological advances potentially enabling the detection of unique electronic signatures by advanced sensors and faster processing may make aircraft more vulnerable to detection, tracking, and targeting. SSBNs may become more vulnerable to anti-submarine warfare if adversaries are able to use electronic communications to identify their operating area. Moving forward on modernization requires robust communications links that enable management and direction of forces consistent with operational concepts that maximize survivability of mobile platforms.

Finally, in providing timely adjustments responsive to evolving threats and technical challenges, the importance of restoring and maintaining the capabilities of the R&D and industrial base that sustains and modernizes nuclear forces cannot be understated. Until then, we must rely on a less-than-desirable strategy of maintaining additional spare warheads in the U.S. nuclear stockpile to hedge against such uncertainty. Restoring the infrastructure needed to produce uranium and plutonium components for nuclear warheads is a priority. Remaining on track with other ongoing triad modernization efforts is essential. Assuring continued competence of our nuclear warhead and reentry system designers, engineers, and production personnel is a prerequisite for everything. On this last point, the Navy's program for the Mk7/W93 warhead and reentry system—and its intent to offer modern features including modularity for rapid adaption to evolving threats, field maintainability, and others—will be an excellent "test case" for a restored R&D and industrial base for nuclear forces.

Conclusion

Surveying this landscape of requirements and risk, I draw the following principal conclusions.

- Keeping the U.S. nuclear modernization on track for the two decades that modernization will play out remains a key technical and political challenge.
- There is little flexibility to absorb further triad modernization delay without affecting robust nuclear deterrence in future years.
- A contentious debate on arms control should be avoided because it would only tear at the fabric of consensus on nuclear modernization.
- The debate over nuclear forces must increase focus on Russia and, in particular, Mr. Putin's bad behavior.
- Achieving viable means to hedge strategic uncertainty is critical—most importantly by restoring and maintaining the capabilities of the R&D and industrial base that sustains and modernizes forces. The Mk7/W93 "next Navy warhead" will be an important "test case" for a more responsive nuclear weapons enterprise.

The U.S. nuclear arsenal in 2030 and beyond will not look much different than it does today. There will be a Triad, but a modern one with life-extended warheads and enhanced NC2. We should anticipate some U.S. programs will be initiated or bolstered to respond to technological advances or evolutions in deterrence strategies outlined earlier. In taking such steps, the U.S. nuclear posture will continue to meet deterrence needs against any potential adversary. The big uncertainty is, well, uncertainty. We should expect to be surprised. Consequently, possessing the means to respond to surprise—a robust and responsive nuclear R&D and industrial base—will be essential. Key infrastructure recapitalization, in this regard, is being funded and aggressively carried out, but the jury is still out on whether and when this will be achieved.

In closing, I wish to emphasize the need for bipartisanship in stewardship of our nuclear deterrent. The end of the Cold War was followed by nearly two decades of confusion and divisive debate over the post-Cold War role and mission of nuclear weapons. Some of you may recall the Modern Pit Facility, Nuclear Weapons Advanced Concepts, the Robust Nuclear Earth Penetrator, the Reliable Replacement Warhead—mostly solid programs, all killed by Congress. At least one member of Congress had enough; the late Rep. Ellen Tauscher told us what needed to be done:

> Our strategic posture should place the stewardship of our nuclear arsenal, nonproliferation programs, missile defenses, and the international arms control regime into one comprehensive strategy that protects the American people.

At her initiative, near the end of George W. Bush's second term, Congress established the bipartisan Congressional Commission on the Strategic Posture of the United States—the so-called Perry-Schlesinger Commission—to seek a bipartisan path out of the mess we were in. Despite a spectrum of commissioner views bracketed by Johnny Foster on the Right and Mort Halpern on the Left, Bill Perry and Jim Schlesinger, with timely interventions from Tauscher, were able to establish overall consensus.[22] Their work was drawn on extensively by Mr. Obama's team, many of which, including Tauscher—who became the administration's Undersecretary of State in 2009—were drawn from the Commission process in crafting that comprehensive strategy. The result was renewed bipartisan support for nuclear modernization as one piece of that overall strategy. The administration taking office on January 20, 2021 should heed her sound advice.

22 *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, 2009).

21st Century Deterrence: Hedging with Resilience

Sheryl Hingorani

As we look ahead to 2030 and beyond, we must recognize the uncertainty that naturally comes with decadal time scales. While many structural and cultural things evolve slowly over time, driven by shifting competitive relationships or new ideas, dramatic transformations can occur with technological breakthroughs, and significant change can result from geopolitical and policy swings. Inherently unpredictable "black swan events" can also occur, as evidenced by the coronavirus pandemic. To prepare as best we can for an uncertain future, it is useful to look back at the path we have been on and assess the strategies we have used to hedge against future uncertainty. One of the lessons that stands out is that, as we extend the life of the U.S. nuclear stockpile and recapitalize the scientific and production infrastructure over the coming decade, we must build resilience into our tools, our processes, and our people to hedge against an uncertain future, help prevent strategic surprise, and ensure success in 2030 and beyond.

The Policy Context

In the early days of the post-Cold War era, the nuclear security community was excited about the real opportunity to dramatically reduce the risk of nuclear war, mitigate other nuclear dangers, and generally to seize the nuclear peace dividend. The "lead but hedge" strategy in the 1994 Nuclear Posture Review (NPR) committed the United States to leading the way toward major reductions in the number of nuclear weapons, as well as towards a reduced role for nuclear weapons in international security. This NPR stated "…no new strategic nuclear systems are either under development or planned."[23] It also committed the United States to retention of a nuclear posture, both in force structure and in infrastructure, which could "respond to any challenge" as a hedge against future uncertainty. In the report of the Secretary of Defense to the President and Congress in January 1995, which included this first NPR, Secretary of Defense William Perry called out the need to "protect America's freedom and security into the 21st century."[24]

At that time, a quarter of a century ago, it was difficult to imagine the complexities of the 21st century security landscape that would emerge. Policymakers worried about a resurgent Russia that "could restore the strategic nuclear threat to the United States literally overnight."[25] They worried about nuclear-armed rogue states. A few

23 *Annual Report to the President and the Congress,* William J. Perry, Secretary of Defense (February 1995), p11.

24 Ibid., see *Message from the Secretary of Defense.*

25 Ibid., p86.

worried about whether or not China would become a peer challenger. No one predicted the full scope of the terrorist threats that would unfold, nor the myriad technological advancements and their implications for global security and stability.

What we in the nuclear security community knew for sure in the early 1990s was that all of the new nuclear weapon system development programs that were underway had been cancelled. The nuclear enterprise made a major shift from the rapid ongoing modernization of a large and diverse nuclear arsenal to stewardship of a shrinking and aging arsenal for an indefinite period of time. The unilateral underground nuclear test moratorium established in 1992 put an additional constraint on the enterprise's approach to retaining confidence in the safety, security, and reliability of these systems. The science-based stockpile stewardship programs that were set in motion created an extensive suite of world-class experimental and computational tools which we rely on today, along with our historic underground nuclear test data, to underpin our confidence in the state of health of the stockpile.

Conventional war in Iraq, the 9/11 attack and the war on terrorism, and then counter-insurgency operations in Afghanistan and Iraq created a situation where the most pressing U.S. national security challenges had little if any bearing on requirements for nuclear deterrence. They did, however, have significant implications for safeguarding nuclear materials and weapons to prevent terrorist access. The 2001 NPR reframed deterrence as not relying exclusively on nuclear forces and introduced a "new triad" consisting of (1) nuclear and non-nuclear strike capabilities, (2) defenses, and (3) a responsive infrastructure.[26]

The 2010 NPR brought together in one integrated strategy an actionable policy framework for strengthening both nuclear security and nuclear deterrence. Like its predecessor, it included explicit objectives of putting an end to Cold War thinking and reducing the role that nuclear weapons play in U.S. national security strategy. "The threat of global nuclear war has become remote, but the risk of nuclear attack has increased…today's most immediate and extreme danger is nuclear terrorism."[27] Sustaining a safe, secure, and effective nuclear arsenal was called for, in order to maintain strategic deterrence and stability, and strengthen regional deterrence and assurance of allies. The National Nuclear Security Administration (NNSA) was called upon to complete the W76-1 life extension program, well underway at that time. A "full scope" life extension of the B61 nuclear bomb was called for, as was a study of options for life extending the W78 ICBM warhead, "including the possibility of using the resulting warhead also on SLBMs to reduce the number of warhead types."[28]

The 2010 NPR reinforced longstanding U.S. policy of refraining from new nuclear weapons capabilities. "The United States will not develop new nuclear warheads. Life Extension Programs…will not support new military missions or provide for new

26 Secretary of Defense Donald Rumsfeld, *Annual Report to the President and Congress* (2003), p122.

27 *Nuclear Posture Review Report,* Department of Defense (2010), piv.

28 Ibid., pxiv.

military capabilities."[29] This commitment was underscored by an exchange between 10 former NNSA lab directors and the then Secretaries of Defense and Energy Robert Gates and Stephen Chu. The former lab directors objected to the strong preference for refurbishment and reuse options for life-extending existing systems and to the decision that presidential authorization would be required for any replacement approach.[30] Gates and Chu responded emphatically:

> The Laboratory Directors will make sure that the full range of LEP approaches, including refurbishment, reuse, and replacement of nuclear components, is studied on a warhead case-by-case basis. The NPR expresses a policy preference for refurbishment and reuse in decisions to proceed from study to engineering development—requiring Presidential authorization for replacement is an additional step to make sure that no one mistakes life extension activities for the pursuit of new warheads.[31]

Once the New START Treaty was signed and ratified, a shared view of the right-sized nuclear deterrent force structure emerged, and NNSA set about creating modernization plans for life extending nuclear warheads and bombs to address aging and technology obsolescence, while the Department of Defense set about planning the replacement of delivery systems facing end-of-service life.

The Program of Record which was developed over the next several years created a strong foundation for the path we are on today, based on the 2018 NPR, which was initiated to "ensure that the United States nuclear deterrent is modern, robust, flexible, resilient, ready, and appropriately tailored to deter 21st-century threats and reassure our allies."[32] This NPR, along with other national policy documents, assesses that strategic competition with Russia and China has replaced terrorism as our number one national security concern. It calls for military capabilities that go beyond life-extending current systems and breaks tradition with the ban on new military capabilities:

> The United States has understood the value of flexibility for nuclear deterrence for six decades, but its importance is now magnified by the emerging diversity of nuclear and nonnuclear strategic threats and the dynamism and uncertainties of the security environment. This need for flexibility to tailor U.S. capabilities and strategies to meet future requirements and unanticipated developments runs contrary to a rigid, continuing policy of "no new nuclear capabilities."[33]

29 Ibid.

30 Letter from former National Laboratory directors to the Secretary of Defense and the Secretary of Energy (May 19, 2010).

31 Letter from Secretary of Energy, Steven Chu, and Secretary of Defense, Robert M. Gates, to former National Laboratory directors (June 25, 2010).

32 Sec. 3(b) from *Presidential Memorandum on Rebuilding the US Armed Forces* (January 27, 2017).

33 *Nuclear Posture Review,* Department of Defense (2018), p27.

The Stockpile

By the time the Cold War ended, the size of the U.S. nuclear arsenal had been reduced significantly from its peak of over 30,000 warheads in the mid-1960s. Reductions continued in both overall quantities and in the number of different types of nuclear weapons, especially through the Presidential Nuclear Initiatives on tactical weapons, and the Strategic Arms Reduction Treaties. The composition of the remaining stockpile evolved, but slowly and in fits and starts. In the 1990s, a variant of the B61 nuclear bomb was designed and deployed that included a penetrating nose cover to improve U.S. ability to hold hard and deeply buried targets at risk. But a few years later, the design and development of the Robust Nuclear Earth Penetrator (RNEP) came to a halt. The life extension of the W76 submarine launched ballistic missile warhead was undertaken as a refurbishment, which precluded any significant changes to the nuclear explosive package. The Reliable Replacement Warhead (RRW) and the W80-3 life extension program were each authorized but later cancelled, as political and military leaders grappled with the uncertainty associated with the stockpile characteristics needed for meeting nuclear deterrence and assurance requirements. A significant development effort on the concept of interoperable warheads, sometimes designated IW, which could have been fielded on either silo-based or submarine-based missiles, might have enabled significant reductions in the number of non-deployed U.S. nuclear weapons that the United States currently retain as a hedge against potential technical issues in the deployed stockpile. Like RNEP and RRW, plans for IW have been cancelled.

In sum, for a quarter of a century, the primary focus was on sustaining and now life extending the Cold War stockpile, and very little advanced nuclear weapon design and development work took place at the NNSA labs. This was as intended by policymakers in the Clinton, Bush, and Obama administrations, who judged that the pursuit of new nuclear military capabilities might generate reactions by others that would result in a net erosion of the security of the United States and its allies. Funding constraints imposed by Congress, and new priorities for U.S. defense budgets, such as missile defense and prompt conventional strike capabilities, were also factors. In addition, the United States took a prudent cautionary stance against nuclear weapon designs that might lie outside the national underground nuclear test history and thereby call into question their certification basis. In large measure, this national approach was to strive to keep everything the same, and to resist change.

More than two decades later, it is clear that stockpile stewardship has accomplished its primary objective. Due to the sustained science investments of the stockpile stewardship program, we not only have confidence that U.S. nuclear weapons will work, but we have established new understanding of how they work, why they work, and under what circumstances they might not work. Our knowledge base today supports important assessments of design margins and uncertainties, and our next challenge is to develop the ability to certify the full range of design options, including those that lie outside the nuclear test experience of the past.

Now the geostrategic landscape and U.S. national leadership calculus has changed. The restraint shown by the United States was not reciprocated by others. Russia and China have modernized and adapted their nuclear deterrents to new purpose, while North Korea has proceeded to develop a nuclear force of its own. Change occurred, despite our resistance. The course charted since approximately 2016 rests heavily on modernization of the existing arsenal. But it also hedges more aggressively than before against the possible future need for new and different nuclear weapons.

This is an opportunity and a challenge for the nuclear enterprise. A series of activities and programs were initiated that allowed the enterprise to anticipate and prepare for future military needs that might require new or different nuclear weapons capabilities. For example, the FY15 National Defense Authorization Act (NDAA) stated that:

> The directors of the national security laboratories shall jointly develop a multiyear plan to design and build prototypes of nuclear weapons to further intelligence estimates with respect to foreign nuclear weapons activities and capabilities.[34]

This allowed the labs to perform a series of annual practicums in which scientists and engineers were able to work on weapon system prototypes which, if they had been for U.S. deployment, would have fallen outside the policy prohibiting work on weapon systems with new military capability.

The following year, the FY16 NDAA directed that:

> The Secretary of Energy, acting through the Administrator and in consultation with the Secretary of Defense, shall carry out a Stockpile Responsiveness Program (SRP)…to identify, sustain, enhance, integrate, and continually exercise all capabilities required to conceptualize, study, design, develop, engineer, certify, produce, and deploy nuclear weapons.[35]

This resulted in the NNSA and the labs working together with DoD representatives to identify high priority challenge problems and follow-on design and prototyping work by tri-lab teams. Both the foreign nuclear weapons practicums and the SRP challenge problems provide opportunities for the limited number of remaining experienced nuclear weapons designers to work with early and mid-career scientists and engineers. These designers lead multi-disciplinary teams and projects that require us to bring the scientific tools and knowledge created for stewarding the legacy stockpile to bear on real design work for demonstrator and pathfinder systems.

34 Sec. 3111(a) from *Carl Levin and Howard P. "Buck" McKeon National Defense Authorization Act for Fiscal Year 2015*, Public Law 113-291 (December 19, 2014.)

35 Sec. 4220(b) from *National Defense Authorization Act for Fiscal Year 2016,* Public Law 114-92 (November 25, 2015).

This work, along with earlier studies, paved the way for what the enterprise is doing in response to the 2018 NPR implementation plans and to subsequent decisions. The SRP challenge problems, which tie to key nuclear force attributes described in the 2018 NPR, were preceded by a number of tri-lab workshops and paper studies that occurred in 2013 and 2014. Because the NNSA labs are truly national security labs, and not solely nuclear weapons labs, they were able to assemble cross disciplinary teams of experts in intelligence-based threat characterization, conventional and nuclear weapon system design, frontier science, policy analysis and more, to investigate possible challenges to U.S. nuclear deterrence effectiveness in the 21st century, and explore potential solutions. As Federally Funded Research and Development Centers (FFRDCs), the NNSA labs have a special long-term relationship with the government and are charged with anticipating future needs and responding to emerging issues. The rapid retooling of the W76-1 production line at Pantex to create a W76-2 low yield subpopulation, called for in the 2018 NPR, was possible because the development team had explored options and design variants in advance of hard requirements.

Remaining Challenges

There are three broad categories of 21st century deterrence challenges that should inform thinking about potential future requirements. The first challenge is to maintain parity (or "strategic equivalency") while Russia and China adapt their forces. Despite the shift between 2015 and 2018, the United States is still taking a slow and methodical approach to modernizing legacy capabilities—in stark contrast to the much more aggressive and extensive modernization programs underway in Russia and China. Parity does not require mirror imaging their forces. But deterrence does require that these two countries perceive no significant gap in the U.S. deterrent posture that they might be able to exploit with new capabilities.

The second challenge is to be able to continue to hold at-risk targets that are heavily defended, hard and deeply buried, and/or mobile. The ability to do so is essential to the credibility of the deterrent. These are not new challenges, but they are evolving as U.S. adversaries and competitors develop and field more and greater capability in an attempt to deny or degrade the ability of the U.S. to achieve potential mission objectives.

The third challenge is to ensure that deterrence remains robust as the traditional conventional-to-nuclear escalation ladder gives way to the messier landscape of all-domain warfare and cross-domain escalation with multiple disruptive technologies. This is very complex because these new technologies and domains can be used both offensively and defensively, and both by the United States and by its adversaries.

Some of the newer programs, such as the foreign nuclear weapons practicums and the Stockpile Responsiveness Program, provide opportunities for exploring solutions to these challenges. Through the practicums, we can explore for nuclear intelligence purposes, not for U.S. military purposes, designs that U.S. adversaries

are pursuing. For example, by studying warheads for deployment on hypersonic boost glide vehicles, design teams can confront, and in the end surmount, the associated technical challenges. This helps prevent the technology surprise that might result if U.S. researchers were not allowed to lean into how 21st century technologies might be taken advantage of to create new solutions for national security. The SRP challenge problem process is also being used to explore some of the potential solution space for the evolving challenges described above. But these relatively new programs are insufficient in a number of ways. Because they proceed only to the point of creating prototypes, the practicums and SRP challenge programs cannot identify problems that would only be encountered in the transition to full scale production. These programs are also small relative to the life extension programs, and in particular SRP funding is very misaligned with the expansive objectives legislated by Congress, including exercising all capabilities of the joint nuclear weapons life cycle, transferring knowledge and skills to the next generation, and demonstrating responsiveness through prototypes, tests, and demonstrations. In addition, SRP does not have the bipartisan support that the core life extension programs have.

A nuclear posture fit for purpose in 2030 requires more than the nuclear deterrent force structure, the scientific and production infrastructure, and the workforce and leadership to address what we foresee to be the most significant global and national security challenges in 2030 and beyond. The nuclear security enterprise must also more fully transition to a resilient posture that explicitly accounts for future uncertainty in our planning and accepts—even embraces—the opportunity to anticipate and adapt to changes in our environment and to adopt new technologies.

Creating a framework for understanding the implications of new domains and new technologies for nuclear deterrence requirements is very important. In some applications, these developments could reduce requirements for nuclear forces. For example, one argument for U.S. conventional prompt global strike is the need to hold time-sensitive targets at risk, which might include mobile launchers. Today we retain some high-yield warheads to ensure we can achieve counter force military objectives by covering the range of location uncertainty associated with mobile systems. Perhaps high yield requirements for this purpose will be obviated by a future conventionally-armed prompt strike system. Another example is offensive cyber tools to degrade adversary systems. If the United States could develop the capability to degrade or disable an adversary's air and missile defense systems with a cyber attack, perhaps military requirements for winning the numbers game (e.g. through decoys or additional weapons on target) could be eliminated. In other areas, developments in new technologies and new domains might result in

additional requirements for nuclear weapons. As military systems, including nuclear delivery platforms, become increasingly digital and connected, new requirements for cybersecurity will likely emerge.

Resilience for the Future

As we look ahead to 2030 and beyond, the U.S. nuclear security enterprise is facing significant economic, political, technological, and geostrategic uncertainty. A number of terms are used interchangeably to describe the posture we want in order to ensure future success—agility, responsiveness, resilience—mostly to denote the speed with which the enterprise can react to changing circumstances. But resilience is more than that. An adaptation of a model which was developed to study resilience of systems such as the electric grid to cyber attacks is shown in Figure 1. The dashed line represents resilience as the ability to operate through an attack or a challenging situation, degrade gracefully instead of catastrophically, remain functional at some critical level, and then recover quickly. This not only applies to hardware systems, but also to institutions, to individuals, and especially leaders. We must devote the time and the energy to consider, and then act, to strengthen the resilience of our enterprise at this moment of unprecedented change and uncertainty.

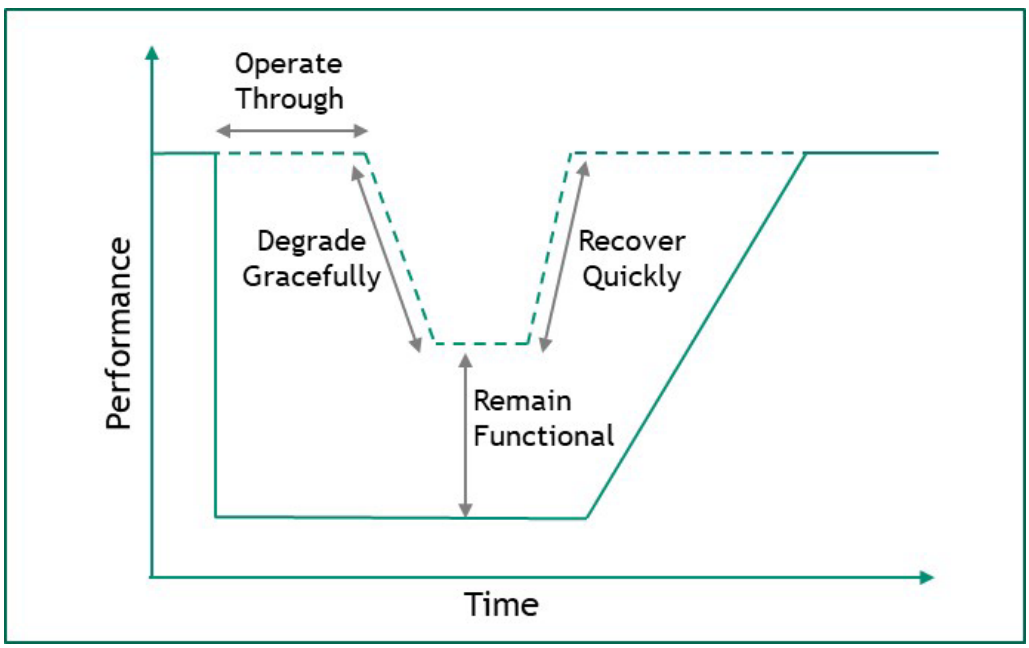

Figure 1.

For the stockpile, and hardware systems generally, attributes like diversification, interoperability, and modularity contribute to resilience. Because these characteristics often come at a near-term incremental financial cost, many prior calls for these

approaches have been unsuccessful. Resilience in the face of harsh environments, such as nuclear or cyber attacks, can be strengthened with sensors for rapid detection and characterization of the environment, as well as autonomous systems for deploying defenses and counter measures or directing circumvention.

For institutions, greater resilience can be achieved with vibrant research portfolios and changes to our processes. Cutting-edge and disruptive science helps prevent strategic surprise and ensure a strong foundation for meeting future security challenges. Processes need to be flexible, but more importantly scalable to allow navigation through the inevitable ebbs and flows of core mission work. Surge capacity, for example, allows institutions to quickly adapt to changes in demand. Countercyclical structures, such as the Strategic Partnerships Programs, can offer a relief valve when growth in core programs is particularly challenging, and can also keep core capabilities exercised during downturns.

Leaders can do a number of things to strengthen their personal resilience. Ensuring cognitive diversity on leadership teams and transparency in decisionmaking enables the active challenging of assumptions, thereby ensuring they can withstand scrutiny. By demonstrating the ability to act decisively at the speed that changing circumstances dictate, we create confidence in the resilience of ourselves and each other.

Scanning the external environment and focusing on longer time horizons prepares us for the future in ways that simply delivering on the here and now does not. The nuclear security community has at times overcompensated for near-term changes in our security environment, and we run the risk of doing so again. Our important focus on counter terrorism and nonproliferation was not well balanced with continued efforts to track and respond to changes in the strategic balance with peer competitors. As we now turn our attention to shoring up our deterrence and assurance posture relative to strategic competition with Russia and China, we must continue our work on preventing nuclear terrorism, as well as our arms control and nonproliferation efforts.

We must also build resilience in our technical and research teams. In addition to staying on the cutting edge of science to avoid technology surprise, we need integrative strategic analyses focused on the evolving and emerging threat landscape and the implications for our strategic toolkit. Our scientists and engineers need the freedom of thought and action to pursue advanced concepts and pave the way for potential future solutions. We have to allow for, and even reward, failure in a way that celebrates the learning that occurs when people take courageous risks and strive for aspirational goals.

We can also build resilience by "rehearsing the future." War games and exercises provide a forum for this, often focused on a specific scenario. Scenario planning can also be used to facilitate strategic conversations about alternate futures. The baseline case—or "business as usual" in scenario-planning parlance—for stockpile modernization is expressed in the tightly interconnected plans and programs found

in the Nuclear Matters Handbook[36] and the NNSA Stockpile Stewardship and Management Plan.[37] But what worst case or crisis scenario should we be rehearsing, perhaps driven by significant political or economic change? How would we rise to the occasion if a scenario emerged that required us to deliver more and perhaps even different capabilities needed on shorter time scales?

A nuclear posture fit for purpose in 2030 requires more than the nuclear deterrent force structure, the scientific and production infrastructure, and the workforce and leadership to address what we foresee to be the most significant global and national security challenges in 2030 and beyond. The nuclear security enterprise must also more fully transition to a resilient posture that explicitly accounts for future uncertainty in our planning and accepts—even embraces—the opportunity to anticipate and adapt to changes in our environment and to adopt new technologies. As we design and deploy the 21st century nuclear stockpile, and as we grow the next generation of nuclear security experts, robustness to known or assumed requirements for the future should not be the objective, but rather resilience to ensure success in a dynamic and uncertain future.

36 *Nuclear Matters Handbook,* Office of the Deputy Assistant Secretary of Defense for Nuclear Matters (2020).

37 *Fiscal Year 2020 Stockpile Stewardship and Management Plan,* Report to Congress (July 2019).

Missile Defense: Fit for What Purpose in 2030?

Brad Roberts

To outward appearances, the U.S. project to integrate missile defenses into its strategic posture is moving along nicely. The homeland defense posture is becoming more robust, albeit in fits and starts, with growth in the capacity of the Ground-based Mid-course Defense (GMD) system. The United States and its allies are also adding capacity to the regional defenses in Europe and Asia. Political interest remains strong in future technical improvements. Overall, the project enjoys bipartisan support, as reflected in continuity of purpose across multiple administrations and also Congressional action to ensure a steady flow of an average of $10 billion per year for the last two decades.

But outward appearances are deceiving. The project has come to a significant inflection point. In recent years, the geopolitical context has changed dramatically. The technological context has also changed, as the limits of current systems have come into clearer focus (while new technologies remain elusive). These factors compel a return to the basic questions guiding the missile defense project: What is the problem we're trying to solve? And how do we think we can solve it? One manifestation of this inflection point is the fact that the U.S. Congress is again asking questions about the values of missile defense and the needed future architectures.[38] Those are questions to which the next administration, of whichever political stripe, must have answers in 2021. Moreover, those answers must be compelling to the diverse members of the missile defense coalition if they are to be politically durable.

To help inform this debate, this chapter takes a long-term look at the U.S. missile defense project. It begins with a look back 20 years to the policy framework put in place with the 1999 National Missile Defense Act in order to understand what purposes missile defenses have so far served. Toward that end, it catalogues the strategic benefits the United States has sought from missile defenses over the following two decades and considers whether they have been achieved. The chapter then describes the new inflection point, arguing that geopolitical and technological factors have altered the context in fundamental ways. I then turn to implications for the pathway to 2030 and the question of metrics by which the 2030 posture might

38 The FY2020 National Defense Authorization Act includes the following task: "a study on the impacts of the development and deployment of homeland missile defenses of the United States on the security of the United States as a whole. The study…shall consider whether security benefits obtained by the deployment of homeland missile defenses of the United States are undermined or counter balanced by adverse reactions of potential adversaries, including both rogue states and near peer adversaries." See section 1692. See also Jason Sherman, "House panel declines to back MDA's layered homeland defense proposal, requires AOA," *Inside Defense* (July 26, 2020).

be judged. Toward this end, I sketch out three alternative answers to the question of "What purpose is the missile defense posture intended to serve?"[39]

The 1999 Missile Defense Act and its Legacy

The U.S. missile defense project dates back nearly to the dawn of the missile age.[40] But the focus here is on the new chapter that opened in 1999 with the National Missile Defense Act. That legislation established national policy to "deploy as soon as is technologically possible an effective national missile defense system capable of defending the territory of the United States against limited ballistic missile attack, whether accidental, unauthorized, or deliberate." Note the emphasis on *limited* and the absence of specific countries of concern.

In implementing this policy, the Clinton, Bush, and Obama administrations have, each in their own way, elaborated three complementary policies. First, anticipating growth in the arsenals of nuclear-tipped long-range missiles being assembled by North Korea and potentially others, they have added a commitment to "stay ahead of the rogue states." This reflects their rejection of mutual vulnerability as the basis of the emerging strategic relationships with such states, in part because nuclear deterrence was not seen as fully reliable in preventing aggression and escalation by "rogue" leaders.

Second, each presidential administration has also tried to reassure Russia and China that U.S. homeland missiles defenses "are not pointed" at them. More precisely, they have rejected a role for missile defense in negating the strategic deterrents of Russia and China. Accordingly, they all quietly adopted a laissez-faire attitude to any adjustments to the nuclear postures of Russia and China that their leaders might deem necessary to ensure the credibility of their deterrents. This means that those adjustments did not result in compensatory actions by the United States. In doing so, they judged that such a role for U.S. homeland missile defense was both impractical and unnecessary, as nuclear deterrence would be effective in dealing with the large-scale strikes of which they are capable.

In contrast, policy perspectives on regional missile defenses have not been colored by the need to distinguish limited from unlimited defenses or rogue threats from major power threats. Rather, in pursuing regional missile defenses it has been U.S. policy to protect against any threat, whatever its source—the third basic policy principle. This reflects a judgment that regional defenses raise none of the issues for strategic stability that homeland defenses might. It also reflected the fact that there was no perceived regional missile threat from Russia or China in 1999.

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39 The views expressed here are those of the author and should not be attributed to his employer or any of its sponsors. He wishes to express his gratitude to Lesley Kucharski for her research support in preparing this essay, to those who provided feedback during the July 2020 workshop, and to Ivanka Barzashka, Paul Bernstein, Cliff Chen, Brad Clark, Jacek Durkalec, Chuck Lutes, and Larry Welch for their feedback on earlier drafts.

40 See *History of Strategic Air and Ballistic Missile Defense, Volumes I (1945-1955) and II (1956-1972)*, U.S. Army, Center of Military History (2015).

These missile defense policy objectives have been well aligned with the main elements of U.S. defense strategy and also U.S. national security strategy over the same period. The national security strategies of the Clinton, Bush, and Obama administrations all took a cautiously optimistic view of the potential to improve major power relations and to cooperate to reduce the dangers posed by nuclear-arming regional powers and violent extremists. Accordingly, the defense strategies of these administrations focused military planning on regional challengers like North Korea and Iran and on counter-terrorism and counter-insurgency warfare, with little or no concern about major war with Russia or China and thus about the potential flashpoints to war with them (with the exception of episodic concern about war with China over Taiwan). Trump administration strategies departed in some important ways, as discussed further below.

This basic policy framework enjoyed a measure of bipartisan support sufficient to enable a great deal of continuity in U.S. missile defense policy despite periodic changes in the national political structure. Twenty years later, what has the United States got to show for it?

What Security Benefits Has the United States Sought?

More precisely, what particular benefits did the United States seek? And what costs has it paid (measured in geopolitical, not financial terms)?[41] Although the four presidential administrations since the Cold War made their cases for missile defense differently, there has been relative continuity of national purpose when it comes to the desired benefits of missile defense. They fall into three main categories: benefits in time of war, in time of crisis, and in peacetime.

In time of war:

- The freedom to reverse acts of regional aggression and, if necessary, to prosecute regime removal without fear of retribution on the U.S. homeland
- The freedom to discount enemy threats of limited escalation
- The freedom of maneuver (by enabling the projection of conventional power through critical nodes)
- Protection of U.S. allies sufficient to ensure their continued political support for the military campaign

41 The following catalogue of desired benefits is drawn from the George W. Bush administration's Nuclear Posture Review of 2001, the Obama administration's *Ballistic Missile Defense Review* of 2010, and the Trump administration's *Missile Defense Review* of 2019. For further analysis see Brad Roberts, *On the Strategic Value of Ballistic Missile Defense*, Proliferation Papers (Paris: IFRI, 2014) and Roberts, "Anticipating the 2018 Ballistic Missile Defense Review," in Thomas Karako, ed., *Missile Defense and Defeat: Considerations for the New Policy Review* (Washington, DC: Center for Strategic and International Studies, 2017).

In time of crisis:

- Assurance of U.S. leaders, and of the American public, that the risks of defending the challenged interest are acceptable
- Assurance of U.S. allies that the United States remains "coupled" to their defense despite enemy reminders that the U.S. homeland is not a sanctuary
- Retention of the initiative (by buying time and reducing pressures for preemption)

In peacetime:

- Assurance of allies of coupling (especially of those allies not protected from nuclear-armed adversaries by forward-deployed U.S. nuclear weapons)
- An opportunity to share burdens and risks and to adapt security cooperation to a changing security environment
- Support to diplomacy
- Dissuasion of those who might contemplate starting a missile program in order to put U.S. forces and the U.S. homeland at risk
- Dissuasion of those with missile programs who might contemplate expanding a missile program to "stay ahead" of U.S. BMD
- Protection against accidental and unauthorized launches (also a benefit in crisis and war)
- A reduction in reliance on nuclear threats for deterrence—especially for deterrence of those forms of aggression for which the threat of retaliation by nuclear means may not be credible.

What Does the Available Evidence Tell Us?

The available evidence is mixed. There have been both benefits and costs, as well as desired benefits still un-tested by experience.

The desired operational and strategic benefits of homeland missile defense in war have not been put to the test. Indirect evidence about the potential operational benefits exists in the form of the performance of missile defenses in operational tests. It is mixed. Only about half of the tests of the Ground Based Interceptors (GBI) have been successful, though the success rate has improved in the more recent tests. The desired benefits of regional missile defenses in war have been demonstrated on a limited basis with point defenses operating in the Middle East (Patriots in Saudi Arabia, Iron Dome in Israel). Operational testing of systems like

Aegis and THAAD demonstrates a success rate superior to that of the GBIs.[42] Moreover, very little of this testing fully replicates war-time conditions.

The desired benefits of missile defense in crisis have been partially put to the test by the provocations associated with the North Korean missile development program. Faced with uncertainty about the nature of each new provocation and the possibility that a North Korean missile warhead might strike South Korea, Japan, or the United States, the three allies have repeatedly cooperated to upgrade missile defense readiness.[43] This has sent a signal of collective resolve and helped to reduce pressures for preemptive military action. The impact of these signals on North Korea is unknown. Regional defenses played a role in mitigating the risks associated with a strong Iranian response to the January 2020 U.S. assassination of General Soleimani.[44] These tests must be recognized as partial, in that none of these crises were at the brink of major war or posed potentially existential threats to any of the allied parties.

On support to peacetime diplomacy, missile defenses have had mixed results. On the one hand, as discussed further below, missile defense is a major barrier to the improvements in the strategic military relationships with Russia and China that U.S. leaders have sought through political engagement and arms control. They have also sometimes been a source of friction with U.S. allies, who have had concerns about the negative reactions of the major power neighbors. On the other hand, missile defenses have been an instrument of improved defense industrial cooperation with some allies (e.g., with Japan on development of an advanced regional interceptor). They have also been integral to U.S. efforts to work with allies in Europe, Asia, and the Middle East to develop comprehensive regional deterrence architectures and adapting them to new purposes.

The peacetime benefits of assurance and dissuasion are especially difficult to characterize and assess. On assurance, despite North Korea's progress in fielding a small nuclear force atop long-range missiles, the U.S. alliances with Japan and South Korea have not broken and neither country has chosen a nuclear pathway for itself. But these outcomes have many potential explanations. Moreover, in Japan there is a rising discussion of the appropriate mix of defensive and offensive capabilities, suggesting that missile defenses alone are insufficient for assurance purposes. In South Korea, that discussion is much further along, reinforcing the point. In addition,

42 See Ballistic Missile Defense Intercept Flight Test Record, fact sheet, Missile Defense Agency, available at: https://www.mda.mil/global/documents/pdf/testrecord.pdf. Accessed September 18, 2020. See testimony by MDA Director Samuel Greaves in Hearings of the Subcommittee on Strategic Forces, Senate Armed Services Committee, Ballistic Missile Defense Policies and Programs, March 22, 2018, available at https://www.armed-services.senate.gov/hearings/18-03-22-ballistic-missile-defense-policies-and-programs. Accessed September 18, 2020.

43 See Senate testimony for MDA FY2020 budget request, April 2019, at https://www.armed-services.senate.gov/imo/media/doc/19-33_04-03-19.pdf. Accessed September 18, 2020.

44 https://www.washingtonpost.com/national-security/us-officials-knew-iranian-missiles-were-coming-hours-in-advance/2020/01/08/b6297b4c-3235-11ea-a053-dc6d944ba776_story.html and https://www.defensenews.com/opinion/commentary/2020/01/13/iran-attack-highlights-us-missile-defense-vulnerability/. Accessed September 18, 2020.

in Europe there is mixed evidence about allied concern with de-coupling and thus the value to European security of U.S. homeland missile defense. Owing in part to NATO's nuclear posture, most U.S. allies in Europe are not concerned the way allies in Asia are about the de-coupling challenge posed by missile vulnerability of the U.S. homeland; thus, they attribute little or no assurance value to U.S. homeland missile defenses. But others—principally the newer members in Central Europe, who are more worried about the effectiveness of deterrence of Russia, and especially about the effectiveness of extended nuclear deterrence—perceive a de-coupling challenge and thus an assurance value to U.S. homeland missile defenses.

On dissuasion, there has been no surge in missile proliferation over the last two decades. In fact, since the 1998 report of the Commission to Assess the Ballistic Missile Threat to the United States, the number of countries reported to be developing or deploying long-range missiles has held steady at 20-25.[45] However, there is no evidence to suggest that this pattern is somehow related to the desired dissuasive effect of U.S. missile defenses; of course, the absence of evidence may be misleading. Throughout this period, North Korea and Iran have stood out as of primary concern to the United States. Neither North Korea nor Iran has abandoned the further development of long-range missiles. North Korea seems to believe that effective defeat of U.S. homeland defenses is within its reach through penetration aids and strike diversification (e.g., ballistic missile submarines).

In addition, the desired protection against accidental and unauthorized launches has gone untested. But the reduced reliance on nuclear threats for deterrence desired by the Clinton, Bush, and Obama administrations has occurred—through a step-by-step process in which improving missile defenses were a factor, but only one of many.[46]

The Other Side of the Ledger: Geopolitical Costs

Russia and China have reacted with concern and hostility to the U.S. missile defense project.[47] In 2019 Presidents Putin and Xi jointly declared that they believe the United States seeks "Absolute Security" for itself with a strategic posture that would enable it to act with impunity against their interests and which thus, in their view, would expose them to U.S. coercion and possible intervention in pursuit of regime change.[48] They fear a globally integrated missile defense architecture that could be utilized by the United States and its allies for purposes of encirclement

45 See the report of the Commission to Assess the Ballistic Missile Threat to the United States (1998), the final (2001) issue of the annual report *Proliferation: Threat and Response* (Office of the Secretary of Defense), the report of the Defense Intelligence Ballistic Missile Analysis Committee—Ballistic and Cruise Missile Threat (NASIC, 2017), and the annual Worldwide Threat Briefing to the Congress by the Director of National Intelligence.

46 See the Nuclear Posture Reviews of the Clinton, Bush, and Obama administrations.

47 For expert analysis from those two countries, see Alexey Arbatov et al., *Missile Defense: Confrontation and Cooperation* (Moscow: Carnegie Center Moscow, 2013) and Tong Zhao, *Narrowing the U.S.-China Gap on Missile Defense: How to Help Forestall a Nuclear Arms Race* (Beijing: Carnegie Center Beijing, 2020).

48 Press statements following Russian-China talks (June 5, 2019).

and containment. Thus, they have robust projects of their own to ensure that their nuclear deterrents will remain effective in the eyes of the United States and its allies whatever our long-term missile defense postures might be. These are buttressed by other efforts to deny the United States the superiority it seeks in cyber space and outer space and conventional power projection. They have also been motivated to develop new approaches to regional war on their periphery and to power projection. Developments in U.S. missile defense policy and posture have certainly not been the main drivers of these new approaches; but they have informed the development of the "Absolute Security" narrative.

In addition, President Putin has used the U.S. missile defense project to justify a Russian nuclear modernization program that goes beyond a baseline program to modernize its strategic triad and penaids (technologies that help ensure that warheads penetrate defenses) to the pursuit of novel weapon systems that might come to constitute 4th and 5th legs of the strategic force. Some of these new capabilities are simple qualitative enhancements expected in any modernization program, but others seem motivated by a genuine concern to preserve a survivable second-strike capability in anticipation of the further development of U.S. precision-strike and missile defenses. As President Putin argued in announcing those new systems in March 2018,

> The U.S. is permitting constant, uncontrolled growth of the number of anti-ballistic missiles, improving their quality, and creating new missile launching areas. If we do not do something, eventually this will result in the complete devaluation of Russia's nuclear potential. . .The American machine has been set into motion, the conveyor belt is moving forward.[49]

Putin has also cited U.S. missile defenses as one of many factors justifying a rejection of deeper arms control cuts and a foreign policy that contests presumed U.S. encirclement and containment.[50] Equally opposed to NATO missile defenses, he has rejected U.S. proposals for ballistic missile defense (BMD)-related confidence and security building measures (CSBMs).

Changes to China's nuclear posture have been less dramatic but still consequential. Beijing has continued the expansion and diversification of its nuclear deterrent while it also pursues modernization and consolidation of a secure retaliatory capability. Its leaders and experts regularly attribute to U.S. homeland missile defense a central role in determining "how much is enough" in the design of that retaliatory force, along with the capabilities of the United States to strike preemptively against China's forces with both nuclear and non-nuclear means. The U.S. intelligence community has regularly explained Chinese nuclear modernization and force expansion and diversification as "intended to ensure the viability of China's

49 Presidential Address to the Federal Assembly (March 1, 2018).

50 Address by the President of the Russian Federation to the State Duma and Federation Council (March 19, 2014).

strategic deterrent by providing a second-strike capability and a way to overcome missile defenses."[51] It remains unclear, however, whether these factors alone can fully explain China's choices about nuclear sufficiency.[52] At the regional level, China has responded with a substantial buildup of conventionally-armed ballistic missiles as well as intensified pressure on South Korea and Japan to curtail missile defense cooperation with the United States. The likely addition of hypersonic systems to this regional strike force underscores China's commitment to negate U.S. and allied regional missile defenses.

Are these Russian and Chinese actions simple reactions—or are they over-reactions? Given U.S. assurances to both, they seem to many Western experts like over-reactions. President Putin is clearly reacting to what he judges to be the logical endpoint of U.S. policy and capability development rather than the posture as it exists—and thus dismisses those assurances. China appears to be taking more incremental steps while hedging against the risk that so motivates President Putin. Neither Moscow nor Beijing has been reassured by U.S. statements about not seeking protection against large-scale strikes largely because those statements do not address the problem that concerns them. Their concern is not with their ability to conduct a large-scale strike preemptively on the United States. Rather, their concern is with the credibility (in American eyes) of their threat to retaliate by nuclear means if struck by the United States. Especially if their forces are not operating on alert when struck by the United States, they may be left with few nuclear forces. The limited retaliation of which they might then be capable must be sufficiently large to penetrate U.S. homeland missile defenses. By this logic, their reactions are not over-reactions. Their reactions are, in their view, necessary to ensure relief from American nuclear-backed coercion and efforts at regime removal.[53]

In considering the validity of these arguments, we must consider also that both Russia and China embrace "information confrontation" strategies aimed at manipulating the security perceptions of the United States and its allies. This calls into question whether the strategic logic sketched out above fully reflects the factors driving the modernization and diversification of the strategic forces of Russia and China.

Some U.S. missile defense advocates reject any suggestion by foreign leaders, or by U.S. experts, that there is an action-reaction cycle between U.S. missile defenses and the nuclear modernization programs of Russia and China. Micaela Dodge has argued, for example, that "empirical evidence shows that countries make armament choices for a multitude of reasons that sometimes have nothing to do with U.S.

51 Daniel R. Coats, Director of National Intelligence, Statement for the Record, Worldwide Threat Assessment of the US Intelligence Community, Senate Select Committee on Intelligence (January 29, 2019), p9. https://www.dni.gov/files/ODNI/documents/2019-ATA-SFR---SSCI.pdf. Accessed September 18, 2020.

52 See Brad Roberts, "China's Strategic Future," in Paul Bolt, ed., *China's Strategic Arsenal: Worldview, Doctrine, and Systems* (Washington, DC: Georgetown University Press, forthcoming).

53 These insights are drawn from informal Track 1.5 dialogues with Russian and Chinese experts. See the chapters on Russia and China in Brad Roberts, *The Case for U.S. Nuclear Weapons in the 21st Century* (Stanford, CA: Stanford University Press, 2015).

choices."[54] This requires accepting that the U.S. missile defense project had no impact on the scope, scale, or pace of Russia's nuclear modernization project and that President Putin's claims to the contrary are a mere "political expedient." Clearly, Russian and Chinese nuclear modernization would have happened without the U.S. missile defense project; but the functional attributes of the resulting force must meet certain sufficiency requirements if they are to be seen as credible in Moscow and Beijing (and Washington and Brussels and Tokyo…) and U.S. missile defenses affect the calculus of sufficiency.

Whatever their impetus, these Russian and Chinese actions have so far affected U.S. interests in a number of ways. Their new military preparedness for regional conventional war under the nuclear shadow has exposed a key vulnerability in terms of the ability of the United States and its allies to fight and win on their terms.[55] There has also been an arms control cost. Presidents Obama and Trump have both sought deeper reductions in nuclear arms, while Russia and China have both argued against arms control so long as the United States refuses to accept limits on its missile defense project. More broadly, all four post-Cold War administrations have sought to put the bilateral strategic military relationships with both Russia and China onto a more positive footing; both have expressed skepticism about such efforts because of the U.S. missile defense project. Their opposition to that project has also led them to put new pressure on U.S. allies in both Europe and Asia to distance themselves from the United States (albeit with results that ought to disappoint them).

What Has Been the Net Impact on U.S. Security as a Whole?

In sum, the historical record is obviously mixed. On some of the most important aspects, such as wartime benefits, there is little or no evidence. On other aspects, the evidence is ambiguous. It is possible nonetheless to tally positive and negative results.

On the positive side of the ledger, the missile defense project has reduced U.S. vulnerability to a nuclear-arming DPRK, though it has apparently failed to dissuade further development. It has helped to hedge against nuclear breakout by a second state (Iran). It has assured U.S. allies and reinforced "coupling" without requiring politically fraught changes to the U.S. extended nuclear deterrent.

On the negative side of the ledger, reactions by Russia and China have been unwelcome. The rhetoric from Moscow and Beijing has been unhelpful but not in itself particularly consequential. The failure to improve the strategic military relationships are regrettable, but the strategic military relationships with both are volatile for many reasons. The emerging threats to U.S. allies are more troubling, as are the novel Russian weapon systems, as they signal an end to the principle of rough strategic

54 Michaela Dodge, *Missile Defense Reckoning is Coming: Will the United States Choose to be Vulnerable to All Long-Range Missiles,* Information Series No. 465 (Fairfax, VA: National Institute for Public Policy, August 2020).

55 *Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission* (2018).

equivalence that has governed the bilateral U.S.-Russian strategic military relationship for decades.

How should we weight these different outcomes? The answer should follow from national strategy. From 1999 until recently, the national strategy was clear—in part because the strategic context was clear. The strategic context was defined by emerging rogue state threats and cautious optimism in major power relations. U.S. strategy focused on escaping a relationship of mutual nuclear vulnerability with rogue states and on promoting strategic stability with Russia and China (though not at the price of weakening deterrence of rogue states). Accordingly, as noted above, U.S. policymakers adopted a laissez-faire attitude toward changes in the Russian and Chinese strategic postures that they were pursuing in the name of ensuring a credible deterrent posture.

In this context, the benefits of the U.S. missile defense project can be judged to have outweighed the geopolitical costs. On balance, missile defenses have contributed to the security of the United States and its allies—so far—by supporting the main objectives of U.S. defense strategy. The costs in terms of negative reactions by Russia and China were bearable because the basic trajectory in major power relations seemed positive.

It is important to note that these judgments follow in part from the technology of missile defense. Once the United States settled in the 1990s on a non-nuclear, hit-to-kill missile defense "solution," it became possible to compose a defense against ballistic missiles aligned with policy objectives. The United States could scale and locate the interceptors and sensors of the homeland defense in a manner that would maximize their effectiveness against rogue states without posing a credible threat to the large-scale strikes of which Russia and China are capable. And it could similarly scale and locate regional interceptors and sensors, with their limited ranges, so that they could not credibly operate against the strategic forces of Russia and China.

The New Inflection Point

But the context has changed in some significant ways, calling into question a simple linear forward progression on the past policy trajectory. Four changes stand out as especially consequential for the missile defense project.

First, North Korea is now well launched on its project to build up a force of nuclear-tipped missiles. Its growing force will come up quickly on the ability to overwhelm the existing GMD system—NORTHCOM's projection is that North Korea will reach this threshold in 2025.[56] This raises new questions about what it means to stay ahead of the rogue state threat. Staying ahead of the rogue state threat wasn't very challenging when rogue states had neither ICBMs nor nuclear weapons nor production capacity. Does the United States accept the necessity of a prolonged and expensive offense/

56 Jason Sherman, "NORTHCOM: U.S. to assume increased risk" against North Korean ICBMs in 2025," *Inside Defense* (July 26, 2020).

defense race with North Korea? And would the resulting U.S. missile defense posture still lack effectiveness about Chinese forces?

Second, the technological improvement of U.S. homeland missile defenses has faltered. Yet another attempt to deploy an improved kill vehicle has been cancelled after great expense. The ambition to rapidly deploy improved interceptors has again gone unfulfilled. The needed network of space-based sensors has again proven unaffordable. Many of the ambitious technology development projects envisioned in 2017 were then studied and largely set aside in the budgeting process. These factors overshadow some important positive developments, including capabilities for left-of-launch operations, both kinetic and non-kinetic (including artificial-intelligence enabled counter-force capability improvements).[57] In response, attention is beginning to shift to longer-term, "more elegant" possible solutions.[58]

The combination of the first two factors puts the United States in a difficult new spot. Substantial improvements to the GMD system are unlikely for another decade. Thus, to stay ahead of North Korea is going to require an "underlayer" of shorter-range systems that could be surged in time of crisis and war to protect the U.S. homeland. Because of the potentially large number of such systems that could be surge-able, Russia and China could see them as a significant new threat to their deterrents, especially in those scenarios where they assume a first strike upon their forces by the United States.

This calls into question a core premise of U.S. missile defense strategy as it has been pursued since 1999: that the United States can field a homeland defense robust enough against rogue states but not so robust as to deprive Russia and China of confidence in their strategic deterrents. It also invites a discussion of whether it remains important to stay ahead of the emerging rogue state threat. If and as North Korea's forces grow, it may become capable of not only overwhelming the defense but engaging in larger-scale strikes posing an existential threat to U.S. allies and also potentially to the United States. In its relations with Russia and China, the United States has deemed missile defense as unnecessary to deal with such larger scale strikes because the threat of nuclear retaliation is credible. Should this logic also apply to the larger scale strikes of rogue stakes, if in fact they become possible?

Third, Russia and China have become major power rivals to the United States. They are deeply opposed to U.S.-backed regional security orders and are well prepared for military conflict with the United States over those orders. Moreover, missiles play a central role in their preparations, leading to significant investments, including in the latest hypersonic technologies. Some discount these capabilities on the argument that they add little to the strategic deterrents of Russia and China—already well stocked with hypersonic ballistic weapons. But Russia and/or China may deploy hypersonic cruise

57 Herbert C. Kemp, *Left of Launch: Countering Theater Ballistic Missiles,* Issue Brief (Washington, DC: Atlantic Council, 2017).

58 Tom Karako and Wes Rumbaugh, *Inflection Point: Missile Defense and Defeat in the 2021 Budget,* Issue Brief (Washington, DC: Center for Strategic and International Studies, March 2020) and Steve Trimble, "Missile Defense Agency Reveals Hypersonic Defense Vision," Aviation Week Online (August 7, 2020).

missiles for the particular purpose of striking critical command and control assets very early in a conflict, thus introducing a new source of crisis instability.

This calls into question another core premise of U.S. missile defense policy since 1999: that the United States could adopt a laissez-faire attitude toward adjustments in their strategic postures. It also calls into question the hope that Moscow and Beijing could be sufficiently assured by Washington to cooperate to ensure strategic stability. This naturally raises questions about whether the United States should continue to seek strategic stability with both and ultimately whether missile defense doesn't have some purposes relative to Russian and Chinese strategic forces.

The fourth and final factor is change in the U.S. policy framework. With the arrival of the Trump administration in 2017, there were major changes to U.S. national security strategy, U.S. defense strategy, and U.S. missile defense policy. The need to consider changes was obvious, as some of the critical assumptions underpinning U.S. policy were no longer valid. Some of the policy choices were not as obvious.

A characterization of the Trump record is complicated by various factors. The administration's Missile Defense Review (MDR) set out an ambitious agenda for capability enhancement, seemingly premised on the high level of missile defense funding in the administration's first year; but it was not sustained, jeopardizing many projects. The review committed to nearly a dozen follow-on studies, with results that are not obvious. Perhaps most importantly, the president's remarks on the occasion of the public release of the review called into question whether the Pentagon and White House had in fact arrived at an agreed agenda (more below).

Thus, on some important points of missile defense policy, there is some ambiguity. On others, however, the administration was quite clear. To the question about whether to try to stay ahead of emerging rogue state threats, the MDR is unequivocal: stay ahead. Toward this end, the administration embraced further growth in the GMD system and subsequently proposed the underlayer to cover the capability gap in the second half of the 2020s.

Moreover, the Trump administration joined with allies in Congress to eliminate the legislative language committing the United States to seek only protection against limited strikes.[59] Instead, the MDR stated a commitment to "continuously strengthen and expand" missile defenses. The president set "a simple goal"—"to destroy any missile launched against the United States, anywhere, any time, any place."[60] His commitment to make space-based sensors and interceptors "a very, very big part of our defenses" aligns well with his commitment to seek "overmatching" military capabilities.[61]

59 Michaela Dodge, *The Backward Step on Missile Defense in the FY 2020 NDAA,* Information Series No. 455 (Fairfax, Va.: National Institute for Public Policy, 2020).

60 "Remarks by President Trump and Vice President Pence Announcing the Missile Defense Review," The White House (January 17, 2019).

61 *National Security Strategy*, White House (2017).

To the questions flowing from renewed major power rivalry, the Trump administration provided a mix of answers. On homeland defense, it repeated the assurances of prior administrations to both Russia and China that U.S. ballistic missile defenses are not intended to negate their strategic deterrents; but it also set out a program to defend against the hypersonic systems they are adding to those deterrents. On regional defenses, it committed clearly to protecting against Russian and Chinese regional threats; but its agendas for cooperating with allies to strengthen regional defenses, as set out in the MDR, did not address cooperation toward this end. The administration appears to have expunged "strategic stability" from its strategic lexicon and its MDR makes no effort to assure Russia, China, or U.S. allies of an enduring U.S. commitment to strategic stability. The supporting logic has not made clear but seems to have something to do with the conviction that strategic stability remains valid as a concept but in practice has been used to pressure only the United States and thus to limit its responses to destabilizing new forms of competition by Russia and China.

Having come to a crossroads, U.S. policy appears to be frozen in place, gripped by uncertainty over primary objectives and the needed level of effort.

To the questions flowing from the new technical landscape, the Trump administration again provided a mixed response. In response to concerns about the long-term viability of the GMD system, the administration committed to the development of an advanced kill vehicle, but then killed the program in 2019. It has instead invested in the Next Generation Interceptor.[62] The MDR committed the United States to develop a defense against hypersonic missiles and work has begun to address both regional and homeland threats. The review also committed to an ambitious set of studies that foreshadowed an aggressive pursuit of advanced capabilities, including space-based sensors and possibly, at a future time, space-based interceptors. But there is no evidence that the studies took place. Whether or not they did, the president's subsequent budgets have not supported these ambitions.[63]

In addition, the clear technical dividing line that once existed between homeland and regional defenses has begun to blur, with sensors that are increasingly interconnected and interceptors that are increasingly mobile. As a matter of policy, the Trump administration accelerated this process with its stated commitment to a layer-based, globally integrated defense that envisions the use of regional BMD systems to defend against rogue state ICBMs.[64] These developments also raise questions about whether the regional defenses being deployed by the United States and its allies can

62 Jason Sherman, "DoD eyes new 'homeland layered' missile defense while developing next generation Interceptor," *Inside Defense* (February 10, 2020).

63 Karako and Rumbaugh, *Inflection Point.*

64 Robert Soofer, "The Case for a Layered Missile Defense of the US Homeland," *The Hill* (June 4, 2020). See also ibid.

so readily be separated from the strategic stability concerns of Russia and China about U.S. homeland defenses.

In sum, having come to some dead ends in legacy policy approaches, the Trump administration took a number of significant decisions departing from that legacy. But they have not launched the United States well on a new trajectory. Implementation has been uneven. Some of the administration's decisions were ambiguous in character, not least because the president and DoD do not appear well aligned. Moreover, the most ambitious policy departures do not enjoy the congressional support necessary for long-term policy continuity—or even the support of the Office of Management and Budget in the White House. Having come to a crossroads, U.S. policy appears to be frozen in place, gripped by uncertainty over primary objectives and the needed level of effort.

The 2030 Posture: Fit for Purpose?

Will the posture of 2030 be fit for purpose? The answer will depend on which pathway forward the United States takes from the new crossroads. Three alternatives are considered here, each premised on a different answer to the question: What problem are we trying to solve with missile defense?

1. Continue to try to solve the "old problem"—defined as deterring and dissuading regional challengers by "staying ahead" while assuring major powers that missile defense "is not pointed at them."
2. Try to solve the next problem—defined as the problem of major power rivalry and the need to fit a strategy "to compete, deter, and win" to Russia and China.
3. Try to solve the strategic problem—defined as negating the coercive value of missile-backed threats in crisis and limited war by "taking the cheap shots off the table."

Case #1: Continue to Try to Solve the Old Problem

Assuming there are no changes to policy or investment strategy in 2021, the U.S. missile defense posture of 2030 is easy to predict. In 2030, the existing GMD system of 44 GBIs will have been supplemented with some or all of the envisioned 20 Next Generation Interceptors (assuming there are no delays). Some elements of the envisioned underlayer may also be in place, if a skeptical Congress can be persuaded. The effectiveness of this homeland defense may be buttressed by some improved "left-of-launch capability." A layer of space sensors may also be in place. Some new sensors and interceptors may also be in place to deal with the threat of advanced cruise missiles, especially hypersonic missiles. Regional missile defenses are likely to have increased in number and integration, with some limited introduction of shorter-range directed energy weapons.

In 2030, a substantial transformation of missile defense by 2040 may appear to be within reach. The move of missile defenses to space could accelerate with the

deployment there of advanced sensors and interceptors. Directed energy weapons may yet prove to be viable replacements for hit-to-kill technology, thereby providing relief from the classic problem of the cost effectiveness of missile defense at the margin.

Would this posture then be fit for purpose? For the purpose of "staying ahead," it may succeed in putting the United States back ahead of the DPRK threat by 2030; the actual result will depend in part on the DPRK. For the purpose of remaining ahead in 2030-2040, the answer will depend on the U.S. ability then in place to out-accelerate developments in the North Korean threat and also on the extent to which Iran and/or other regional challengers join the competition. For the purpose of providing protection from the hypersonic weapons of Russia and China in a way that improves crisis stability, some limited capabilities may be in place.

For the purpose of maintaining stable strategic relations with Russia and China, this posture will be unhelpful, especially if pursued in combination with intermediate- or long-range hypersonic weapons in any significant numbers and with the improved integration of regional and homeland defenses. In that case, leaders in Moscow and Beijing would likely determine that more must be done to respond to what they would deem to be a more dangerous U.S. posture.

For the purpose of taking "cheap shots" off the table and protection against limited strikes by regional actors, this posture would exceed what's needed, as the United States builds an ever larger defense to stay ahead of the ever less limited strikes of which North Korea may become capable.

At what "price" might these potential benefits be purchased? As argued above, this approach would further erode the credibility of the claim that the United States seeks a missile defense robust enough to negate rogue deterrents but not so robust as to undermine Russian and Chinese confidence in their strategic deterrents. It may be that the United States and its allies have already paid whatever price might be required in the way of negative Russian and Chinese reactions; but it may also be that one or both could further develop their strategic postures in one way or another that would increase danger of various kinds. It is possible also that this pathway will result in a worst-case outcome in 2030: rogues whose capabilities have outgrown the U.S. defensive response, major powers even more antagonized by developments in the U.S. strategic posture, and allies who are alarmed by an intensifying tripolar arms race that the United States is struggling to not lose.

Case #2: Try to Solve the Next Problem (Major Power Rivalry)

This case would involve setting aside remaining restraints on the relevance of the missile defense project to the military relationships with Russia and China and indeed to give that project a central place in U.S. and allied efforts to "compete, deter, and win" (from the 2018 National Defense Strategy) in an era dominated by major power rivalry. This implies getting ahead and staying ahead of not just regional challengers but also China and Russia. It implies setting aside the rogue state threat as the pacing factor for the further development of U.S. defenses (it also implies that protection against rogue

state threats would become a lesser-included problem in U.S. missile defense strategy, as protection from their potential attacks would continue).

The presumed benefits of such a posture are many.[65] The United States and its allies would be free from the coercive effects of Russian and Chinese missile-backed threats. They would have the confidence to stand up to aggression aimed at re-making the regional security orders. Having been out-competed by the United States to a position of strategic dominance, Russia and China might then be chastened in their international behaviors.

But these presumed benefits are not within reach by 2030. Indeed, there is a high likelihood that they are beyond our practical reach—technologically, fiscally, politically. Even the attempt could be very costly, with high budget costs, opportunity costs (reducing the willingness of Moscow and Beijing to cooperate in other ways), and assurance costs (renewing allied anxieties about the potentially destabilizing consequences of U.S. missile defenses). There is a significant risk as well: of an arms race with Russia and China that the United States might not be able to win.

For the purpose of maintaining stable strategic relations with Russia and China, this posture would be significantly counter-productive. It would introduce new arms race and crisis instabilities. This "cost" is more significant than before. In the period from 1990 to 2015 or so, when we were little worried about the risks of major war and especially nuclear war with Russia and China, new instabilities carried little risk. In the new period, the risks are substantially higher.

Case #3: Try to Solve the Strategic Problem

The other basic alternative is to re-focus on protection against limited strikes. To do so, it would be necessary to account for the likely future growth of the missile forces of regional challengers by clarifying that the United States seeks protection from limited strikes on its homeland, *whatever their origin*, and sees nuclear deterrence as credible and effective for preventing larger scale strikes, *whomever might contemplate them*. This would rule out larger warfighting requirements to focus instead on the roles of missile defenses in negating blackmail, brinkmanship, and coercion. It would also rule in a role for missile defenses in protecting against limited strikes with hypersonic weapons on critical command and control assets.

The presumed benefits of this approach are that it would provide protection against the most worrisome rogue state threats while offering some hope for restabilizing the strategic military relationships with Russia and China. This could provide a basis for a new arms control bargain with one or both. Even if that were to prove elusive, the United States would have a solid foundation for criticizing any further growth in their forces.

The potential costs could be domestic and political: the further erosion of the bipartisan basis of U.S. strategic policy. Here too there are significant potential risks. Once they have outmatched the topped-off U.S. homeland defense posture, rogue

65 See also Steve Lambakis, *The Future of Homeland Missile Defenses* (Fairfax, VA: National Institute for Public Policy, 2014).

states might be emboldened to adventurism to test out their new-found, presumed leverage. Moreover, Russia and China might perceive appeasement in this approach and be similarly motivated to test U.S. resolve.

Conclusions

Will the U.S. missile defense posture be fit for purpose in 2030? As with each of the other capabilities examined in this collection of essays, the answer is "it depends." And it depends most fundamentally on how the purpose is defined.

Some of the strategic benefits the United States and its allies have enjoyed from missile defenses over the past two decades will be available to them a decade hence. But the purpose of those defenses has become uncertain, due to changes in the geopolitical, technical, and political contexts. Having come to this crossroads, the Trump administration deliberated for two years before setting off boldly on a new pathway, only to be pulled back to the crossroads by competing priorities and its own indecision.

It is time to revisit fundamental questions about U.S. missile defense strategy. What problem are we trying to solve? How do we plan to do so? The existing answer has us solving problems we can no longer solve. A steady-as-she-goes strategy to 2030 only postpones an inevitable reckoning with the contradictions of the legacy approach. How might we re-think the purposes missile defense might fulfill? There are two fundamental alternatives to trying to solve an old problem we cannot now solve. One is to try to solve the next problem—that is, to use missile defense to "solve" the major power problem—that is, to "compete, deter, and win" against Russia and China. The other alternative is to try to use missile defense to "solve" the problem of missile-backed coercion, blackmail, and brinkmanship, whatever its source. This would require a return to the principle of protection only against limited strikes.

For these two purposes, might the 2030 posture be fit? A missile defense posture that seeks to negate the deterrents of Russia and China would not be possible by 2030 and its pursuit between now and then could have wide-ranging, negative repercussions. A missile defense posture scaled and sized to provide protection against limited strikes against the U.S. homeland and in the regions is necessary and would be reliable. It would come at modest cost in terms of the further erosion of strategic relations with Russia and China. Moreover, a missile defense posture aimed at defeating the large-scale strikes of which rogue states might by 2030 be capable would be unnecessary and unreliable.

The need for a choice is clear. The current pathway can be pursued productively for some limited period of time. But the crossroads cannot be ignored. This net assessment points to a conclusion that the United States would be best served by a choice to restore but modify the goal of protection against limited strikes.

Conventional Prompt Strike in 2030 and Beyond

Dean Wilkening

U.S. national security strategy in the next decade or two will focus largely on the strategic rivalry with Russia and China along political, economic and military dimensions. Terrorism, which preoccupied U.S. foreign and defense policy for the last two decades, likely will receive less attention. The rivalry with China will be particularly intense because China is a revisionist power that wishes to supplant the United States as the dominant military power in the Western Pacific and it has the technology and the resources to make good on this threat. Russia also has sophisticated technology in some areas, however, it faces greater economic constraints on its ability to produce advanced weaponry at scale.

This great power rivalry largely will involve conventional, not nuclear, weapons. Conventional weapons, after all, consume the largest fraction of military budgets. Moreover, this rivalry will play out across a spectrum of conflict from gray zone tactics involving economic and political warfare, foreign interference principally enabled by information operations and the use of civilian militias, up to the possibility of regional warfare, perhaps including the use of non-strategic nuclear weapons. In addition, this rivalry will play out in three highly contested domains: space, cyber, and the electromagnetic spectrum. It will also play out in the competition for advantage with precision-guided conventional weapons for land, sea, and air warfare, some of which will have long range and/or high speed.

Hypersonic weapons, the focus of this chapter, are one of the main developments that will affect conventional prompt strike in the next two decades, although supersonic weapons also will play a significant role. A number of technologies will impact the effectiveness of long-range hypersonic weapons, specifically materials that can withstand the intense aerothermal environment at speeds above Mach 5; advanced guidance; navigation and control systems; advanced radar and electro-optical sensors; communication networks for the rapid dissemination of data; and artificial intelligence and machine learning for rapid processing of sensor data and possibly as an aid to rapid command and control decision making.[66]

Understanding Hypersonic Weapons

Hypersonic weapons are a top U.S. research and development priority. Ballistic missiles with ranges beyond approximately 300 kilometers (km) reenter the atmosphere at speeds above Mach 5 and, hence, are hypersonic weapons. The two new types are hypersonic glide vehicles (HGV) and hypersonic cruise missiles (HCM).

66 Distribution Statement A: Approved for public release; distribution is unlimited.

The latter relies on supersonic combustion ramjet (SCRAM jet) engines to maintain hypersonic speeds at altitude. Unlike ballistic missiles, HGVs and HCMs glide at altitudes between approximately 20 and 40 km using aerodynamic lift. HGVs initially are boosted to high speeds by rocket engines much like ballistic missiles, after which they glide toward their target under the influence of gravitational and aerodynamic forces alone. HCMs initially are boosted to speeds approaching Mach 5 after which the SCRAM jet engine ignites adding thrust to the gravitational and aerodynamic forces acting on the vehicle.

Non-ballistic hypersonic weapons are difficult to intercept, especially in their glide phase. Their high-speed, high-altitude flight and substantial maneuver capability implies that defense is difficult. High speed means there is little time for defensive systems to react. At altitudes of 20 to 40 km, HGVs and HCMs fly beneath the minimum intercept altitude of most midcourse ballistic missile defense (BMD) interceptors and above the maximum intercept altitude of most surface-to-air missiles (SAMs). Finally, the capability of non-ballistic hypersonic weapons to engage in midcourse maneuvers means that defensive interceptors would have to have substantial cross-range maneuver capability to close on their quarry. The result is that wide area defenses are rendered largely ineffective.

Boost-phase defense would be an exception, but such defenses must act quickly due to the short boost-phase timeline and, hence, must be close to hypersonic weapon launch sites. Those may be deep within Russian or Chinese territory. This is difficult even from space, not to mention that space-based defenses may be vulnerable to anti-satellite attacks and are costly to deploy and maintain on orbit.

Point defense, on the other hand, may be feasible because hypersonic weapons have less room to maneuver as they descend on their target. Still, their substantial maneuver capability makes them difficult to intercept—defensive interceptors must be extremely agile to get close enough to destroy their target. The range and maneuver capability of hypersonic weapons also makes it difficult to predict the intended target if a large number of important targets are to be defended. Still, point defenses may have an important role in protecting a relatively small number of critical targets, such as ships.

In addition, hypersonic weapons generally will be less expensive than the defensive weapons designed to intercept them. Consequently, hypersonic weapons will form the basis for a cost-imposing strategy against any country committed to defenses against them. Therefore, the best strategy for the hypersonic age likely will be deterrence, albeit with conventional, not nuclear, weapons. Of course, the requirements for conventional deterrence are less well understood than for nuclear deterrence, which is one reason why conventional deterrence has failed repeatedly throughout history.[67]

67 See for example Barry Wolf, *When the Weak Attack the Strong: Failures of Deterrence* (Santa Monica, CA: RAND, 1991) at https://www.rand.org/pubs/notes/N3261.html and Ken Watman, Dean Wilkening, Brian Nichiporuk, and John Arquilla, *U.S. Regional Deterrence Strategy* (Santa Monica, CA: RAND, 1995) at https://www.rand.org/pubs/monograph_reports/MR490.html. Accessed September 18, 2020.

The Potential Contributions of Hypersonic Weapons to the U.S. Deterrent

The two main rationales for U.S. hypersonic weapons, including ballistic missiles, are (1) to penetrate adversary advanced integrated air defense systems (IADS) and (2) to hold time-sensitive targets at risk. As such, U.S. hypersonic weapons likely will stimulate an intense offense-defense competition as Russia and China improve their defenses against hypersonic threats. This is not an arms race in the traditional sense because this competition involves conventional, not nuclear, weapons. Competitions in conventional weaponry are common. While they consume resources, they generally do not pose the same risks as nuclear arms races. Moreover, as noted above, this competition likely will favor the United States and impose asymmetric costs on Russia and China as they attempt to modernize their IADS to cope with this threat.

Time-sensitive targets are targets that must be attacked quickly. Typically, they either are targets on the move that quickly travel outside the field of regard of typical seekers (e.g., ships at sea) or are relocatable targets, that is, targets that are mobile but must stop for a short period of time to carry out their mission [e.g., mobile missile Transporter-Erector-Launchers (TELs) and mobile SAM systems]. During this stationary time they are relatively vulnerable. Mobile missile TELs, for example, remain hidden until alerted for attack at which time they move from garrisons to remote launch sites, stop to erect their missile, and wait for launch orders from higher command. During this stationary phase they are vulnerable to attack, although this time can be quite short. Consequently, holding mobile missile TELs at risk either requires conventional strike assets located close to these remote launch sites, or weapons that fly at high speed to arrive before relocatable targets start moving again back to a hide site. Other time-sensitive targets might include antisatellite weapons, whether fixed or relocatable, or weapons of mass destruction in transit by a terrorist organization or rogue state, as suggested in a 2009 Defense Science Board study.[68]

Conventional hypersonic weapons destroy their targets largely by their kinetic energy upon impact. This implies that only soft point targets are vulnerable to conventional hypersonic attack. Traditional subsonic conventional weapons are more suited for attacking large industrial facilities and some hard targets like command bunkers. Even critical economic infrastructure (e.g., telecommunications, electric power, the financial system, and water distribution) probably is best held at risk with traditional conventional weapons because they often are not time-critical targets and their number might be quite large (unless a small number of critical nodes can be identified where the destruction of which would disrupt the entire infrastructure). For example, in Operation Desert Storm the United States temporarily shut down Iraqi telecommunications, electricity, and oil refining systems for a period of a few months by launching approximately 1,465 strikes against these targets, many with large warheads, over a period of many days. Overall, the United States expended

68 Defense Science Board, *Time Critical Conventional Strike from Strategic Standoff* (Washington, DC: U.S. Department of Defense, Office of the Under Secretary of Defense for Acquisition, Technology and Logistics, March 2009), https://dsb.cto.mil/reports/2000s/ADA498403.pdf. Accessed September 18, 2020.

approximately 16,800 conventional weapons during Operation Desert Storm.[69] In short, hypersonic weapons will play a key role in targeting heavily-defended high-value fleeting targets; however, they will not replace most conventional weapons in the current U.S. inventory.

The main goal of hypersonic attacks is to deny a rapid fait accompli by regional adversaries. In other words, U.S. hypersonic weapons should convince attackers of the risks and uncertainties involved in a rapidly expanding hypersonic battle, one in which the adversary does not hold a speed advantage. If deterrence fails, U.S. hypersonic weapons would be used to degrade the opponent's long-range strike capabilities as rapidly as possible, thereby denying a sanctuary from which to threaten U.S. military forces and U.S. allies in the region.

How Much is Enough?

To support this strategy, how many hypersonic weapons are enough? The first attempt to deploy a U.S. hypersonic weapon was the Conventional Prompt Global Strike (CPGS) program initiated during the George W. Bush administration.[70] The first CPGS weapon candidate was a conventionally-armed Trident submarine launched ballistic missile (SLBM). Given its intercontinental range, this weapon was relatively expensive. The limited number of submarine tubes also meant that few weapons would be on station at any given time. Hence, the CPGS program framed hypersonic weapons as a niche capability to hold at risk a small number of high priority "strategic" targets. The current rationale—penetrating advanced IADS and holding time-sensitive targets at risk—suggests a much wider target set for hypersonic strike. These targets could include conventional mobile missile TELs, advanced SAM systems, surface combatants, and other high priority conventional strike assets such as land-attack and anti-ship cruise missiles, and conventionally-armed bombers on airfields.

The United States will want an inventory of many hundreds, if not several thousand, hypersonic weapons.

How might the operational requirements of contingencies with China drive numerical requirements for the United States? By one estimate, China has over 1,100 time-sensitive targets of the sort described above. These include approximately 150 medium-range conventional ballistic missile (mostly DF-21) TELs, approximately 200 intermediate-range DF-26 ballistic missile TELs, approximately 100 medium-range CJ-10 ground-launched cruise missile launchers, two aircraft carriers, 1 cruiser (Renhai-class), 32 destroyers (Luyang-class), 49 frigates (principally Jiangkai-class), a large number of smaller surface combatants, 189 medium-range naval and air force

69 Thomas Keaney and Eliot Cohen, *Gulf War Air Power Survey: Summary Report* (Washington, DC, 1993), p66-77.

70 Amy Woolf, *Conventional Prompt Global Strike and Long-Range Ballistic Missiles: Background and Issues*, Congressional Research Service (updated February 14, 2020).

bombers (variants of the H-6), approximately 150 medium- and long-range special mission aircraft, and at least 192 advanced long-range SAMs (e.g., HQ-9, SA-10, and SA-20 systems).[71] Even if not all of these targets are of equal priority, one can readily justify in excess of 500 hypersonic weapons at the ready for a conflict in the Western Pacific in times of crisis.

The total U.S. requirement also will have to account for Russian contingencies. Recognizing that more than one hypersonic weapon may be required for some targets and that not all weapons in the inventory will be available for immediate use in a regional conflict, it is easy to conclude that the United States will want an inventory of many hundreds, if not several thousand, hypersonic weapons.

For such large inventories, cost becomes a critical factor. A lot has been made of the alleged high cost of hypersonic weapons—which may be true of intercontinental-range systems (such as those considered under the CPGS program) but is not true of medium-range weapons with ranges between 1,000 and 2,000 km. Weapons of such range would be capable of putting at risk most of the time-sensitive targets mentioned above. What makes medium-range weapons relatively inexpensive? SCRAM jet engines, for example, on HCMs are little more than a hollow tube, albeit one that is carefully shaped so shockwaves can efficiently compress the airflow for controlled combustion at transonic and supersonic speeds inside the engine (i.e., they do not involve the complex turbine machinery required to compress the airflow in traditional jet engines). Hence, medium-range HCMs should be relatively inexpensive to build once the challenges associated with the intense aerothermal environment have been mastered and manufacturing facilities have been built to produce these systems at scale. Time will tell if the United States can meet these challenges. Nevertheless, inventories on the order of 1,000 medium-range hypersonic weapons should be affordable and will be required for deterrence and war fighting if deterrence fails.

U.S. R&D Priorities

The United States (like Russia) has been conducting research on hypersonic technologies for over 70 years. However, neither country has tried seriously to develop weapons based on this technology. U.S. efforts have largely been limited to R&D activities that have suffered from vicissitudes in funding. Today, the United States has made the development of hypersonic weapons a top priority.

The United States currently has five major programs underway.[72] The intermediate-range Conventional Prompt Strike (CPS) program is a submarine-launched HGV (referred to as the common glide vehicle) with a range in excess of 3,500 km. It

71 *Military and Security Developments Involving the People's Republic of China 2020*, Annual Report to Congress, Office of the Secretary of Defense, p46, 59, 165-166, https://media.defense.gov/2020/Sep/01/2002488689/-1/-1/1/2020-DOD-CHINA-MILITARY-POWER-REPORT-FINAL.PDF (Accessed September 18, 2020); and *The Military Balance, 2018* (London: Routledge Press for the International Institute for Strategic Studies, 2018), p249-255.

72 Kelley M. Sayler, *Hypersonic Weapons: Background and Issues for Congress*, Congressional Research Service, R45811 (updated August 27, 2020). https://fas.org/sgp/crs/weapons/R45811.pdf. Accessed September 18, 2020.

should achieve initial operational capability in the mid- to late-2020s.[73] The U.S. Army has two hypersonic weapon programs. The Long-Range Hypersonic Weapon (LRHW) uses the same common glide vehicle and booster stack as CPS, is launched from a mobile TEL and has a reported range in excess of 2,000 km. The second program, Operational Fires (OpFires), is a DARPA-Army collaboration on a shorter-range HGV also deployed on a mobile TEL. The extent to which both will be fully funded remains to be seen.[74] The Air Force had two programs underway. However, the Hypersonic Conventional Strike Weapon (HCSW) was recently canceled. The surviving Air Force program is the Air-launched Rapid Response Weapon (ARRW), which is an HGV based on DARPA's tactical boost-glide technology. It reportedly has a range of approximately 900 km and will be undergoing flight testing in early 2020, after which it should become operational.[75] The last major U.S. hypersonic weapon program is the Hypersonic Air-breathing Weapon Concept (HAWC). This is a joint DARPA-Air Force HCM technology demonstration program designed to reduce the technical risks associated with a hypersonic cruise missile. Presumably, a hypersonic cruise missile will be deployed within the next decade based on HAWC technologies.[76]

The U.S. flight test program reportedly will ramp up quite rapidly with over 40 flight tests planned for the next decade.[77] By mid-decade, the United States should have several operational hypersonic weapons, most likely the Army LRHW, the Navy CPS missile, and/or the Air Force ARRW, with a HCM deployed shortly thereafter. Beyond 2030, these weapons likely will be upgraded in terms of quantity, range, and improved subsystems to make these weapons more effective.

A number of enabling technologies are critical to making hypersonic weapons truly effective military weapons. Foremost among these are Intelligence, Surveillance, and Reconnaissance (ISR) sensors required to find, fix, and track mobile and relocatable targets. Without timely targeting data, hypersonic weapons largely are ineffective. Robust data links also are required to transmit ISR data to command centers where launch orders are created, and from launch platforms to hypersonic weapons in flight to update possible target movement. Finally, within command centers, dynamic targeting decisions must occur very rapidly to take full advantage of short hypersonic flight times. This will require new decisionmaking protocols, aided by man-machine interfaces, that allow command and control decisions to be made on a timeline consistent with hypersonic flight times (that is, within a few minutes).

In summary, the entire "kill chain" of events from initial target detection, positive target identification, target geolocation and tracking, command and control decisionmaking, and hypersonic flight time must be shorter than the stationary

73 Ibid., p5.

74 Ibid., p6.

75 Ibid., p6-7.

76 Ibid., p7.

77 Connie Lee, "Pentagon to Test-Fly New Hypersonic Glide Body This Year," *National Defense* (March 2, 2020).

time associated with relocatable targets if they are to be held at risk. This requires sustained attention to these enabling technologies in addition to the focus on hypersonic vehicles themselves. If the kill chain cannot be closed before the target moves, hypersonic weapons still can penetrate defenses but they will fall short of their ability to hold time-sensitive targets at risk.

Finally, it is important to note that all U.S. hypersonic weapons will be conventionally armed. The United States has no plans to place nuclear payloads on hypersonic vehicles. But Russia and China do. This raises the question whether nuclear-armed hypersonic weapons will change the strategic balance between major powers. The short answer is that they will not. Russia and China already have sufficient strategic nuclear weapons deployed on ICBMs and SLBMs, in addition to weapons on long-range bombers, to ensure a robust retaliatory capability. The fact that nuclear-armed hypersonic weapons can penetrate U.S. homeland BMD adds marginally to this deterrent capability.

The Programs of Russia and China

It is also likely that the majority of Russian and Chinese hypersonic weapons will be conventionally-armed, although the first Russian hypersonic weapon, Avangard, allegedly is a nuclear-armed HGV launched by an SS-19 ballistic missile booster stack. Avangard apparently became operational in December 2019.[78] Russia also is working on the 3M 22 Tsirkon, a ship-launched HCM that allegedly can cruise at speeds between Mach 6 and Mach 8 and attack both ships at sea and land targets. The system reportedly has a range between 400 and 900 km and could become operational as soon as 2023. A third Russian hypersonic weapon, Kinzal, is an air-launched ballistic missile carried on fighters or long-range bombers. Kinzal reportedly has a range of 2,000 km when launched from a MIG-31 fighter, although this range estimate has been questioned. Kinzal allegedly can carry conventional or nuclear warheads and may become operational as soon as 2020.[79]

In contrast China has had relatively little hypersonic research until recently. But it quickly became the pacing hypersonic threat. According to Mike Griffin (former Undersecretary of Defense/Research and Engineering), by 2018 China had conducted 20 times the number of hypersonic tests as the United States.[80] It also has made major investments in ground test facilities, allegedly building one of the largest hypersonic wind tunnels in the world, and it has invested in a large cadre of aerospace engineers working on hypersonic technologies.[81] It has also deployed hypersonic weapons: road-mobile ballistic missiles with maneuvering reentry vehicles,

78 https://en.wikipedia.org/wiki/Avangard_(hypersonic_glide_vehicle). Accessed September 18, 2020.

79 Sayler, Ibid., p11-12.

80 Paul McLeary, "China Loves DoD Acquisition Culture, says R&D Chief Griffin; He Loves Hypersonics," *Breaking Defense* (March 6, 2018).

81 Sayler, Ibid., p14-15.

namely the DF-21 medium-range ballistic missile and the DF-26 intermediate-range ballistic missile. Both have variants designed for attacking targets on land and ships at sea, specifically U.S. aircraft carriers in the Western Pacific. Some of these systems reportedly are armed with nuclear weapons, although the majority likely are conventionally armed.[82] The first Chinese HGV to become operational is the DF-17, 16 of which were on display at the October 2019 parade in Beijing commemorating 70 years of Communist Party rule. The DF-17 has an estimated range between 1,800 and 2,500 km.[83] Another program, Xingkong-2 (Starry Sky-2), involves a hypersonic cruise missile that may become operational by 2025. This system reportedly reached speeds between Mach 5.5 and Mach 6 at an altitude of approximately 30 km for 400 seconds in an August 2018 flight test. Its range is alleged to be between 700 and 800 km.[84] China also is reportedly developing a supersonic anti-ship ballistic missile, the CM-401, with a range up to 900 km.[85] The large number of ongoing Chinese hypersonic flight tests strongly suggests that additional hypersonic weapon are under development.

The Policy Context

Finally, hypersonic weapons raise a number of important policy issues, in particular whether hypersonic weapons undermine strategic stability between the major powers.[86] Strategic stability has two facets, crisis stability and arms race stability. As noted above, hypersonic weapons likely will stimulate an intense offense-defense competition, although this competition will involve conventional weapons, not nuclear. Arms competitions in the conventional realm are commonplace, for example, between stealth aircraft and air defenses, tanks and anti-armor munitions, attack submarines and anti-submarine warfare, anti-satellite weapons and various techniques to ensure the survival of space assets, for example. Moreover, some arms races are necessary.[87]

82 https://en.wikipedia.org/wiki/DF-21and https://en.wikipedia.org/wiki/DF-26. Accessed September 18, 2020.

83 "Dongfeng-ZF / DF-17 Hypersonic Glide Vehicle [HGV]" https://www.globalsecurity.org/wmd/world/china/df-17.htm; David Axe, "Wait, China Has TWO Hypersonic Missiles?," *National Interest* (Dec. 3, 2019), https://nationalinterest.org/blog/buzz/wait-china-has-two-hypersonic-missiles-101422; and Sayler, Ibid, p12-13. Accessed September 18, 2020.

84 https://www.globalsecurity.org/wmd/world/china/xingkong-2.htm (Accessed September 18, 2020); and Sayler, Ibid., p14.

85 David Lague, *China leads U.S. on potent super-fast missiles*, Reuters, special report, (April 25, 2019).

86 For a more in-depth discussion of these issues, see Dean Wilkening, "Hypersonic Weapons and Strategic Stability," *Survival* 61, no. 5 (October–November 2019), p129–141.

87 For example, during the Cold War there was an intense offense-defense competition between U.S. strategic bombers and Soviet strategic air defenses. Initially, the Soviet Union reacted to U.S. high-altitude B-52 bombers by deploying air defenses that could reach high altitudes. In response, the United States introduced low-altitude flight tactics, thus allowing bombers to fly between gaps in the Soviet air defenses, and it planned to attack air defense sites along ingress routes. In response, the Soviet Union developed look-down shoot-down fighters and mobile surface-to-air missile systems at considerable cost to close these gaps. The United States then turned to electronic warfare to jam Soviet radars and it deployed air-launched cruise missiles launched from outside Soviet airspace to saturate their air defenses. As Soviet strategic air defenses improved, the United States developed stealth bombers to guarantee that U.S. strategic bombers could penetrate Soviet, now Russian, airspace. This arms competition was required to maintain the efficacy of one leg of the U.S. nuclear triad.

U.S. conventionally-armed hypersonic weapons are being designed to hold at risk Russian and Chinese time-sensitive targets (in particular, conventionally-armed medium- and intermediate-range mobile missile launchers). This raises the prospect that mobile ICBMs might also be at risk from U.S. conventional counterforce attacks. If so, this would tend to be crisis destabilizing. How destabilizing is a matter of debate. Only one element of their strategic nuclear force would become vulnerable, and even then only partially because this U.S. counterforce capability would not be perfect. More importantly, only one side's strategic nuclear force would be partially vulnerable, not the forces of both sides, as Russia and China do not yet have a comparable conventional counterforce capability against U.S. ICBMs. As Thomas Schelling pointed out decades ago, crisis instability becomes acute only when the strategic nuclear forces of both sides are vulnerable to preemptive counterforce attacks, thus giving rise to a "reciprocal fear of surprise attack."[88] That is, both sides have to have the ability to significantly limit damage if, and only if they strike first, thereby creating strong pressures to preempt the other side. Since the hypothetical vulnerability introduced by U.S. conventional hypersonic strikes is one sided, the nuclear balance still would be stable in a crisis even though Russian and Chinese leaders would have additional incentives to modernize their ICBM forces to make them less vulnerable to conventional attack.

The real problem hypersonic weapons create for crisis stability is the fact that they will increase the difficulties of controlling escalation. If they occur, hypersonic battles will take place very rapidly. Consequently, there will be very little time for careful decisionmaking, thereby increasing the chance for miscommunication and misunderstandings in the midst of battle and, hence, inadvertent escalation.

In addition, attacks that obfuscate the attacker's intent invariably contribute to inadvertent escalation. As noted above, some Russian and Chinese hypersonic systems can be armed with either nuclear or conventional warheads. Therefore, the nature of the attack would not be known until the weapon detonates. Recall that the U.S. Congress ultimately cancelled the conventionally-armed Trident SLBM program due to concerns that Russia or China would not be able to distinguish a conventionally-armed SLBM headed their direction from a nuclear-armed one, leading potentially to catastrophic and unwanted nuclear escalation. Apparently, Russian and Chinese leaders do not think along similar lines.

Russia and China also are known to co-locate conventional and non-strategic nuclear assets at the same garrison. This could obfuscate the intent of attacks designed to destroy their conventionally-armed systems because they might believe the intent is to destroy their non-strategic nuclear systems. This also is a problem of Russia's and China's making. Avoiding co-location, unfortunately, does not entirely solve this problem because the substantial lateral maneuver capability of hypersonic

88 T.C. Schelling, *The Reciprocal Fear of Surprise Attack,* P-1342 (Santa Monica, CA: RAND, 1958).

weapons implies that targets hundreds of kilometers to either side of the initial hypersonic trajectory could come under attack with only a few minutes warning. Thus, if conventional and nuclear assets are not located sufficiently far apart, leaders still might wrongly believe an incoming attack is designed to degrade their nuclear forces.

These factors imply that misunderstandings and misperception in the midst of a battle in which hypersonic weapons are used is more likely, thus increasing the chance of inadvertent escalation. Consequently, the major strategic challenge of the hypersonic age will be maintaining an effective conventional deterrent against hypersonic attacks, while controlling escalation across the nuclear threshold if deterrence fails. Controlling escalation clearly is more difficult than ensuring the survival of one's nuclear forces because the former involves human behavior in extremis while the latter is more akin to an engineering problem.

Suffice it to say that modern conventional warfare between the major powers, if it occurs, will involve a wide range of possible attacks from gray zone operations to regional wars fought with long-range high-speed precision guided munitions. The risk of nuclear escalation will always be in the background. Future conventional wars will be fought in multiple contested domains—air, sea, land, space, and cyber/electromagnetic. The speed and complexity of modern conventional war does not bode well for conventional deterrence or for the ability to control escalation once attacks are unleashed. This is the central strategic problem the United States, Russia, and China must face lest conventional conflicts, in particular with hypersonic weapons, escalate to levels never intended and that all sides might in retrospect wish to have avoided.

The Changing Role of Space in the U.S. Strategic Posture

Benjamin Bahney

The decade ahead promises to be marked by increased competition among the United States, Russia, and China for strategic advantage in space. It is likely that the United States will retain a net advantage through the period, but China will continue to erode the size of the U.S. advantage. The 2020 U.S. military space strategy deems the availability of space capabilities to be fundamental to U.S. military superiority in all domains. The United States has been explicit that it will seek to maintain "space superiority" by defending U.S. and allied space systems, providing space support to joint operations, and ensuring stability in space.[89] Russia and China are intent on denying the United States such superiority by using their growing anti-satellite weapon arsenals while also utilizing space for their own military benefit. And the United States has entered this competition well after the playing field had already shifted under its feet.

The 2020 space strategy seeks to improve U.S. capabilities to use space to generate, project, and employ power across all domains, primarily by placing the emphasis on survivability. Relative to the 2011 National Security Space Strategy, this goal is somewhat more modest. In 2011, the United States sought to strengthen safety, stability, and security in space, maintain advantages afforded by space, and energize the space industrial base. Given its broader objectives, the 2011 strategy looked beyond the military realm alone, seeking other means to advance national interests in space by promoting responsible and peaceful use, providing improved space capabilities, partnering with other nations and commercial operators, preventing and deterring space aggression, and preparing to defeat attacks and operating in a degraded environment.[90] The narrower 2020 focus on military concerns reflects in part the need to address more effectively the intensifying competition with Russia and China. It reflects also the interim development of thought about the needed requirements of the United States military space posture and about the roles and missions of the new Space Force and unified Space Command.

To better understand the evolving role of space in the U.S. strategic posture—and the implications of the coming decade of intensifying competition—this essay proceeds as follows. It begins with a review of the changing role that defense space systems have played from the Cold War to today. It then explores the emerging strategic uses of space. It then turns to the new challenges that Russia and China are presenting through the deployment of counterspace weapons and their growing use

89 *Defense Space Strategy*, Department of Defense (June 2020).

90 *National Security Space Strategy*, Department of Defense and Office of the Director of National Intelligence (January 2011).

of space to enable the other domains. It closes with a net assessment of likely 2030 space postures.

Space's Role from the Cold War to Today

Early in the Cold War, U.S. policymakers became committed to the preservation of space as a sanctuary. Their goals were to keep military competition in space to a minimum and to keep weapons out of space—in order to maintain insight into Soviet strategic weapons programs. This was true despite significant debate at the time about the utility of space as the ultimate high ground, the utility of space-based nuclear weapons, and robust counterspace research and development in both the United States and the Soviet Union, even well into the 1960s.[91] The vision of space as a sanctuary eventually became a shared one between the superpower rivals as it became clear that such a sanctuary supported both arms race and first strike stability. It did so by providing each country's insights into the other's nuclear weapons programs and by delivering missile early warning and nuclear detonation detection. This service to strategic stability was codified in the Outer Space Treaty of 1967, which keeps nuclear weapons out of space and off the moon, and via the Strategic Arms Limitation Treaty in 1972, which provided that the parties would not interfere with each other's national technical means of verification in peacetime, which included intelligence satellites.

But the codification of space as a sanctuary in these treaties, along with technical advances in computing and sensing, also cleared a path to the introduction of space as a support area to aid in conventional means of warfighting in the 1970s and 1980s. Fielding these new space systems to enable stand-off precision strike weapons also cleared the way for a new competition in conventional counterspace capabilities between the United States and the Soviet Union.[92]

After the first Gulf War demonstrated the possibilities of space-enabled military power, the United States continued to drive forward the use of space systems to support conventional military operations. The U.S. military incorporated Global Positioning System (GPS) information into munitions, proliferated communications satellites across the geostationary belt to aid military operations in remote theaters, and even began to use space-based infrared systems for tactical applications.[93]

This growth in space-based information support capabilities, along with the increasing use of intelligence, surveillance, and reconnaissance (ISR) systems, have enabled dramatic increases in the accuracy of and thus the capability of conventional strike weapons. United States conventional strike weapons that are enabled with targeting and position information from space and airborne systems could even in the

91 Peter Hays, "Struggling Towards Space Doctrine: United States military space plans, programs and perspectives during the Cold War," Doctoral Thesis, Tufts University, Fletcher School (May 1994).

92 Benjamin Bahney and Jonathan Pearl, "Why Creating a Space Force Changes Nothing," *Foreign Affairs* (March 26, 2019).

93 Ellen Pawlikowski, Doug Loverro, and Tom Cristler, "Space: Disruptive Challenges, New Opportunities, and New Strategies," *Strategic Studies Quarterly* (Spring 2012), p27-54

1990s strike targets that were previously targetable only with nuclear weapons.[94] This fact has not been lost on the Chinese and Russian militaries, which have also become increasingly capable with information-enabled conventional strike systems over the past 15 years.[95]

One result is the growth of the threat to mobile forces, both conventional and strategic. Experts in Russia and China became alarmed about this threat with the display of U.S. capability in the Persian Gulf War. United States experts have been less motivated because they perceived no particular vulnerability to Russian and Chinese strikes—until recently. The United States is only now beginning to comes to terms with the implications of the increasing capabilities of adversary conventional precision strike. That concern can be expected to intensify in coming years with the expected integration of Artificial Intelligence (AI) into target planning and the continuing proliferation of sensors and communications. Adversary counterforce capabilities will continue to improve, generating new Blue concerns about force survivability. But U.S. counterforce capabilities will also continue to improve, further reinforcing Red survivability concerns.

In short, space has only become more central to the strategic posture since the Cold War, as it now supports first strike and arms race stability through the traditional set of space capabilities introduced in the 1960s, as well as more operational and tactically relevant capabilities which only first became available in the early 1990s and are now standard across the militaries of all the major powers. This, of course, has huge implications on the requirements for the U.S. strategic posture in space in the face of a growing set of Chinese and Russian space and counterspace capabilities.

Space Increasingly Enables Mobile Strategic Force Operations as Well as Counterforce

Space is also playing an increasingly important role in the competition in strategic forces and counterforce among the major powers. That role stems from the competition between conventionally weaker states that want survivable and useable nuclear options for coercive escalation (even under conditions of strategic nuclear stalemate) and conventionally stronger states that want counterforce capabilities to nullify these coercive nuclear options and to improve their ability to assure allies.[96] The United States has explicitly pursued these counterforce options as part of its comprehensive approach to missile defenses, which combines the traditional means (improving midcourse hit-to-kill capability and terminal phase defenses, along with the pursuit of

94 Barry Watts, *The Evolution of Precision Strike* (Washington, DC: Center for Strategic and Budgetary Analysis, 2013).

95 On China, Ibid., On Russia, see David Johnson, *Russia's Conventional Precision Strike Capabilities, Regional Crises, and Nuclear Thresholds*, Livermore Papers on Global Security No. 3 (Livermore, CA: Center for Global Security Research, 2018).

96 Kier Lieber and Daryl Press, *The Myth of the Nuclear Revolution: Power Politics in the Atomic Age* (Ithaca, NY: Cornell University Press, 2020).

boost phase defense) with so-called "left of launch" capabilities (namely, the ability to conduct counterforce attacks against adversary missiles before they are launched).[97]

Russia and China have responded by fielding new systems that can evade traditional missile defenses or that complicate conventional counterforce capabilities. Moscow's "six pack" of strategic capabilities revealed in President Putin's March 2018 speech, along with ongoing modernization of the Perimetr automatic nuclear-weapons control system, are likely a result in part of the improving United States counterforce capabilities of the last few decades.[98] More precisely, the development of these new capabilities are likely a result of fears in Moscow (as well as Beijing) about the capability and intention of the United States to draw on improving cyber, electronic warfare, precision strike, and in particular, missile defense capabilities to coerce and if necessary defeat Russia in regional war.

While these developments in U.S. capability were driven largely by the growing North Korean nuclear threat and were not aimed at Russia or China, they have been highly motivating in Moscow and Beijing and significant in shaping their own strategies for military modernization. Looking ahead to 2030, the strategic "balance" among the three will be decisively shaped by this interaction of perceived intention, improving capability, and rising vulnerability. Layered on top of this will be the growing role of space in U.S. missile defenses as the United States fields a midcourse sensing layer to "stay ahead" of emerging threats by better tracking and discriminating adversary missiles in the near-space and space environments.

This new competition for strategic advantage in space is intensifying. This is evident first and foremost in the strategies of Russia and China which, over the last decade, have surged new counter-space capabilities.

China's strategic forces are both diversifying and growing, apparently in part to counter these perceived challenges from the United States and in part to support China's growing need for a more flexible nuclear force as its national interests grow. The U.S. Defense Intelligence Agency has estimated that by 2030 the Chinese military will at least double the number of deployed nuclear warheads and will complete the final leg of its triad with the addition of an air component to the existing land- and sea- based weapons. China is also developing theater and precision strike nuclear coercive options.[99]

By 2030, this major shift in China's strategic forces will also likely levy requirements for the People's Liberation Army (PLA) to overhaul its use of space to support strategic forces. The Defense Intelligence Agency recently stated that developments in 2019 further suggest that China intends to increase the peacetime

97 U.S. Defense Department, *Missile Defense Review* (2019). On left of launch, see U.S. Defense Department, *Report to Congress: Declaratory Policy, Concept of Operations, and Employment Guidelines for Left of Launch Capability* (May 2017).

98 President V. Putin, Presidential Address to the Federal Assembly (March 1, 2018).

99 Lt. Gen. Robert P. Ashley, *Russian and Chinese Nuclear Modernization Trends*, remarks at the Hudson Institute, (May 29, 2019).

readiness of its nuclear forces by moving to a launch-on-warning (LOW) posture with an expanded silo-based nuclear force.[100] This would likely require the combined use of space-based infrared satellites (in high orbits) and ground-based radars. Also, mobile systems like the Jin-class ballistic missile submarines and the H-6N bomber will likely require communications links to the People's Liberation Army (PLA) command structure to maintain command and control when they are far from the Chinese mainland. It is no surprise that China is now launching a new generation of larger, more capable communication satellites into geostationary orbit—enabled by the new, heavier LM-5 launch vehicle—that will give them more capacity and will enable more robust communications.[101] This will move the PLA into a more symmetric space balance with the United States, as well as requiring additional counterspace capabilities to defend these high value space assets.

These substantial space posture improvements by Russia and China will proceed in parallel with evolutionary improvements to United States space systems. Major expected improvements include a new generation of overhead infrared sensors (replacement of the Space-Based Infrared System or SBIRS with the Overhead Persistent Infrared-Follow-on) and a successor to the system of Advanced Extremely High Frequency satellites used for secure communications among United States strategic forces.[102]

In sum, space is playing an increasingly important role enabling Russian and Chinese strategic forces and a continuing role enabling United States strategic forces. Further, space will play a more and more important role in United States missile defense capabilities. But while Chinese and Russian space postures are being driven by new missions and capabilities for their strategic forces, the United States posture is being driven by the increase in Russian and Chinese counterspace threats that have come now taken shape. The competition for strategic advantage in space, and through space into the other domains, is a key new feature of the emerging strategic landscape.

The Competition in Counterspace is Accelerating

Moreover, this new competition for strategic advantage in space is intensifying. This is evident first and foremost in the strategies of Russia and China which, over the last decade, have surged new counter-space capabilities, most of which are based on the ground. DIA reports that the Russian and Chinese militaries have fielded a staggering number of new capabilities to flexibly deny the United States the ability

100 U.S. Defense Intelligence Agency, *Military and security developments involving the People's Republic of China,* Annual Report to Congress (2020).

101 "Successful Long March 5 launch opens way for China's major space plans," *Space News*, December 27th, 2019. https://spacenews.com/successful-long-march-5-launch-opens-way-for-chinas-major-space-plans/. Accessed September 18, 2020.

102 Mandy Mayfield, "Air Force to Use Rapid Acquisition Authority for New Satellite Program," *National Defense Magazine* (October 16, 2018). https://www.nationaldefensemagazine.org/articles/2018/10/16/air-force-to-use-rapid-acquisition-authority-to-for-new-satellite-program. Accessed September 18, 2020.

to use space to enable military operations against them.[103] The development and deployment of Russian and Chinese counterspace capabilities over the past decade should be seen as the most significant change in their military postures—more important even than developments in their nuclear arsenals. DIA predicts that the surge of new counterspace capabilities will only continue in the years ahead.[104]

China has rapidly fielded a suite of both counterspace capabilities for both low earth orbit (LEO) and geostationary orbit (GEO), with a heavy focus on weapons capable of generating reversible effects, such as ground-based jammers and laser dazzling weapons. China also has been testing on-orbit systems with potential weapons utility. It is also further advancing its space situational awareness capabilities. But the PLA has also deployed a ground-based kinetic weapon for LEO, likely to counter U.S. ISR and communications capabilities. It has also tested a ground-based kinetic weapon at near GEO altitudes for comprehensive counterspace warfighting that could possibly even reach U.S. strategic support systems.[105] Further, as the Chinese expand their use of space in 2020s to support a more global force posture, the Chinese military space order of battle will increasingly look like that of the United States in 2010—that is, large, diverse, and vulnerable. As a result of its increasing reliance on GEO over the next decade, China will also likely have to invest more in counterspace and defensive capabilities.

The Russian military, by comparison, has developed seemingly more significant LEO ASAT programs, with a mix of dazzlers, jammers, and kinetic weapons. But in contrast to China, it has pursued a much more fulsome development of on-orbit capabilities, which have undergone significant testing in the past two years. Russia also seeks to deny the United States the use of GEO communications, likely as a means of reducing U.S. military effectiveness in Russia's near abroad. For this purpose, it has focused on jammers; there are no known Russian kinetic capabilities for GEO.[106]

As Russia and China began to compete with longstanding United States advantages in space, the United States had its military focus elsewhere—on rogue states, counter-terrorism, and counter-insurgencies. Early in the Obama administration the United States began to describe space as a competitive and contested domain but only late in the administration did it begin to invest in space defense capabilities. The Trump administration then took action to establish a new Space Service to organize, train, and equip around this problem and create a new geographic Space Combatant Command to enable space operations in this new heavily contested environment.

From a capabilities perspective, United States counterspace capabilities through this period can best be described as anemic, with only a handful of jamming systems.

103 Defense Intelligence Agency, *Challenges to Security in Space* (January 2019).

104 Ibid.

105 Ibid.

106 Ibid.

But after a strategic pause by the Obama administration aimed at testing the intent of Chinese and Russian leaders on space weapons, by 2013 the U.S. government realized that improved protection was increasingly required, especially as critical strategic force-enabling satellites operating in high orbit became vulnerable.[107] By 2016, the Department of Defense announced multi-billion dollar per year "space control" programs.[108] The Trump administration followed up on these investments by creating a new Space Force military service under the Department of the Air Force. Government officials and military leaders now commonly think of and refer to space as a warfighting domain. The competition has been joined.

The Shifting Terms of Competition: 2020 to 2030

The Russian and Chinese threats to U.S. space-based capabilities is driving not only the pursuit of space control capabilities. It is also driving efforts to improve the resilience of space-based capabilities to attack. This has put the focus on augmentation of existing U.S. satellite communications and ISR systems via resilient proliferated and hybrid architectures, some of which will likely be operationally available by 2030. Satellite proliferation has been made possible only by the expansion of commercial space into lower earth orbit, as venture capital investments in the past 15 years have driven U.S., and now increasingly Chinese, startup companies to try to field proliferated communications and sensing capabilities into lower orbit when constant availability and low latency could open new market possibilities.

In addition, the new Space Development Agency may succeed by 2030 in developing and deploying a space sensor layer for countering hypersonic missile threats (and more generally for mid-course tracking) as well as a new communications layer to enhance joint all domain command and control (JADC-C2). The successful development of these new capabilities would make LEO more central to U.S. warfighting and would enable more capable precision strike and missile defense systems. This of course will only heighten the Russian and Chinese fears of U.S. military space capabilities, and will likely increase their investments in counter-LEO weapons.

In the U.S. approach, these proliferated architectures will be complemented by so-called hybrid architectures, which mix satellite capabilities into different orbital regimes and into broader constellations of systems, building resilience via both numbers and geography. This competition may soon start moving to less conventional orbits and deep space as potentially the new replacement for the geostationary belts, as these orbits are more defensible than LEO (which is both close to earth and cluttered) or GEO (where there are already over 500 satellites).[109] But the United States should also focus significant new efforts on developing space interoperability

107 Maximillian Betmann, "A counterspace awakening?" *The Space Review* (May 2017).

108 Mike Gruss, "DoD will spend $2 billion on space control this year," *Space News* (March 23, 2016). https://spacenews.com/dod-will-spend-2-billion-on-space-control-this-year/. Accessed September 18, 2020.

109 https://www.satsig.net/sslist.htm. Accessed September 18, 2020.

with key regional allies in Europe and East Asia, starting with Japan, France, the United Kingdom, and Australia. These core regional allies could add significant space capabilities and resiliency in ISR, communications, space situational awareness and missile warning. Getting these efforts right could greatly increase the chances of the United States competing successfully in the 2020s and 2030s as they could dramatically expand capacity and challenge Red's ability to separate the United States from its allies via crippling but publicly obscure counterspace attacks.

While the United States moves in these directions in the decade ahead, China and Russia will be on their own trajectories. China's presence in GEO will likely continue to grow with improving communication capabilities as well as significant growth of Chinese ISR and its global Beidou positioning, navigation, and timing capabilities. Although China has only a handful of assets in GEO today, its new generation of DFH-5 GEO communications satellites is on the way, potentially laying the groundwork for a major expansion of China's presence in GEO. Further, the new Chinese LM-5 heavy launch vehicle will also open up more possibilities for large and highly capable satellites for remote sensing in GEO and other high orbits by 2030. These shifts will make China's high orbit space posture much more capable and resilient than it is today. These developments will also substantially improve its strike capabilities.

Russian space programs will likely continue to muddle along in the 2020s. Its ISR systems will likely continue to underperform, despite recent efforts to reinvigorate its optical capabilities.[110] Its new, one-meter accuracy Global Navigation Satellite Systems (GLONASS)-K2 capabilities may come online just in time to avoid embarrassment.[111] One bright spot in the Russian military space story is their YeKS missile warning constellation, which is now finally coming into service to enable Russian launch under attack capabilities as well as possibly new missile defense capabilities. The Russians have little GEO capability because the country is at such a high average latitude, and as a result their satellites are almost entirely in highly inclined and elliptical orbits, meaning that there is little need for defenses in GEO.

In short, between now and 2030 we should expect to see further growth in an already crowded and capable LEO environment, a significant growth of Chinese activity in high orbits, and a United States shift to capabilities in a variety of different orbital regimes. The net result is that higher orbits will become more of a focus for both the United States and China, and the competition there will likely be intense in the 2030 timeframe.

The Net Space Balance in 2030

We can confidently make a number of predictions about the net space balance a decade from now. One is that the Russian posture is likely to erode further relative

110 Bart Hendrickx, "Upgrading Russia's fleet of optical reconnaissance satellites," The Space Review, August 10, 2020.

111 Pavel Luzin, "Russia is behind in military space capabilities, but that only drives its appetite," *Defense News* (April 2, 2020). https://www.defensenews.com/opinion/commentary/2020/04/02/russia-is-behind-in-military-space-capabilities-but-that-only-drives-its-appetite/. Accessed September 18, 2020.

to that of the United States and China. Although the Russians have had significant ambitions in space, they are likely to get outpaced and generally left behind by the United States and China over the next decade. They will prioritize programs like YeKS that support their strategic forces, as well as counterspace capabilities that can protect their strategic forces against ISR and missile defense. But will this posture be "good enough" in terms of its utility in defending core Russian interests? Probably so, as its strategic deterrent will remain viable.

Another prediction is that the U.S. posture will be less vulnerable than it is today. The continued pursuit of space control capability, recapitalization of space programs, and increased reliance on hybrid architectures should be enough for defense.

China will continue to slowly approach parity with the United States in space. But by 2030, it will not have achieved this goal, despite its much more robust posture relative to 2020. Parity is at least another decade away (all things being equal), as it will take that long for China to become fully competitive with the United States in high orbits. A more competitive response from the United States could help assure its lead in space over China well into the 2040s.

Setting aside questions about China's relative gains by 2030 and 2040, will its capabilities then suffice for its purposes? Already today the Chinese have a resilient LEO ISR constellation, which constrains United States freedom of action in the Western Pacific, as these satellites improve the targeting of Chinese missiles.[112] But China's own strategic forces, including the mobile ones, are also becoming more vulnerable, as improving United States ISR in LEO becomes more capable of all-time tracking. These factors will likely continue to fuel robust U.S.-People's Republic of China (PRC) counterspace competition, driving the United States to develop new and more flexible dynamic force concepts, while driving China to continue to grow and diversify its strategic forces.

In higher orbits, it is likely that the postures of both China and the United States will become more resilient. Increased symmetry may bring with it increased stability, as each country refrains from planning for the increasingly large-scale strikes that would be necessary to have decisive effect but which would also be hugely escalatory. But such symmetry plays to China's advantage in regional conventional war because, if both sides lose access to space, the United States stands to lose because it is fighting at such distance.

The implications for the United States are clear. It should not concede to China's effort to strip away its advantages. To safeguard its interests—and those of its allies—through the projection of conventional power the United States must have a more formidable counterspace posture than does China. This requires the ability to dissuade Chinese counterspace aggression through survivable and resilient space posture. A U.S. "overmatch" capability via space-to-ground strike or new missile

112 Kevin Pollpeter et al., *China Dream, Space Dream: China's Progress in Space Technologies and Implications for the United States,* report prepared for the United States-China Economic and Security Review Commission (March 2, 2015).

defense capabilities isn't necessary for the United States to retain the ability to conventionally thwart Chinese troublemaking in East Asia. Unfortunately, senior civilian and military leaders have often argued that the United States seeks to dominate in space—a catchy phrase that rings alarm bells in those countries best prepared to compete with the United States to deny it such dominance.

What the United States should seek in space is what it sought (and had) for decades: strategic stability. It should not (and does not) seek to deny China and Russia the means to defend their core interests. Strategic stability requires that the United States improve its competitive response to adversary space strategies. Its interests would be well served by dropping terms like "overmatch" and "dominance" which have reinforced worst-case thinking in Beijing and Moscow and their commitment to develop capabilities to break U.S. power projection, thereby threatening our ability to project power credibly and weakening our alliance structures.

Conclusion

The past decade was the warm-up act for the more challenging decade to come. China and Russia surged capabilities into space as part of a strategy to negate United States advantages, and the United States belatedly joined the competition. Space is increasingly central to the strategic postures of all three powers, both in terms of supporting their key military capabilities and in denying those of the other side. Losing access to any key military space capabilities would be crippling to all three, although to varying degrees. It would be severely threatening to the United States and its allies, dependent as they are on the U.S. ability to project power. The competition in space is pivotal in that space is a core enabler to military forces in the terrestrial domains and without space superiority it is hard to imagine how a military campaign could be successful against one of the other major powers. Thus, U.S. space superiority is an enduring, core requirement.

However, in looking ahead to 2030, the Department of Defense should be focused on more than maintaining United States space superiority. Safety and stability in space—core goals of the 2011 National Security Space Strategy—are essential, not least for commercial space enterprises to be viable.[113] Indeed, these enterprises are core to the space posture of the future. Further, interoperability with allies is only in its infancy in the space domain, and this idea has been undervalued by the United States for decades. As its network of alliances is core to U.S. security and to the Blue theory of victory, this thinking should also extend to space. Thus, future space strategists and planners should recognize the importance of the stability and security of the space domain in peacetime, and should strive for an interoperable set of space capabilities with allies.

113 Michael Markey, Jonathan Pearl, and Benjamin Bahney, "How Satellites Can Save Arms Control," *Foreign Affairs* (August 5, 2020). https://www.foreignaffairs.com/articles/asia/2020-08-05/how-satellites-can-save-arms-control. Accessed September 18, 2020.

Toward an Integrated Strategic Deterrent

Paul Bernstein

This chapter explores the need for greater integration across the strategic forces toolkit as a means to strengthen deterrence and defense, the opportunities that exist to advance this goal, and obstacles that must be overcome to ensure progress. The chapter begins by framing the integration challenge broadly and as an aspiration over time that must nonetheless inform current thinking and planning. It then examines two current initiatives that address more discrete, near-term integration challenges: offense-defense integration for missile defeat, and conventional-nuclear integration to support regional deterrence strategies. It closes with a brief discussion of organizational approaches that could accelerate the integration process.[114]

The Integration Imperative: Modern Strategic Warfare

Increasingly, the Joint Force is being driven to achieve higher levels of integration in order to deliver effects that will produce decisive operational advantage over adversaries and thereby deter or defeat aggression. From "globally integrated operations" to "multi-domain task forces" and ambitious command and control architectures, the joint warfighting community is developing concepts and capabilities premised on the expected payoff of greater synchronization across operating domains, Service platforms, and combatant command areas of responsibility. In a July 2020 interview with National Public Radio, General John Hyten (U.S. Air Force), Vice Chairman of the Joint Chiefs of Staff, was asked about the major challenges facing the U.S. military. Facing an adversary like China, he said, the biggest challenge was to develop the capability to bring together all military capabilities to "simultaneously and seamlessly" conduct operations.[115]

Today's warfighters seem to understand intuitively the promise of greater integration at the operational level of war, even if making progress toward this goal will be incremental and not always smooth. Completely seamless and simultaneous operations may be an unattainable ideal, but stronger operational integration is one way to manage the complexity of the battlespace that will define conventional conflict with another major power and accomplish those military tasks essential to prevailing at acceptable cost.

Less attention has been paid to the requirements of integration in an escalating conflict moving toward higher levels of violence that could involve the more strategic

114 The views expressed here are the author's own and not those of the National Defense University or the Department of Defense.

115 "Pentagon's No. 2 Officer Says Military Must Do Better on Diversity," National Public Radio (July 22, 2020). https://www.npr.org/2020/07/22/894077398/pentagons-number-2-officer-says-military-must-do-better-on-diversity. Accessed September 18, 2020.

application of non-nuclear instruments—such as cyber weapons and global precision strike—as well as the introduction of nuclear threats or even the limited use of nuclear weapons. Given the high stakes should a local or regional war escalate in this way, the imperative for integration must extend to what we might refer to as "modern strategic warfare." The continuing development by the great powers (and some others) of non-nuclear weapons capable of achieving effects that are strategic in their impact makes the problems of deterrence and escalation more complex, and heightens risk. Current concepts of deterrence and escalation do not adequately account for the range of capabilities that can now be brought to bear by parties to a conflict to make coercive threats, manipulate risk, and impose costs, and in particular for how non-nuclear capabilities may interact with nuclear weapons.

Russia and China are working toward conceptions of integrated strategic deterrence premised on the belief that future conflict will be "cross-domain" in nature and require the effective integration of multiple capability sets.[116] As they make progress toward their goals, their capacity to impose strategic dilemmas on the United States in a crisis or conflict will grow. Anticipating these dilemmas should be a priority for U.S. policymakers and planners. In turn, as the U.S. strategic forces toolkit becomes more diverse and capable, it is essential to think rigorously about how these forces can be integrated to mitigate risk and achieve advantage.

A workshop in 2017 co-organized by CGSR and the Center for the Study of Weapons of Mass Destruction at National Defense University offered a working definition of integrated strategic deterrence:

> An understanding of the relationships among different types of capability at the strategic level and how they can be leveraged to achieve objectives for crisis management, intra-war deterrence, and the management of escalation risk. The ability, enabled by this understanding, and expressed in plans, to execute actions that optimally apply some or all of these capabilities in support of these objectives.[117]

Put simply: if nuclear, cyber, precision strike, space, missile defense and advanced intelligence, and surveillance and reconnaissance (ISR) capabilities can be woven together and leveraged dynamically, the result should be stronger deterrence, a better prospect for managing escalation risks, and expanded options for leadership,

116 "Exploring the Requirements of Integrated Strategic Deterrence," Workshop Report, August 2017, Center for the Study of Weapons of Mass Destruction, National Defense University and Center for Global Security Research, Lawrence Livermore National Laboratory, p2-3. https://wmdcenter.ndu.edu/Publications/Publication-View/Article/1293593/exploring-the-requirements-of-integrated-strategic-deterrence/. On China, see Michael Chase and Arthur Chan, "China's Evolving Approach to 'Integrated Strategic Deterrence,'" RAND Corporation (2016), https://www.rand.org/pubs/research_reports/RR1366.html. On Russia, see Kristin Ven Bruusgaard, "Russian Strategic Deterrence," *Survival* 58, no. 4 (2016), p726. https://www.tandfonline.com/doi/full/10.1080/00396338.2016.1207945. Accessed September 18, 2020.

117 Ibid., p 1.

including courses of action that provide viable alternatives to the use of nuclear weapons.[118]

To be sure, this is a powerfully appealing vision. Although simple to articulate, it will be difficult to realize, not least because the "intellectual homework" needed to lay the foundation for operationalizing integrated strategic deterrence remains to be done. More systematic thought is required, and the mindset driving other forms of Joint Force integration must migrate to the strategic policy community. Generally, the Department of Defense (DoD) practice has been to incrementally add capability to address discrete deterrence and defense problems or shortfalls, with less focus on how they fit together. As a result, deterrence thinkers and defense planners today have at best a limited understanding of what it would mean to "wage" integrated or cross-domain strategic deterrence in the context of a contest with a nuclear-armed peer competitor.[119] Nor does it appear that any particular DoD organization has the job of addressing this challenge.

Deterrence thinkers and defense planners today have at best a limited understanding of what it would mean to "wage" integrated or cross-domain strategic deterrence in the context of a contest with a nuclear-armed peer competitor. Nor does it appear that any particular DoD organization has the job of addressing this challenge.

The 2018 report of the National Defense Strategy Commission, while not explicitly addressing the need for integration, points to the problem in the following observation:

> Due to the increased complexity of evolving domains such as cyber and space, the challenges of dealing with multiple rivals, and the reliance of countries such as Russia on highly escalatory approaches, which may include use or threatened use of nuclear weapons, the requirements for deterrence are significantly different today than during the Cold War or the early post-Cold War era. Deterring our rivals will be highly challenging. Although the NDS states that deterring adversaries is a key objective, there was little consensus among DoD leaders with whom we interacted on what deterrence means in practice, how escalation dynamics might play out, and what it will cost to deter effectively.[120]

118 Paul Bernstein, "Contemporary Deterrence Challenges," in *The Return of Deterrence: Credibility and Capabilities in a New Era,* eds. von Hlatky and Nossal, Kingston Conference on International Security (2019), p13. https://www.queensu.ca/kcis/publications/2018-return-deterrence. Accessed September 18, 2020.

119 Ibid.

120 *Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission*, p21. https://www.usip.org/sites/default/files/2018-11/providing-for-the-common-defense.pdf. The Commission also notes: "The United States needs concepts that account for an adversary's…blending of nuclear, space, cyber, conventional, and unconventional means in its warfighting doctrine." p27.

A framework is needed to help build a common understanding of what integrated deterrence means in practical terms. Such a framework must reflect both conceptual thinking and real world experience, and to be useful must generate insights that can inform strategy, operational concepts, and plans. That is not an easy task—especially given the need to plan against two distinct great power competitors—and it is important to have realistic ambitions. The goal should be to help policymakers, planners, and operators envision the likely interplay of strategic-level capabilities, allowing them to better weigh risk and reward in developing tailored deterrence strategies and operational plans for leveraging or employing these capabilities.[121]

As I have observed elsewhere, developing this framework will require identifying a set of working propositions around considerations related to "red lines" and thresholds, effects, proportionality and norms, attribution, and messaging. These propositions need to be debated, tested, and refined, and then formed into a set of organizing principles or guidelines—or, somewhat more ambitiously, a "rule set"—that can support policy development, deliberate and adaptive planning, and exercises for complex escalation scenarios that will pose challenges for deterrence and place unique burdens on decisionmakers.[122] It is likely that a number of useful propositions already exist based on both analytic work and real world experience.

For instance, in the workshop that provided the basis for this monograph there was an interesting discussion about the prospects of deterring Chinese counter-space operations against the United States in a regional conflict. There was a rough consensus among the discussants that this was highly unlikely; given the Joint Force's reliance on space to support nearly all types of military operations, China would have a strong incentive to degrade this center of gravity. Of course, this very reliance creates a powerful incentive for the United States to protect its space assets and take steps to deter or deny attacks against them. Which assumption should govern United States planning—that it can devise and execute a multi-domain deterrence strategy to restrain Chinese counter-space operations, that such a strategy is necessary but not sufficient and must be accompanied by damage limitation operations, or that deterrence in any form is unlikely to work and therefore should not pre-occupy U.S. planning or thinking? Alternatively, should the United States seek to establish a policy of mutual restraint among the great powers with respect to attacks on space assets? Questions like these, which frame choices on how best to balance operational necessity and escalation risk management, are certain to emerge with respect to all aspects of strategic warfare and point to potential payoffs and risks for strategic force integration.

The tools that can be useful in teasing out the full family of questions like this are well-known—net assessments, emulations, wargames and simulations, red teaming, policy analysis. But they must be applied with rigor to the problem of "modern

121 "Exploring the Requirements of Integrated Strategic Deterrence," p8.

122 Ibid.

strategic warfare" so as to enable the development of concepts, plans and exercises that anticipate critical dilemmas and choices and provide opportunities to rehearse decisionmaking under conditions of complexity, uncertainty, and high risk.[123]

The alternative, it seems, is to expect that these questions will be deliberated and resolved adequately "on the fly" during the prosecution of a regional war. Some would argue that it may be preferable to try to achieve integration in real time by relying on leadership guidance, operator experience, and force management principles.[124] To be sure, there are limits to how well strategies, concepts, and plans can anticipate the requirements of an integrated set of deterrence actions in a crisis or conflict that could unfold in unexpected ways. But the goal is not to eliminate uncertainty and risk. Nor is it to predict the precise contours of a future conflict—other than to suggest its likely stresses and stakes, and the kinds of issues that could arise. Given this, a more prudent approach would invest some effort in thinking through these issues in a structured way to enable at least incremental progress toward the goals of integration.

Progress could take a number of forms aligned with how the national security community works its way through tough problems. Foundational strategy documents (e.g., the National Security Strategy, the National Defense Strategy, or perhaps a Presidential directive) need to be used as a forcing function to motivate the work needed to develop the integration framework suggested earlier. This work could be aided and catalyzed by an expert commission modeled on the 2009 Strategic Posture Commission or the earlier Commission on Integrated Long-Term Strategy, whose *Discriminate Deterrence* report in 1988 offered new ways of thinking about deterrence in light of the changing technology landscape.[125] As useable propositions and insights are generated, integration goals and approaches can be articulated in joint concepts that help the warfighter community prepare for campaign planning. Here, ongoing work to produce a Joint Warfighting Concept provides an early opportunity to introduce strategic integration as key consideration for future force development and design.[126] Likewise, U.S. Strategic Command should use an update to the Deterrence Operations Joint Operating Concept (DO-JOC) to develop and promote integrated

123 In a recent article a senior Obama administration national security official offers similar thoughts about the need to think more systematically about integrated strategic deterrence. Elizabeth Sherwood-Randall observes: "U.S. strategists and planners need to undertake a broad and integrated effort to develop a framework for synchronizing deterrence across multiple platforms—and for developing a related framework that addresses the implications for strategic stability. This will require working through a wide range of scenarios and exploring multiple escalation pathways…" See "The Age of Instability: How Novel Technologies Disrupt the Nuclear Balance," *Foreign Affairs* (July 21, 2020). https://www.foreignaffairs.com/articles/russia-fsu/2020-07-21/age-strategic-instability. Accessed September 18, 2020.

124 "Exploring the Requirements of Integrated Strategic Deterrence," p9.

125 *Discriminate Deterrence: Report of the Commission on Integrated Long-Term Strategy* (January 1988). https://babel.hathitrust.org/cgi/pt?id=uc1.31822004849782&view=1up&seq=35. Accessed September 18, 2020.

126 Little is available publicly about the Joint Warfighting Concept being developed. See https://www.defense.gov/Newsroom/Transcripts/Transcript/Article/2266872/secretary-of-defense-mark-t-esper-message-to-the-force-on-accomplishments-in-im/. Accessed September 18, 2020.

deterrence thinking.[127] As this type of thinking matures and becomes more concrete and actionable, an "Integrated Deterrence Campaign Plan," nested under the Joint Strategic Campaign Plan (JSCP) process, would serve as a capstone-like guidance for combatant command deliberate plans. On the policy side, a parallel process would move toward transforming currently stovepiped strategies for nuclear, missile defense, cyber, and space into a comprehensive, integrated strategic deterrence posture review.[128]

Moving in this direction could bring other benefits. For one, a sharper conception of how strategic forces can work together or complement one another to achieve vital objectives could provide a basis for more robust portfolio management. To date, the capabilities referred to here as being in the strategic forces "toolkit" have not been integrated in a unified approach to program management. Each represents its own programmatic or investment stovepipe, so to speak. Undoubtedly there are pros and cons to adopting a more openly "cross-domain" portfolio philosophy; one can imagine the management, budgetary, and bureaucratic challenges in making the kinds of trades implicit in such an approach. But one can also see the possibility, over time, of achieving efficiencies if investments could be more optimally aligned with requirements derived from an integrated concept for leveraging strategic forces.

Additionally, gaining a better understanding of how strategic forces can operate as an integrated capability set may enable more productive discussion with the other great powers (or the P5) about possible "rules of the road" for weapons whose potential for disruption and damage may not yet be fully understood. This may be especially true for cyber and space/counter-space, and possibly hypersonic systems, where collective thinking about escalation potential and interactions with nuclear deterrence is still at an early stage.

Offense-Defense Integration for Missile Defeat

Even if truly integrated strategic deterrence remains a somewhat distant goal, progress on more discrete types of integration can be achieved.[129] Integration initiatives currently underway offer the promise of an improved deterrence and operational posture against certain persistent threats. The first of these is a form of *offense-defense integration*. Exploring the relationship between strategic offensive and defensive forces dates back to the Cold War, and the period following the establishment of the Strategic Defense Initiative in the mid-1980s in particular saw focused work on the question of how to transition from an offense- to a defense-dominant strategic framework. But little came of this as the end of the Cold War drove a shift in U.S. priorities toward regional missile threats and away from the idea of

127 United States Strategic Command, "Deterrence Operations Joint Operating Concept Version 2.0" (December 2006). https://www.jcs.mil/Portals/36/Documents/Doctrine/concepts/joc_deterrence.pdf. Accessed September 18, 2020.

128 Brad Roberts, "It's Time to Jettison Nuclear Posture Reviews," *Bulletin of Atomic Scientists* (January 2020). https://thebulletin.org/2020/01/its-time-to-jettison-nuclear-posture-reviews/. Accessed September 18, 2020.

129 The author would like to thank his colleague Dr. Shane Smith for his insights on this topic.

transitioning strategic deterrence from mutual vulnerability to mutual protection. Today it would require both major technology breakthroughs and significant policy shifts to begin considering such a transition.

Rather, the emerging focus for offense-defense integration is the rogue state missile and nuclear threat. This a relatively new problem in historical perspective. We have not relied on mutual vulnerability to deal with it but rather on ballistic missile defense (BMD), a major U.S. defense project since the mid-1990s. The threat of greatest concern today is posed by North Korea's long-range missiles, a capability intended to hold American territory at risk of nuclear attack. As this capability has grown in size and sophistication, the United States has found itself making adjustments to its homeland missile defense architecture in the hopes of "staying ahead" of the threat. Hardware programs to strengthen this mission continue to shape priority investments of the U.S. missile defense enterprise, especially as the centerpiece program—Ground-Based Midcourse Defense (GMD)—encounters persistent challenges.

Considerably less attention has been given by the policy, operational, and technology development communities to other approaches to neutralize long-range regional missile threats. The emphasis persists on refining or expanding interceptor-based solutions. Only in recent years has there been movement to investigate and promote a broader concept based on a developing a role for offensive missions against this threat. This concept—usually referred to as "attack operations" or "left-of-launch" operations—seeks to improve overall capability by adopting a more comprehensive (and presumably more cost effective) missile defense and defeat strategy comprised of both active defense and offensive components. The mission of the offensive component, in the words of the 2019 Missile Defense Review (MDR), is to "degrade, disrupt, or destroy an adversary's missiles before they are launched."[130]

This may be described as an operational task in support of a strategic imperative—ensuring that North Korean nuclear-armed ICBMs do not successfully attack the U.S. homeland. A credible offensive capability to neutralize these missiles (and perhaps other missiles of lesser range) would provide a U.S. president with additional options to address the threat and strengthen the ability of the active defense component to perform its intercept mission against a degraded adversary missile force. A demonstrated attack operations capability could also help reduce North Korea's confidence in its ability to employ its missile force in support of coercive and operational goals.

This is not a new idea, of course; there are Cold War and early post-Cold War antecedents. But the ability of the Joint Force to perform attack operations, with their emphasis on rapidly locating, targeting, and destroying mobile missiles, has steadily improved over recent decades, especially with advances in ISR, time sensitive

130 Department of Defense, *Missile Defense Review* (2019), p60. https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR_Executive%20Summary.pdf. Accessed September 18, 2020.

targeting, and prompt precision strike. Additionally, non-kinetic options are believed to exist that can help neutralize enemy missile capabilities.[131]

It is no surprise that interest in attack operations has grown in recent years. The principal catalyst has been progress in North Korea's long-range missile and nuclear programs, beginning with the appearance of the KN-08 road mobile missile in April 2012, the launch of a satellite using the Taepodong-2 satellite launch vehicle in December 2012, and the regime's third nuclear test in February 2013. Continuing difficulties in improving the capabilities of the GMD system to counter this threat and, more broadly, the growing costs of Service active defense programs and other capabilities supporting the nation's layered Missile Defense System, have reinforced the search for a more diverse approach to the missile problem.[132]

In the second term of the Obama administration, DoD leadership initiated a number of special projects on missile defeat with the goal of identifying and testing operational concepts and enabling technologies for left-of-launch operations in a Korea contingency that could complement the active defense mission. Little has been reported about this work in the open literature, but statements from officials suggest that the means and opportunity exist to develop a tailored, integrated concept for persistent surveillance, strike operations, and BMD to limit North Korean launch opportunities and enhance the effectiveness of active defense systems.[133]

The Congress weighed in through the FY 2017 National Defense Authorization Act, directing a report from the Secretary of Defense and the Chairman of the Joint Chiefs of Staff on U.S. policy, operational concepts, and employment plans for left-of-launch capability. The unclassified version of the report, issued in May 2017, offers only general information that sheds little light on how attack operations would be planned, authorized, and executed—or on the strategic implications of such operations for deterrence and escalation.[134] The classified annex may provide a more useful assessment. According to the Missile Defense Review, the Congress in fiscal

131 See Joint Chiefs of Staff, "Joint Integrated Air and Missile Defense: Vision 2020" (December 5, 2013). https://www.jcs.mil/Portals/36/Documents/Publications/JointIAMDVision2020.pdf. See also David E. Sanger and William J. Broad, "Trump Inherits a Secret Cyberwar Against North Korean Missiles," https://www.nytimes.com/2017/03/04/world/asia/north-korea-missile-program-sabotage.html and "U.S. Strategy to Hobble North Korea Was Hidden in Plain Sight," https://www.nytimes.com/2017/03/04/world/asia/left-of-launch-missile-defense.html (both March 4, 2017). For a more skeptical view see Jeffrey Lewis, "Is the United States Really Blowing Up North Korea's Missiles?" *Foreign Policy* (April 19, 2017). https://foreignpolicy.com/2017/04/19/the-united-states-isnt-hacking-north-koreas-missile-launches/. Accessed September 18, 2020.

132 See Sanger and Broad, "U.S. Strategy to Hobble North Korea Was Hidden in Plain Sight" for a rough chronology of senior leader statements reflecting growing interest in "left of launch" capabilities beginning in the 2013-2017 period. See also the memo from two (now-retired) Service chiefs recommending a long-term approach to missile defense that incorporates left-of-launch. https://missiledefenseadvocacy.org/wp-content/uploads/2015/03/03062015_Memo.pdf. Accessed September 18, 2020.

133 For a press account emphasizing the role of enhanced data-sharing in left-of-launch operations, see Sydney J. Freedberg, "DepSecDef Explores New Missile Defense Approach," *Breaking Defense* (August 11, 2015). https://breakingdefense.com/2015/08/depsecdef-launches-new-missile-defense-approach/. Accessed September 18, 2020.

134 Unclassified Report to Congress reviewed by author; authenticity confirmed by the issuing authority.

years 2017 and 2018 made available more than $700 million for new or ongoing capabilities for left-of-launch operations against North Korea's missile force.[135]

The task now is to follow up on the initial progress that was made and follow through on the MDR's commitment to "sustain investments in the capabilities necessary for attack operations, such as improved attack warning intelligence, ISR, time-sensitive targeting, as well as the long-range precision and prompt strike capabilities necessary for destroying mobile missiles prior to their launch."[136]

A number of policy, operational and organizational issues require attention as this work proceeds.

Is the DoD properly organized to develop and deliver the capability? Clearly, a number of DoD organizations have a role to play in developing left-of-launch operational capability. The FY 2017 NDAA directed the Secretary of Defense to designate a Service or Defense Agency with acquisition authority in support of attack operations. While the MDR stated that DoD would clarify roles and responsibilities and identify a lead organization, public documents provide no indication this has occurred. As a result, it is not clear who has principal responsibility for overseeing—and championing—the development of requirements, concepts of operation, and capabilities. Organizations with responsibility for missile defense appear to be less than fully enthusiastic about the mission. The technology development community likely sees left-of-launch as a problem for the warfighter community to solve, as it relies more on a combination of ISR, precision strike, and adaptive command and control rather than the development and procurement of advanced technology systems like active defense interceptors. The policy and operational communities may believe that, at least for the foreseeable future, left-of-launch is not likely to make a significant contribution to the counter-missile mission given technical, operational and other limitations or constraints. Especially in what looks to be an increasingly competitive budget environment, there is a risk this mission could be overlooked if it does not enjoy strong, sustained senior level advocacy. The Vice Chairman of the Joint Chiefs of Staff is in a unique position to play this role. As an alternative, a Combatant Commander could serve as coordinating authority for developing and delivering the overall mission capability.

How effective do attack operations need to be? As noted, this is a tough mission—find, fix, and kill high value targets quickly—and determining requirements may be challenging. The goal is not to eliminate an adversary's missile force but to degrade or thin it sufficiently to give him pause in conducting missile operations and, if this deterrence fails, to enhance the effectiveness of active defense systems in intercepting residual missiles in flight. Determining the measure of effectiveness that hits this "sweet spot" is obviously a critical task that will be informed by a number of

135 Missile Defense Review, p60.

136 Missile Defense Review, p60.

considerations, including confidence levels in the active defense component, adaptive planning and command and control capabilities, and guidance from political leaders.

What types of scenarios should inform planning and what issues arise in these scenarios? While there is little public information on non-kinetic options for left-of-launch operations (e.g., cyber, electronic warfare, directed energy), presumably such tools could be considered for use at almost any time and there may be prevention and deterrence benefits in employing them in peacetime. At the other end of the spectrum, it seems reasonable to assume that if North Korea launches one or more missiles directed at the United States, a U.S. President will authorize attack operations to degrade this threat. The more complicated cases are between these two bookends, and raise the question of whether a U.S. leader would order pre-emptive strikes against missile forces before the onset of open hostilities, and under what conditions.[137] This engages concepts such as hostile intent, imminent threat, and the right of self-defense, but also raises questions about escalation risk that need careful study.[138] Finally, once hostilities have begun, who in the Joint Force has the authority to direct attack operations against what may be nuclear-armed missiles that the adversary undoubtedly views as strategic assets?

How can a credible left-of-launch capability be leveraged to enhance deterrence and how does it fit into a larger deterrence strategy? The payoff of a more comprehensive missile defeat and defense capability built on stronger offense-defense integration is not just operational but strategic as well. This capability must support a larger deterrence strategy that serves to degrade the value of rogue state strategic missile forces. As it matures, left-of-launch capability will need to be conveyed or demonstrated to North Korea and other potential adversaries to achieve desired deterrence effects. An obvious question follows: How are such states likely to respond if they perceive greater vulnerability to their missile operations?

Are there risks with respect to Russia and China? There is no intent to grow the regional attack operations mission into a capability that would enable moving away from mutual vulnerability at the central strategic level. But the Joint Force may learn things in the process of developing the capability—and if necessary employing it in a conflict with North Korea—that would help in countering Russian and Chinese missile forces in a more consequential great power contest. The Missile Defense Review suggests that in a regional war with Russia or China the United States will not limit anti-missile operations due to concerns of escalation risk.[139] But this position could carry growing risk if the United States over time becomes highly proficient at—and more reliant—on left-of-launch operations to manage missile threats. Given the significant investment both Moscow and Beijing have made in mobile ICBMs to ensure

137 Remarks by a former senior defense official in a not-for-attribution discussion of missile defense issues (June 2020) (unpublished transcript).

138 Report to Congress (*Left-of-Launch*), p2.

139 *Missile Defense Review*, p4.

the survivability of their strategic deterrents, it is reasonable to ask how each may react if the United States demonstrates genuine progress—much less some kind of breakthrough—in missile attack operations.

Conventional-Nuclear Integration to Support Regional Deterrence Strategies

A second example of a more discrete integration initiative is the ongoing effort to better harmonize the conventional and nuclear aspects of deterrence and defense for regional contingencies. Conventional-nuclear integration (CNI) aims to strengthen the ability of the Joint Force to operate in the face of adversary nuclear threats and attacks and thereby deter strategies that rely on the threat of escalating a conventional conflict to the nuclear level to gain strategic and operational advantage.

The 2018 Nuclear Posture Review (NPR) acknowledges the challenge posed by competitors that adopt such strategies: "For U.S. deterrence to be effective across the range of threats and contexts, nuclear-armed potential adversaries must recognize that their threats of nuclear escalation do not give them freedom to pursue non-nuclear aggression."[140] An adversary like Russia might believe it could follow such a "theory of victory" with acceptable risk if it concluded that the United States and its allies are unprepared—militarily, politically, and psychologically—to respond in a meaningful way to limited nuclear use. The NPR offers two solutions to this potential deterrence deficit. One is an expanded set of nonstrategic nuclear capabilities in the form of a low-yield option for an existing SLBM (already being fielded) and a nuclear-armed sea-launched cruise missile (still conceptual). The other is enhanced integration of the conventional and nuclear aspects of deterrence and defense.

Both of these initiatives are intended, in a complementary way, to shape adversary calculations of risk when contemplating aggression by calling into question the efficacy of a nuclear escalation strategy. The new nonstrategic capabilities reinforce the ability and resolve of the United States to respond in a proportionate way to an adversary's limited use of nuclear weapons in a local or regional conflict. CNI strengthens deterrence by denial by ensuring that a U.S.-led coalition will not be paralyzed on the ground by limited nuclear attacks, but will be capable of achieving its campaign objectives.

The strategic logic of conventional-nuclear integration may best be demonstrated by examining NATO's effort to respond to the evolution of Russian doctrine and capabilities. Whereas NATO has for many years maintained a largely recessed nuclear deterrent, Russia relies centrally on its nuclear capabilities in its conception of national security and its actions to advance its geopolitical goals. Russia has fielded a large, diverse force of nonstrategic nuclear weapons capable of calibrated employment against political and military targets throughout Europe. The Alliance has concluded that Russia is prepared to threaten or actually employ such weapons in

140 Department of Defense, *Nuclear Posture Review* (February 2018), p21. https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF. Accessed September 18, 2020.

a limited way—potentially at an early stage in a conflict—to deter NATO's response to aggression and thereby achieve a favorable outcome. Thus, NATO faces an increasingly worrisome imbalance in nonstrategic nuclear weapons and doctrine for their possible use. In a crisis, this could weaken deterrence if Russia believed it possessed an exploitable advantage based on asymmetries in forces, doctrine, and ability to control a process of escalation.

Compounding this problem is the fact that these nuclear forces increasingly are intertwined with non-nuclear systems as part of Russia's own drive toward an integrated, multi-domain set of capabilities that exploits ambiguity (e.g., through dual-capable platforms) and appears unconcerned with maintaining a clear conventional-nuclear firebreak.[141] For Moscow, any military confrontation with NATO would include—implicitly or explicitly—an element of nuclear coercion from the outset, and NATO's prudent planning assumption must be that Russian nuclear operations against NATO may be contemplated at any stage of conflict.

NATO has limited options to address this set of risks and reduce Russia's confidence in its strategy for nuclear coercion and escalation control. NATO's land-based nuclear deterrent is small in size, limited to one type of weapon and platform (U.S. gravity bombs and allied dual-capable aircraft), not maintained at a high state of readiness, and not supported by an active military planning process or a discernable employment doctrine. Moreover, NATO's approach to deterrence has been informed by a deeply held tradition of dividing deterrence into distinct conventional and nuclear elements. The nuclear component remains highly sensitive politically and is rarely discussed publicly. One result of this recessed and divided posture is that NATO's nuclear deterrent forces over time have become detached from broader defense strategies, plans, and debates. Thus, while the Alliance has taken significant steps since 2014 to enhance conventional deterrence of Russian aggression, efforts to adapt NATO's nuclear posture in complementary ways have proven more challenging and proceeded at a slower pace. Taking the next logical step—a more practical integration of the conventional and nuclear elements of deterrence—has required overcoming the reservations of some member states who fear a more seamless NATO deterrence posture could mistakenly signal a weakened firebreak.

But the logic of stronger integration—or in NATO parlance, "coherence"—is compelling. The strongest possible deterrence message to Russia is one that conveys clearly that NATO is willing and able to use the full spectrum of its capabilities to counter coercion and aggression—and that these capabilities are mutually supportive rather than isolated from one another. If Russia believes it can discount or negate the capability that embodies nuclear sharing in NATO, deterrence will be less stable. Accordingly, NATO can strengthen security by conveying a deterrence posture that is more indivisible—that is, more integrated or coherent in constructively linking its

141 Dave Johnson, *Russia's Conventional Precision Strike Capabilities, Regional Crises, and Nuclear Thresholds*, Livermore Paper No. 3 (Livermore, CA: Center for Global Security Research, 2017). https://cgsr.llnl.gov/content/assets/docs/Precision-Strike-Capabilities-report-v3-7.pdf. Accessed September 18, 2020.

conventional and nuclear elements. This requires moving past artificial divides in traditional concepts of deterrence that may be comfortable but are not aligned with contemporary threats and how adversaries are thinking and behaving.

As the U.S. defense community works to develop and implement an action plan for CNI based on the NPR direction, a critical task is to shape mindsets and modes of thinking. As in NATO, there have been longstanding divides in the DoD between the conventional and nuclear planning communities. Bringing these communities together to address a shared problem is essential to make CNI work—and indeed will be an important measure of its success in years to come. The Joint Force needs to understand the context and rationale for CNI, in particular the role of nuclear coercion and ambiguity in adversary strategy, the ways in which conventional wars could escalate to the nuclear level, and the imperative to be able to operate successfully under a "nuclear shadow" or following a limited nuclear attack.

Three key questions need to be answered.[142] First, how does the Joint Force win a regional war while deterring nuclear use? This requires planning conventional campaigns in a way that limits adversary incentives to escalate. Campaigns must be calibrated to achieve decisive defeat without posing an existential threat to the adversary. This logic is clear, but achieving the goal may be challenging as it relies on conveying clear messages of restraint and limited objectives that the adversary is prepared to accept despite what may be a significant strategic setback. What objectives and which military operations should the United States and its partners be prepared to forego to mitigate escalation risk? Do we understand adversary threat perceptions well enough to define the right courses of action?

Second, how does the Joint Force become more resilient to limited nuclear attacks? It is essential for plans and forces to anticipate an adversary's limited use of nuclear weapons—and to make these preparations known to the adversary. The ability to survive and then continue operations after a limited nuclear attack can contribute to deterring such attacks; if deterrence fails, the option then exists to continue the conventional warfight without assuming the burden of using nuclear weapons in response. This may help to restore deterrence, though it could also invite follow-on nuclear strikes by the adversary.

Third, what is the integrated approach to developing options to respond to adversary nuclear use? If deterrence fails on a larger scale and can only be restored by a "response in kind," it is important that any nuclear options take clear account of the ongoing conventional campaign and the possibility that leadership will wish to continue prosecuting it. That may limit the focus and scope of nuclear options; so may the imperative to use nuclear weapons in a manner that is restrained so as not to

142 This general framework was introduced by Vincent Manzo and Aaron Miles in their article in *Arms Control Today* in November 2016, and is reflected in recent discussions of CNI by senior DoD officials in not-for-attribution discussions. See "The Logic of Integrating Conventional and Nuclear Planning," *Arms Control Today,* November 2016 for a more detailed discussion than is possible here. https://www.armscontrol.org/act/2016-10/features/logic-integrating-conventional-nuclear-planning. Accessed September 18, 2020.

pose an existential threat to the adversary. Existing and planned nonstrategic nuclear capabilities are sufficient to this task, as long as they are kept modern and ready.[143] Integration also suggests looking for operationally sensible ways for the conventional force to both support the execution of a nuclear response and exploit its effects.

Operationalizing CNI around the answers to these questions will be achieved through tailored political and military guidance and corresponding refinements to Combatant Command operational plans, Service and Joint doctrine, exercise and training activities, strategic messaging, analytic tools to assess the impact of nuclear use, and professional military education. There likely will be new or modified hardware requirements as well (e.g., radiation hardening of electronics, nuclear force protection measures). DoD officials have indicated progress in some of these areas since the NPR was issued.[144]

Finally, it is important to address misconceptions that may exist about CNI. Integration is a response to real changes in the security environment that have led to heightened risk. The goal of CNI is to strengthen deterrence of limited nuclear war, not to move away from a strategy of deterrence to one premised on its expected failure. Nor is the purpose to normalize nuclear weapons, create a "safe space" for their employment, or make them an extension of conventional operations. While integration may imply for some a vision of joint nuclear-conventional warfighting, fundamentally CNI seeks to ensure the nuclear threshold remains high by undermining adversary confidence in strategies built on the threat of escalation.

A Closing Thought

The challenges of integration are diverse and are being addressed in different ways. Progress is possible in offense-defense and conventional-nuclear integration precisely because they are discrete and limited to a modest intersection of domains. Even here, however, both conceptual and institutional barriers must be overcome in order to take practical strides forward. For the more daunting task of making progress toward a concept of all-domain integrated strategic deterrence and a capability to manage the risks of "modern strategic warfare," these barriers are quite high. So, the hard thinking and homework called for in the opening discussion of longer-term integration aspirations are indeed necessary.

But they may not be sufficient if institutional stovepipes impede the formation and adoption of innovative ideas and approaches. Here it may be useful to consider organizational strategies tailored to managing conceptual and institutional complexity, such as cross-functional teams (CFTs). Mandated by Congress in the FY 2017 NDAA, CFTs are being used in complex, high priority initiatives that require a significant degree of collaboration and integration across existing DoD boundaries and

143 Ibid., p12.

144 Based on not-for-attribution statements and discussions. In August 2020, the U.S. Army issued guidance on conventional-nuclear integration in Executive Order (EXORD) 245-20, *U.S. Army Doctrine, Training and Education for Operations in a Nuclear Environment.*

authorities.[145] This or some similar approach seems well suited to the challenges of strategic force integration.

145 See Christopher J. Lamb, *Cross-Functional Teams in Defense Reform: Help or Hindrance*? Strategic Forum No. 298 (August 2016), Institute for National Strategic Studies, National Defense University. https://inss.ndu.edu/Portals/68/Documents/stratforum/SF-298.pdf?ver=2016-08-30-123820-727. Accessed September 18, 2020.

The Tripolar Strategic Balance in 2030

Linton F. Brooks

The essays in this monograph are designed to help scholars and policymakers understand the adequacy of the United States nuclear posture, including both forces and doctrine, in the year 2030. One important consideration is the trilateral strategic relationship among the United States, the Russian Federation, and the People's Republic of China. This essay seeks to give some plausible outlines of that relationship in 2030, the variables on which it will depend and its implications for U.S. nuclear policy.

Assessing the tripolar balance in 2030 is particularly difficult because of the uncertainty of the future U.S. strategic approach, which could depend heavily on the results of the November 2020 election. It is also difficult because it is important to consider the entire strategic posture and not look at the tripolar balance in purely nuclear terms. Even this may not be the most important factor. Whether our strategic deterrent will be adequate in 2030 may depend on the nature of Russian and Chinese leadership and on China's overall strategic approach.

In what follows I argue that the greatest threat to the United States in 2030 and beyond does not come from disparities in force structure. Rather, the risk arises from a possible failure to deal with policy innovations in both Russia and China. The Russian case is immediate and reasonably well understood. China poses different and longer-term challenges. But both require thinking that does not now appear to be going on within the United States. I also argue that the trilateral situation between now and 2030 is best thought of and managed as a set of bilateral relationships and that the convergence between Russia and China in politically opposing the United States is unlikely to lead to significant military cooperation.

Nuclear Forces

What can we expect the strategic forces of the United States, Russia, and China to look like 10 years from now? In all three countries they will look essentially like the forces that exist in 2020.

United States

The U.S. nuclear force structure in 2030 will be quite similar to today's force. None of the currently-approved modernization programs are likely to be canceled, but all except the Columbia class SSBN are likely to be stretched out (and possibly truncated in overall size) for financial reasons. This fiscal risk has existed for some time but will be made greater because of the probable lengthy period before the economy recovers from the impact of the coronavirus pandemic. By 2030, actual deployments from the

modernization program will probably be limited to the B61-12 bomb and B-21 Raider bomber. Deployment of a nuclear-armed sea-launched cruise missile is unlikely.

Moving beyond nuclear systems, non-nuclear ground-launched cruise missiles may be deployed by 2030 in both Asia and Europe. The U.S. focus on ballistic missile defense will continue, although most effort will be put on regional defenses, especially in Asia. A modest increase in national missile defense may be deployed in response to the resumption of ballistic missile testing by North Korea or Iran. The most important change in overall U.S. strategic posture will be the extensive deployment of regional prompt strike hypersonic weapons, primarily aboard Virginia class attack submarines.

Russia

Assessing Russian 2030 strategic nuclear forces is straightforward. Russia will complete most of its planned modernization. This is a near certainty because of the strong support President Putin has given to the nuclear modernization program. Russia is unlikely to go beyond its current plans for fiscal reasons. Financial pressure has already resulted in the rail-mobile ICBM, the 20-tube Borei class ballistic missile submarine variant, and major enhancements in aerospace defense vanishing from Russia's program. In addition, some of the exotic systems, particularly the nuclear-armed, nuclear-powered intercontinental cruise missile, will probably be significantly delayed for technical reasons. Deployment of the SARMAT heavy ICBM will give Russia a significant upload capability.

The greatest threat to the United States in 2030 and beyond does not come from disparities in force structure. Rather, the risk arises from a possible failure to deal with policy innovations in both Russia and China. The Russian case is immediate and reasonably well understood. China poses different and longer-term challenges. But both require thinking that does not now appear to be going on within the United States.

Moving beyond strategic forces, the Defense Intelligence Agency (DIA) anticipates significant growth in Russian non-strategic systems over the next decade. In a May 2019 speech, its director stated:

> We assess [Russia's] overall nuclear stockpile is likely to grow significantly over the next decade…primarily driven by a significant projected increase in… non-strategic nuclear weapons….These nuclear warheads include theater- and tactical-range systems that Russia relies on to deter and defeat NATO or China in a conflict.
>
> Russia's stockpile of non-strategic nuclear weapons—already large and diverse—is being modernized with an eye towards greater accuracy, longer ranges, and lower yields to suit their potential warfighting role. We assess Russia to have dozens of these systems already deployed or in development. They include…short- and close-range ballistic missiles, ground-launched

> cruise missiles…antiship and antisubmarine missiles, torpedoes, and depth charges.[146]

China

The most complex case is China. President Xi is obviously set on making China a regional power of consequence. He seeks parity in influence and prestige, although not necessarily in specific weapons systems. In the speech cited earlier, the DIA director said

> Over the next decade, China is likely to at least double the size of its nuclear stockpile in the course of implementing the most rapid expansion and diversification of its nuclear arsenal in China's history.…We expect this modernization to continue.…China has developed a new road-mobile ICBM, a new multi-warhead version of its silo-based ICBM, and a new submarine-launched ballistic missile…China is also working to field nuclear, theater-range precision-strike systems.

We can expect a continuation of major operational improvements in the People's Liberation Army (PLA) Navy and some improvement in the PLA Air Force. The most important development, however, will be in the Strategic Rocket Forces. Although a nuclear role for the PLA Air Force has been announced, this may say more about inter-service politics than strategic thinking.[147] China's major strategic goal will be to have a free hand in dealing with Taiwan. It is unclear the role nuclear weapons will play in 2030 beyond that goal. The most important strategic developments will be non-nuclear, with the increased ability at area-denial in an attempt to force carriers to remain too far offshore to influence the battle for Taiwan, should one occur.

Nuclear Policy

United States

U.S. nuclear policy, despite the overheated rhetoric of some, has been remarkably consistent over the past few decades. The fundamentals—depending on a secure second-strike capability, maintenance of a diverse Triad, a commitment to extended deterrence, and targeting what an adversary values, not what we might value if we were in the adversary's leadership—will continue.

Two changes advocated by some potential members of a Biden administration are to establish a formal policy of no first use of nuclear weapons and to declare that the sole purpose of nuclear weapons is to deter nuclear attack. It is unclear whether a new administration would actually adopt such policies (the Obama

146 DIA press release, "Russian and Chinese Nuclear Modernization Trends," Lt. Gen. Robert P. Ashley, Jr., Defense Intelligence Agency director, remarks at the Hudson Institute (May 29, 2019).

147 Private communication from a knowledgeable mid-level Chinese official.

administration considered and rejected both), but if they did it would be seen by allies as weakening the United States' commitment to extended deterrence. The issue for military planners is whether the Russian leadership would draw a similarly erroneous conclusion and thus be emboldened.

Russia

In a net assessment of the nuclear forces of the United States and the Russian Federation (R.F.) nuclear assessment, the most significant Russian nuclear policy issue is whether or not Russia's leaders, if faced with a failing conventional conflict, might use one or a few nuclear weapons (probably of relatively lower yields) to seek to extricate Russia from the conflict on acceptable terms. (This Russian strategy is often called "escalate to deescalate," but the term should be avoided since it leads to unproductive debates over whether or not the R.F. has a formal doctrine of that name.) The United States has provided the capability for a proportionate response with the deployment of the W76-2 SLBM warhead as an interim capability until the B6-12 bomb and the LRSO cruise missile are fielded. It is less clear whether it has thought through the strategy for responding to such Russian use. The 2018 Nuclear Posture Review states that if deterrence fails, the United States would strive to limit damage while achieving the best possible outcome for the United States and its allies. If the Russian Federation adopts a similar policy, it is easy to see a series of tit-for-tat responses that could lead to major escalation. The government may have thought through this problem in detail, but there is little public evidence of its having done so.

A second recent development that must be assessed in determining the adequacy of U.S. 2030 policy is President Putin's June 2020 approval of the document "Tenets of Russian Federation National Policy in the Area of Nuclear Deterrence."[148] The document suggests that nuclear response would be appropriate to the launch of any ballistic missile aimed at Russian territory (thus codifying launch under attack) as well as to any conventional attack on nuclear command and control.[149]

China

China's stated policy—a commitment to no first use, a denial of any interest in an arms race with any country, and a continued absence of any interest in nonstrategic nuclear weapons—will almost certainly remain in place in 2030. The Trump administration believes that President Xi seeks a much broader nuclear role in the near term. Others believe that Chinese modernization is consistent with maintaining

148 Presidential Decree 355 (June 2, 2020). In private discussions, some Russians have suggested this is not a new document but an unclassified version of a longstanding policy document. The reason for its unclassified publication at this time is unclear as is the question of whether it is aimed at an internal or external audience.

149 An article by two mid-level active military officers in on the General Staff published in the official military newspaper *Krasnaya Zvezda* (Red Star) stresses that Russia will assume any ballistic missile attack is nuclear. Its status as an official Russian statement is unclear. See Vladimir Isachenkov (Associated Press), "Russia warns it will see any incoming missile as nuclear," *Washington Post* (August 7,2020). https://www.washingtonpost.com/world/europe/russia-warns-it-will-see-any-incoming-missile-as-nuclear/2020/08/07/b8f631b4-d8a0-11ea-a788-2ce86ce81129_story.html. Accessed September 18, 2020.

survivability and ensuring the ability to overcome U.S. ballistic missile defenses—and that China's major improvements will primarily be elsewhere, especially in space.

What is not in doubt is that China under President Xi is seeking to improve its ability to fight and win at the conventional level. In an extensive report to the 2017 19th National Congress of the Communist Party of China, Xi stated:

> A military is built to fight. Our military must regard combat capability as the criterion to meet in all its work and focus on how to win when it is called on.... [We will] make progress in combat readiness in both traditional and new security fields. We will develop new combat forces and support forces, conduct military training under combat conditions, strengthen the application of military strength, speed up development of intelligent military, and improve combat capabilities for joint operations based on the network information system and the ability to fight under multi-dimensional conditions. This will enable us to effectively shape our military posture, manage crises, and deter and win wars.[150]

This suggests the challenge for the United States in 2030 will be dealing with the improved nonnuclear capabilities of the People's Republic.

Although it is beyond the scope of this essay, an important variable in the 2030 net assessment will be the long-term goals that China's leaders then espouse. Many in the United States believe that China aspires to be a full peer of the United States by 2049, including in the realm of nuclear weapons. President Xi has stressed goals for the 100th anniversary of the 1921 founding of the Chinese Communist Party, as well as for the 100th anniversary of the 1949 founding of the People's Republic of China. In this regard it is striking that in President Xi's 66-page report to the 19th People's Congress described above, the word "nuclear" does not appear.

The Trilateral Relationship

While it is occasionally useful to speak of a trilateral relationship, a more accurate characterization for today's circumstance is a set of interlocking bilateral relationships. China and Russia will continue to work together politically to weaken the United States and to oppose the international order for which the United States is the traditional leader. This cooperation is unlikely to grow into a true military alliance. China and Russia do not fully trust one another. China is traditionally reluctant to enter into military alliances. The most significant reason for doubting that a significant military alliance will arise, however, is that both the Chinese president and the Russian president believe he should be the senior partner. Arms sales of conventional equipment will continue, but in its strategic planning (especially in the nuclear arena)

150 President Xi Jinping, *Secure a Decisive Victory in Building a Moderately Prosperous Society in All Respects and Strive for the Great Success of Socialism with Chinese Characteristics for a New Era* (October 18, 2017), report delivered at the 19th National Congress of the Communist Party of China, p48-9.

the United States can assume that it must deal with the two principal competitors separately.

Some hope a new arms control regime may help regulate trilateral relations. Hope is often wise, but in this case it will be in vain. Arms control will play a limited role in the strategic posture of the three main competitors in 2030. While New START may be extended, a follow-on treaty is unlikely. A reelected President Trump would find it difficult to include China in a treaty[151] while a Biden administration would have problems negotiating additional reductions for which there appears to be virtually no Russian interest. A verifiable approach to controlling Russian non-strategic nuclear weapons will bedevil either party. If Russian insistence on including significant limits on ballistic missile defense continues, it will make agreement impossible. Finally, the intense partisanship that characterizes the modern U.S. political scene may make ratification of almost any new treaty impossible. This outcome will not lead to a major arms race and will not be the disaster arms control advocates believe it to be.[152]

Wild Cards

The discussion thus far assumes that the current Russian and Chinese leadership will remain in place in 2030. Both President Putin and President Xi clearly expect this to be the case. They may be wrong. Both are aging and may not survive another 10 years. It is also possible, although unlikely, that there will be a challenge to President Putin sufficient to cause him to leave office. Unfortunately, a more likely situation is that he will respond to increasing domestic pressure by becoming even more aggressive in his foreign policy, seeking to rally the nation around him to counter the Western threat. Since Putin is likely to be replaced by one his inner circle dedicated to the same approach of "Putinism" in a patron-client system, a change of Russian leadership may not dramatically change the geostrategic situation.

The situation is more complicated in China. We have only limited insights into who might replace the current president and should expect a considerable period of internal political turbulence while the eventual successor solidifies his position. This situation is inherently dangerous. It could be made worse if Taiwan were to misjudge the situation and seek formal independence. Technically the Taiwan Relations Act would not require U.S. intervention, but politically some use of force might be difficult to resist.

Fit for Purpose?

Against this complex landscape, will the U.S. strategic and nuclear posture be adequate for the trilateral challenges of 2030?

151 This goal may have been abandoned, or at least deferred. White House Press Office, "Remarks by President Trump Before Marine One Departure" (July 29, 2020).

152 For a discussion of why arms control may collapse and what can be done about it, see Linton F. Brooks, "The End of Arms Control?" *Daedalus* 149, no. 2 (2020).

The challenges facing the United States in 2030 are more likely to be in the realm of strategic thinking and crisis management than they are to be caused by any deficiencies in the nuclear force structure. The United States will have enhanced its force structure vis-a-vis Russia in 2030 and will remain fully capable to deterring nuclear attack on America or its allies. It will be capable of dealing with lesser contingencies as well, provided it has crafted appropriate strategic responses to the possibility of Russian limited use of nuclear weapons to extract itself from failed conventional aggression.

With China, there will be force structure issues, but they will not be in the nuclear arena. For the United States to gain or even preserve its position in its bilateral strategic relationship with China will require the deployment of effective regional ballistic missile defenses, including defense of carrier assets, along with prompt regional strike based on hypersonic weapons. Since the number of intermediate-range ballistic missiles that the PLA Strategic Rocket Forces will deploy will far outnumber the submarine-launched hypersonic weapons the U.S. Navy will be able to bring to bear, the United States also needs a significant strategic plan for dealing for maximizing the effectiveness of its forces, including the coordinated efforts initiated in the Air-Sea Battle concept.[153] Finally, the United States will need a better conception of how it might handle potential Chinese threats to use nuclear weapons if the alternative is losing control of Taiwan.

153 For an early unclassified summary, see *AIR-SEA BATTLE: Service Collaboration to Address Anti-Access & Area Denial Challenges,* Air-Sea Battle Office (May 2013).

Russia's Assessment of the 2030 Strategic Balance

Anya Loukianova Fink

"When it comes to the nuclear status, I don't know if it should be written in the Constitution, because the question is not in whether we are a nuclear power today. The question is whether we will be able to stay a step ahead in all new weapons systems forever. And this may not necessarily be nuclear weapons. This could be weapons based on new physical principles, maybe something else, of which it is not appropriate to speak about now, but things that our scientists and industry are working on."[154]

President Vladimir Putin, 2020

Over the last two decades, the Russian Federation has steadily invested in modernizing its nuclear and non-nuclear capabilities to build a comprehensive strategic deterrence system intended to assure Russia's security and sovereignty into the future. Moscow views this future as an emerging multipolar world order, against a backdrop of rapid technological change where the United States seeks to maintain global preeminence by, inter alia, constraining Russia. Looking ahead to 2030, nuclear deterrence and the nature of the U.S.-Russian political-military relationship are likely to remain central to Russia's assessment of the strategic balance. But leaders in Moscow are also signaling a new emphasis on the development of asymmetric responses to future threats by investing in military-technological innovation. Reaping the results of these investments by 2030 will require, however, that the Kremlin address deeper challenges in the Russian economy and in its approaches to science and technology.

This chapter first looks at defense spending and procurement trends that will shape Russia's military modernization toward 2030. It then examines the future evolution of the individual elements of Russia's strategic deterrence system, highlighting some of the challenges with Russia's ongoing innovation drive. Finally, it discusses political factors that are likely to play a role in how Russia's leadership assesses the 2030 strategic balance.

Defense Spending Trends

A central aspect of Moscow's planning for the future involves the continuous improvement of Russia's armed forces to ensure their ability to respond to a spectrum of threats to Russia's security and sovereignty. Moscow has been engaged in a

154 "Встреча с рабочей группой по подготовке предложений о внесении поправок в Конституцию" [Meeting with a working group to prepare constitutional amendment proposals], President of Russia (February 13, 2020). http://kremlin.ru/events/president/news/62776. Accessed September 18, 2020.

military modernization effort, propelled by years of neglect and underscored by the poor Russian military performance in the 2008 war with Georgia. Recent statements made by President Putin and other officials provide clear contours of Russia's future defense expenditures and procurement planning.

Russia's defense spending is unlikely to experience a significant increase over the next decade. To the contrary, there are indications that it will continue to plateau or may even decline as Russia nears the achievement of modernization milestones and levels of qualitative improvements toward the mid-2020s.[155] Publicly, Putin and defense minister Sergey Shoigu have maintained that Russia would not get involved in quantitative arms races that would increase the defense burden—much of the focus would be on quality of the weapons.[156] Recent reports also suggest that, because of COVID pandemic stresses on the Russian economy, there may be five percent cuts in procurement spending in 2021-2023.[157] These cuts may contribute to some programmatic delays and tradeoffs in the first part of the decade.

Russia's overall spending on national defense can be viewed as divided with one half spent on personnel (man, train, and equip) and the other half spent on procurement, R&D, and maintenance.[158] The armed forces' manpower indicators appear positive, with an overall increase in the size of the force over the last five years, a decline in conscripts, and a rise in contract-based service.[159] Russia has made significant progress on procurement and R&D, which are planned through multi-year State Armament Programs (SAP). One key metric is the percent levels of modern military equipment. Under the SAP-2020, which was implemented in practice between 2011 and 2017, the stated level of modern equipment rose from 16 percent in 2012 to 47 percent in 2015. The SAP-2027, initiated in 2018, saw the stated levels of modern equipment rise to over 60 percent by 2020.[160]

155 See discussion in Richard Connolly, *Russian Military Expenditure in Comparative Perspective: a Purchasing Power Parity Estimate*, Center for Naval Analyses (October 2019). https://www.cna.org/CNA_files/PDF/IOP-2019-U-021955-Final.pdf. Accessed September 18, 2020.

156 For example, see Putin's statements in "Defense Ministry Board meeting" (December 18, 2018). http://en.kremlin.ru/catalog/keywords/91/events/59431. See also Shoigu statements in "Defense Ministry Board meeting" (December 24, 2019). http://en.kremlin.ru/catalog/keywords/91/events/62401. Accessed September 18, 2020.

157 Inna Sidorkova and Ivan Tkachev, "Минфин предложил снизить траты на госпрограмму вооружений" [Ministry of Finances offers to decrease expenses on the state armament program] (July 20, 2020). https://www.rbc.ru/politics/20/07/2020/5f15a00e9a7947326377dd89. Accessed September 18, 2020.

158 Alexey Nikolskiy and Ivan Safronov, "Расходы на оборону в 2020 году существенно не вырастут" [Spending on defense will not significantly grow in 2020] Ведомости (8 августа 2019). https://www.vedomosti.ru/politics/articles/2019/08/07/808335-rashodi-oboronu. Accessed September 18, 2020.

159 Michael Kofman, "Russian Demographics and Power: Does the Kremlin Have a Long Game?" War on the Rocks (February 4, 2020). https://warontherocks.com/2020/02/russian-demographics-and-power-does-the-kremlin-have-a-long-game/. Accessed September 18, 2020.

160 Julian Cooper, "Prospects for Russia's Defense Spending," *Russian Analytical Digest* (June 21, 2019). https://css.ethz.ch/content/dam/ethz/special-interest/gess/cis/center-for-securities-studies/pdfs/RAD237.pdf. Accessed September 18, 2020.

The current stated goal is to achieve a 70 percent level of modernization across the Russian armed forces and maintain that level throughout the 2020s.[161] Putin has emphasized this modernization metric, while stressing that Russia's "goal is not a one-time rearmament… [and it is insufficient to have equipment be 'up to world standards' because Russia's] equipment must be better than the world's best if we want to come out as the winners."[162] In addition to continuing modernization across the ground, aerospace, and naval forces, the SAP-2027 prioritizes procurement throughout all three legs of Russia's nuclear triad and its aerospace capabilities with platforms like the S-500, as well as systems like the Avangard hypersonic glide vehicle (HGV).[163]

By 2030, Russia is likely to be in the midst of implementing SAP-2033, which is currently under development. According to Ministry of Defense officials, this phase will go beyond simply maintaining stated modern equipment levels to address the requirements of the "intellectualization of weapons" as well as the deployment of unmanned and robotic systems.[164] As Putin has described the SAP-2033:

> The main goal of this new period is the increase of qualitative and quantitative characteristics of armaments and technology. We speak of modern and future models of high-precision weapons and means of aerospace defense, active employment of artificial intelligence in developing military goods. We also need to expand the selection of unmanned reconnaissance and strike aerial vehicles, laser and hypersonic systems, weapons based on new physical principles, as well as robotic complexes, which could perform diverse roles on the combat field.[165]

Although this program focuses heavily on general-purpose military forces, it also has implications for Russia's evolving strategic deterrence system.

Strategic Deterrence System Evolution

Russia's General Staff spends considerable time thinking about the future of warfare and the resultant implications and metrics for Russia's armed forces, particularly in key theaters in which Russia may see conflict.[166] To date, military planners have assumed that, while the initiation of a large-scale conflict against Russia is unlikely, an armed conflict or a local war, which may also begin as social

161 See statement by head of the MOD Main Directorate for Weapons A.V. Gulyaev (April 10, 2020). http://mil.ru/army2020/statements/more.htm?id=12297890@egNews. Accessed September 18, 2020.

162 Putin's statement at "Defense Ministry Board meeting" (December 24, 2019).

163 See Julian Cooper, "The Russian State Armament Programme, 2018-2027," NATO Defense College (May 2018).

164 Statement by head of the MOD Main Directorate for Weapons A.V. Gulyaev, op. cit.

165 «Заседание Совета Безопасности Российской Федерации» (Meeting of the RF Security Council), (November 22, 2019). http://kremlin.ru/events/president/news/62096. Accessed September 18, 2020.

166 For a discussion of COFM, see Clint Reach, Vikram Kilambi, and Mark Cozad, *Russian Assessments and Applications of the Correlation of Forces and Means* (RAND, 2020). https://www.rand.org/pubs/research_reports/RR4235.html. Accessed September 18, 2020.

instability in Russia, has the ability to quickly escalate to a regional or a large-scale war.[167] If deterrence fails, and Russia finds itself in a conflict against a conventionally-superior nuclear peer, it needs to have effective escalation management strategies and readiness to take decisive actions in the initial period of war. This could include disorganization of an opponent's ability to effectively operate its forces (by attacking the systems for C4ISR—Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance). Thus, Russia has developed a suite of strategic deterrence capabilities for deterrence, escalation management, and warfighting that will continue to evolve throughout the 2020s.

The crown jewels of Russia's strategic deterrence system are its strategic nuclear forces, and authoritative Russian military thinkers argue that these will retain their importance until the 2050s and beyond.[168] And, over the coming decade, modernization efforts that have extended to all three legs of the Russian nuclear triad, along with nuclear command and control, will be largely completed, though production lines will still be warm. The ever-dominant ICBM leg will likely consist of the single-warhead Topol-M ICBM, and MIRV'ed Yars and Sarmat ICBMs, with about a half of the overall force based in silos. Some of the Sarmat ICBM will carry the Avangard HGV, with the stated intent of buttressing Russia's secure second strike. The undersea leg will likely consist of 10 Borei class SSBNs, with five each in the Northern and Pacific Fleets, and several overhauled Delta IV SSBNs.[169] The SSBNs will continue to be based in bastions.[170] The strategic bomber force, anchored by modernized Tu-160 and Tu-95 long-range bombers with new long-range ALCMs, will likely stay relatively stable, with a small possibility that the new generation stealth strategic bomber, the PAK DA, enters serial production by 2030.[171]

Russia's nuclear retaliatory potential will continue to rely chiefly on ICBMs, with silo-based ICBMs instrumental in so-called retaliatory-meeting strikes (*otvetno-vstrechnyi udar* or, in essence, launch on warning) and mobile ICBMs and SSBNs

167 "Тенденции развития военного искусства" (Tendencies of the development of military art), *Nezavisimoe Voennoe Obozrenie* (October 4, 2019). https://nvo.ng.ru/realty/2019-10-04/1_1064_tendenzii.html. Accessed September 18, 2020.

168 A.A. Kokoshin, "Перспективы развития военной техносферы и будущее войн и небоевого применения военной силы" [Perspectives on the development of the military technosphere and the future of wars and the noncombat employment of armed forces], *Vestnik Akademii Voennykh Nauk,* no. 2 (2019).

169 ICBM stands for intercontinental ballistic missiles, MIRV for multiple independent reentry vehicles, SSBN for ballistic missile submarines, and ALCM for air launched cruise missile.

170 See Michael Kofman, "The Role of Nuclear Forces in Russian Maritime Strategy," in Rory Medcalf, Katherine Mansted, Stephan Frühling and James Goldrick, Editors, *The Future of the Undersea Deterrent: A Global Survey* (Canberra: Australian National University, 2020).

171 See Amy Woolf, *Russia's Nuclear Weapons: Doctrine, Forces, and Modernization*,Congressional Research Service report (updated July 20, 2020). https://crsreports.congress.gov/product/pdf/R/R45861. Accessed September 18, 2020.

central to retaliatory strikes (*otvetnyi udar* or, in essence, launch under attack).[172] These forces will need to be able to inflict, as part of a strategic operation, certain "assigned" levels of damage that an adversary will find "unacceptable," though debates about tailoring subjective "unacceptable damage" levels are likely to continue across the Russian military-analytical establishment.[173]

The evolution of the nuclear force as a whole will likely depend on the Russian leadership's perception of the state of strategic stability and the nature of U.S.-Russian mutual nuclear vulnerability to include arms control. Two decades ago, faced with the possibility of unbound U.S. missile defense developments, Russia prioritized R&D and procurement of systems that could penetrate missile defense systems. Blueprints of some of the "exotic" systems announced by Putin in 2018, such as the Burevestnik nuclear cruise missile and the Poseidon nuclear torpedo, may have been dusted off from shelved Soviet ideas to counter the U.S. Strategic Defense Initiative.[174] Other systems, like the Peresvet laser, may be intended to protect Russia's mobile ICBMs by dazzling an opponent's satellites.[175] Still others, like the Kinzhal air-launched ballistic missile (ALBM), are likely intended as regional missile defense infrastructure busters. Russia's investments in asymmetric capabilities, some of which may also be intended for psychological deterrent effects, are likely to continue.

A persistent trend over the 2020s will be Russia's development of a suite of capabilities broadly aimed at disorganizing an opponent's C4ISR, particularly in the critical initial period of war.

Some Russian analysts argue that the U.S. deployment of new intermediate-range missiles in Europe could result in a Russian shift toward a pre-emptive strike posture, while significant U.S. deployments of hypersonic systems could have implications

172 V. F. Lata, "Настоящее и будущее РВСН как гаранта оборонной безопасности России" (Present and future of the strategic missile forces as the guarantor of the defense and security in Russia), *Vestnik Akademii Voennykh Nauk* (February 2018). It should be noted that, while Russia's declaratory policy has been focused on retaliation, Russian military definitions for a strategic nuclear operation include first strike concepts. R.F. MOD Military Encyclopedia, "Стратегическая операция ядерных сил (СОЯС)" (Strategic nuclear forces operation), undated. https://encyclopedia.mil.ru/encyclopedia/dictionary/details.htm?id=14375@morfDictionary; R.F. MOD Military Encyclopedia, "Стратегическое применение РВСН" (Strategic employment of RVSN) (undated). http://dictionary.mil.ru/dictionary/Terminy-RVSN/item/141806/. Accessed September 18, 2020.

173 Michael Kofman, Anya Fink, and Jeffrey Edmonds, *Russian Strategy for Escalation Management: Evolution of Key Concepts*, Center for Naval Analyses report (April 2020). https://www.cna.org/CNA_files/PDF/DRM-2019-U-022455-1Rev.pdf. Accessed September 18, 2020.

174 Austin Long, "Red Glare: The Origin and Implications of Russia's 'New' Nuclear Weapons," War on the Rocks (March 26, 2018). https://warontherocks.com/2018/03/red-glare-the-origin-and-implications-of-russias-new-nuclear-weapons/. Accessed September 18, 2020.

175 Bart Hendrickx, "Peresvet: a Russian Mobile Laser System to Dazzle Enemy Satellites," The Space Review (June 15, 2020). https://www.thespacereview.com/article/3967/1. Accessed September 18, 2020.

for the survivability of Russia's silo-based ICBMs.[176] Russian military thinkers worry that "left of launch" concepts in U.S. missile defense "erase the boundary between offensive (strike) and defensive weapons" and note concerns about the evolution of U.S. missile defense infrastructure in space.[177] The U.S.-Russian strategic relationship could become further unbound by the end of New START and its monitoring and transparency and predictability provisions. At present, these "allow for the accurate forecasting of [both sides' strategic nuclear forces] military capabilities for a given period," while the collapse of bilateral arms control would open up the possibility of an "uncontrolled U.S. buildup of strategic nuclear forces."[178]

Statements by Russian defense officials point to a desire to reduce reliance on nuclear weapons, particularly nonstrategic nuclear weapons, which have been central to Russia's ability to deter and fight regional and large-scale conflicts.[179] To be sure, the State Armament Programs have been delivering improved conventional capabilities, particularly conventional precision strike for "non-nuclear deterrence." There is also interest in conventional hypersonic capabilities as part of "non-nuclear deterrence."[180] However, nonstrategic nuclear weapons, owing in part to their cost-effectiveness, are likely to continue to play important regional deterrent roles and help with signaling, escalation management, and, if deterrence fails, warfighting.[181] At the same time, conventional precision strike systems will continue to grow in importance to Russia's notions of local war and escalation management and warfighting in regional and large-scale conflicts. These systems enable kinetic strikes on key nodes of critical infrastructure for operational and psychological ("deterrent damage") effects.[182] Future operational concepts suggest tighter integration between conventional and nuclear weapons, including as part of a strategic deterrent

176 Alexey Arbatov, "Mad Momentum Redux? The Rise and Fall of Nuclear Arms Control," *Survival* (June-July 2019). https://www.iiss.org/publications/survival/2019/survival-global-politics-and-strategy-junejuly-2019/613-02-arbatov. Accessed September 18, 2020.

177 A.E. Sterlin and A.L. Khryapin, "Об основах государственной политики Российской Федерации в области ядерного сдерживания" (On the foundations of state policy of the Russian Federation in the nuclear deterrence area) *Krasnaya Zvezda* (August 7, 2020). http://redstar.ru/ob-osnovah-gosudarstvennoj-politiki-rossijskoj-federatsii-v-oblasti-yadernogo-sderzhivaniya/?attempt=1. Accessed September 18, 2020.

178 Ibid.

179 «Выступление начальника Генерального штаба Вооруженных Сил Российской Федерации» (Statement by Chief of the RF General Staff), MOD (November 7, 2017). https://function.mil.ru/news_page/country/more.htm?id=12149743@egNews. Accessed September 18, 2020.

180 S.G. Braitkraitz, V.A. Evdokimov, and V.V. Buktiyarov, "Научно-методический подход к обоснованию рационального облика гиперзвукового оружия" (Scientific-methodological approach to developing a rational approach to hypersonic weapons), *Vooruzhenie i Ekonomika,* no. 4 (2019).

181 Kofman, Fink, and Edmonds.

182 Dave Johnson, *Russia's Conventional Precision Strike Capabilities, Regional Crises, and Nuclear Thresholds*, Livermore Papers on Global Security (February 2018); Kofman, Fink, and Edmonds.

forces operation that relies on conventional precision strike and limited nuclear employment.[183]

A persistent trend over the 2020s will be Russia's development of a suite of capabilities broadly aimed at disorganizing an opponent's C4ISR, particularly in the critical initial period of war.[184] These include electronic warfare, cyber, and counter-space systems. As part of closely related, though broader "information war" concepts, Russia will also employ cyber tools to defend itself from perceived external technical and political threats while nurturing the ability to deny the U.S. and its allies information dominance or superiority in conflict. Russia's cyber posture is likely to remain offensive in practice.[185] Russia's aerospace defense systems, some with counter-space capabilities, are likely to remain essential components of strategic deterrence, including for defending critical infrastructure targets, protecting Russia's own C4ISR, and absorbing the brunt of U.S. and allied aerospace power.[186] And, over the coming decade, the Russian military plans the introduction of Artificial Intelligence (AI)-enabled and robotic capabilities to ensure the continued development and credibility of the strategic deterrence system.

The Innovation Drive

Russian political and military leaders have paid close attention to U.S. announcements of investment into emerging technologies, and there is a realization some of the military technologies may have psychological deterrent effects in addition to the more obvious contribution to improvement in warfighting capabilities.[187] In his 2019 address to the Federal Assembly, Putin touted Russia's "high-tech breakthrough in the defense sphere," elements of which could be used in the civilian sphere, and also outlined goals for the development of the science and technology infrastructure and human capital in Russia.[188] His constant return to the theme of innovation and his pride in Russia's lead on the deployment of hypersonic systems suggest that an important part of Moscow's assessment of the future strategic balance will be a review of Russia's own progress on innovation.

183 A.E. Sterlin, A.A. Protasov, S.V. Kreydin, "Современные трансформации концепций и силовых инструментов стратегического сдерживания" (Modern transformations of concepts and forceful instruments of strategic deterrence), *Voennaya Mysl'*, no. 8 (2019).

184 See section 6 in Tim Thomas, "Russian Military Thought: Concepts and Elements," MITRE paper (August 2019).

185 Bilyana Lilly and Joe Cheravitch, "The Past, Present, and Future of Russia's Cyber Strategy and Forces," paper for the 12th International Conference on Cyber Conflict. https://ccdcoe.org/uploads/2020/05/CyCon_2020_8_Lilly_Cheravitch.pdf. Accessed September 18, 2020.

186 O.B. Achasov, "Проблемные вопросы обеспечения сбалансированного развития компонентов системы ВКО" (Challenges with providing support for a balanced development of components of VKO system), *Strategicheskaya stabilnost'*, no. 1 (2012).

187 V.M. Burenok, "Концептуальный тупик" (Conceptual dead end), *Vooruzhenie i Ekonomika*, no. 3 (2019).

188 "Послание Президента Федеральному Собранию" (February 20, 2019). http://kremlin.ru/events/president/news/59863. Accessed September 18, 2020.

For over a decade, the Russian government has taken steps to stimulate domestic innovation. These have included the development of numerous high-level documents and strategies; the creation of coordinating entities, funding mechanisms, and physical campuses for R&D in the civilian and military spheres; and two separate national projects—"Science" and "Digital Economy"—in addition to SAP spending. There is also an expectation that defense innovation may serve as a contributing factor in the modernization of Russia's overall economy.[189] However, innovation has taken diligent efforts because of challenges in Russian R&D.

One example is the Russian government's efforts to stimulate the development of AI technologies, which the Russian leadership views as important for Russia's economic development and improvement in the quality of its citizens' lives. It is difficult to assess the true state of Russian military AI developments, but the Russian military views AI-enabled capabilities as essential to Russia's armed forces in the future, while some Russian thinkers also note that AI, particularly when applied to command and control systems, could help to reduce the "fog of war." [190] Putin signed an AI Strategy in October 2019, and his 2017 statement that a country leading in AI will rule the world also points to his personal interest in the issue.[191]

However, Russia continues to lag significantly behind the United States and China when it comes to civilian AI. Even Russian centers that analyze domestic Russian progress on AI assess that Russia is somewhere between the 20th and the 30th place in the world on civilian AI when considering a range of factors that include the state of science, investment, education, and workforce.[192] In turn, the Russian government has also struggled to coordinate implementation of its AI efforts and received criticism from industry concerned that overregulation of the industry will stymie competition and increase consolidation on the budding market.[193] While Russia's efforts, particularly in the military AI sphere, deserve attention, catching up with the United States and China on broader AI efforts is likely to prove impossible.[194]

189 Richard Connolly and Cecilie Sendstad, "Russian Rearmament: An Assessment of Defense-Industrial Performance," *Problems of Post-Communism* 65, no. 3 (2018), p143.

190 Roger McDermott, "Moscow's Pursuit of Artificial Intelligence for Military Purposes," *Eurasia Daily Monitor* (July 1, 2020). https://jamestown.org/program/moscows-pursuit-of-artificial-intelligence-for-military-purposes/ (Accessed September 18, 2020); A.A. Kokoshin, "Перспективы развития военной техносферы и будущее войн и небоевого применения военной силы" (Perspectives of the development of the military technosphere and future wars and nonmilitary employment of military force), *Vestnik AVN*, no. 2 (2019).

191 Sam Bendett, "In AI, Russia is Hustling to Catch Up," Defense One (April 4, 2018). https://www.defenseone.com/ideas/2018/04/russia-races-forward-ai-development/147178/. Accessed September 18, 2020.

192 МФТИ Центр компетенций Национальной технологической инициативы, "Альманах «Искусственный интеллект»: Итоги 2019 года" (MIPT AI Almanac: 2019 Summary) (March 2020). http://www.aiReport.ru. Accessed September 18, 2020.

193 See I.G. Dezhina, "Science and Innovations," in *Russian Economy in 2019: Trends and Outlooks* (Gaidar Institute for Economic Policy, 2020). https://www.iep.ru/files/text/trends/2019-eng/Book.pdf. Accessed September 18, 2020.

194 Nikolai Markotkin and Elena Chernenko, "Развитие технологий искусственного интеллекта в России: цели и реальность" (The development of AI technologies in Russia: goals and reality), Carnegie Endowment Moscow Center (July 7, 2020). https://carnegie.ru/2020/07/07/ru-pub-82173. Accessed September 18, 2020.

Some argue that Russia's innovation system continues to be challenged by the prevalence of Soviet R&D efforts in military innovation, rigid vertical control of overall R&D activities, and an aging scientific and research community that is "fragmented and poorly linked to the education system and market needs."[195] Russian scholars note that there have been efforts to improve in all of these areas, and some small successes over the past few years. However, the role of government in innovation remains very high and it has proven difficult to incentivize the private sector to invest in R&D, which also complicates the development of innovation to scale.[196]

More broadly, Russian leaders will have to contend with their decision to endow the state with a significant role in economic development, and thus innovation, under what some refer to as a "mobilization" model.[197] Over the medium-term, Russia's economy may continue to suffer from a lack of investor confidence, also posing a challenge to private funding for R&D.[198] And, as Moscow contemplates the strategic environment of 2030, it will have to tackle the economy's reliance on hydrocarbon exports, given the ongoing transformation in the global energy markets.[199]

The Strategic Environment

In 2030, the Russian leadership will continue to focus on the state's ability to assure sovereignty and security, while gradually attempting to improve the lives of ordinary Russians. Perhaps the most critical aspects in Russia's perception of the strategic balance in 2030 will have to do with shifts in relations among great powers and the evolution of the multipolar (polycentric) world where the key poles have nuclear weapons.[200] In this regard, there are many unknowns to include the evolution of the U.S.-China and Russia-China relationships; the potential of further NATO expansion or shifts in regional postures; and the dynamics of threats from nonstate actors and proliferation of WMD, missile, as well as other destabilizing technologies. Still another unknown is the future of bilateral and multilateral arms control.

Moscow does not anticipate any improvements in U.S.-Russian relations. Indeed, it worries about a further deterioration of those relations. And it worries about the

195 Roger Roffey, "Russian Science and Technology is Still Having Problems-Implications for Defense Research," *Journal of Slavic Military Studies* 26 (2013).

196 I.G. Dezhina, "Состояние науки и инновации в 2018 году" (State of science and innovation in 2018), SSRN (Jan. 2019). https://www.researchgate.net/publication/335902136_Science_and_Innovations_in_Russia_in_2018. Accessed September 18, 2020.

197 Vladimir Mau, "Between Crises and Sanctions: Economic Policy of the Russian Federation," *Post-Soviet Affairs* 32, no. 4 (2016), p350-377. https://doi.org/10.1080/1060586X.2015.1053723 (Accessed September 18, 2020); Dezhina, 2020.

198 Ben Aris, "Russia's National Projects: Economic Reboot or Mucky Bog?" Russia Matters (May 30, 2019). https://www.russiamatters.org/analysis/russias-national-projects-economic-reboot-or-mucky-bog. Accessed September 18, 2020.

199 Richard Connolly, Philip Hanson, and Michael J. Bradshaw, "It's Déjà Vu All Over Again: COVID-19, the Global Energy Market, and the Russian Economy," *Eurasian Geography and Economics* (June 2020). https://doi.org/10.1080/15387216.2020.1776627. Accessed September 18, 2020.

200 For a great discussion, see Andrey Kortunov, "Between Polycentrism and Bipolarity," RIAC (September 4, 2019). https://russiancouncil.ru/en/analytics-and-comments/analytics/between-polycentrism-and-bipolarity/. Accessed September 18, 2020.

potential disintegration of bilateral arms control and its contribution to additional stress in the global nonproliferation regime.[201] If it remains on the current trajectory, the bilateral relationship will continue to decay, potentially with the further deepening and retrenchment of the U.S. sanctions regime against Russia. In this context, the nature of U.S. political discourse on Russia, particularly questions about the legitimacy of the Russian leadership, may contribute to misperceptions in any political-military crisis involving Moscow and Washington and potentially carry grave implications for the security of both sides if the crisis acquires nuclear dimensions.

As authoritative Russian military thinker Andrey Kokoshin has argued,

> The stability of the balance is determined by the parameters, which are decisive factors in the evaluation of how easily one of the sides would disrupt the existing balance and attain superiority, and how difficult it would be for the other side to take countermeasures to restore the balance by neutralizing these steps. [202]

In a situation of nuclear parity, an understanding of the strategic balance will also depend on the perceived impact of general-purpose forces and strategic conventional systems, as well as the presence of military and political conditions in which neither side has incentives to use nuclear weapons.[203] If Kokoshin is right, maintaining a stable balance will prove very challenging in an environment of global political and technological change over the coming decade.

201 See Sterlin and Khryapin, op. cit.

202 Andrei Kokoshin, "Ensuring Strategic Stability in the Past and Present: Theoretical and Applied Questions," Belfer Center paper (June 2011). https://www.belfercenter.org/publication/ensuring-strategic-stability-past-and-present-theoretical-and-applied-questions. Accessed September 18, 2020.

203 Ibid.

A 2030 Net Assessment: An Indo-Pacific Perspective

Michael Shoebridge

Will the deterrence postures of U.S. alliances in the Indo-Pacific be fit for purpose a decade from now? Why? Why not? To answer these questions, it is essential first to be clear about the intended purpose. What, precisely, are U.S. alliances in the region intended to deter? The short answers are clear enough: U.S. alliances are intended to deter conflict and, if this fails, to deter escalation in conflict so that the United States and its allies are able to prevail at reasonable cost. This means, for example, that U.S. alliances remain effective at deterring North Korea from using its nuclear weapons or its large conventional military against others.

But there is a longer and more complicated answer: The primary goal the United States and allies must have is to deter the Chinese government from becoming the dominant, malign assertive hegemon in the Indo Pacific with control of major political directions and decisions and primary influence over the direction of economic and technological development and prosperity. Toward this end, we should seek to prevent the further advance of China's authoritarian systems of governance, state information control, and surveillance, while also seeking to slow the growth of China's capabilities to coerce and influence. We wish to deter the use of force against Taiwan in order to retain Taiwan as a democratic entity that contributes positively to our own and our partners' security and prosperity. Australia also wants to deter China from establishing standing military presences in Papua New Guinea, the South Pacific, or East Timor, because that would make it easier for China to project conventional military force against Australia and our near neighbors and it would make our near region more contested and less secure. That would also result in our focus being diverted to this near region, rather than being able to play a greater role in wider strategy.

Looking Ahead to 2030

Let's consider first the sources of political continuity and change in the region. Between now and 2030, the United States will pass through two and a half presidential terms, casting great uncertainty over its future actions and indeed character. Between now and then, there will likely be three national elections in Japan, two presidential elections in South Korea, a change of national government in the Philippines in 2022, and at least three national elections in Australia. Taiwan has just had a presidential election, so Pres Tsai Ing-wen has four years until her final second term ends in 2024. India has its next general election in 2024 with another expected in 2029.

In contrast, consider the authoritarian states. China's current leader is in his seventh year as chairman and is 67. He has no term limit, but will be 77 in 2030. No successors are currently known as identified or being groomed. (For context, Mao died at 82, Deng 92, Hu Jintao stepped down at 70 after five years). Kim Jong Un is 36, so he'll be 46 in 2030.

The net effect from a leadership perspective is that Xi and Kim are the continuity factors. Xi defines his life and rule by struggle[204]—internal to the Party, to China, and against the external world. Kim defines himself by his ability to extort concessions from a reluctant world.

A second Trump term, if it occurs, would push U.S. allies towards greater military capability of their own, less integrated into U.S. strategy and probably with increasingly independent means of sustaining themselves. It would also play into anxieties in Southeast Asia about the uncertainty of U.S. security engagement in the Indo-Pacific,[205] with particular uncertainty over the political will of Americans and their leaders to act in a crisis. These factors would play to Beijing's advantage as it pursues growing influence by enabling growing Chinese presence—economic, technological, civil, and then military. By licensing Chinese assertiveness, this may demonstrate the costs to sovereignty of growing economic integration with China's economy—but with limited alternatives on offer for several Southeast Asian states.

Let's now consider economic factors out to 2030. Trends forecast at the beginning of 2020 look very shaky now. The predominant forecast before the pandemic was for tepid global growth, notably in the developed world, high but moderating growth in China, and patchy higher growth in the broader Indo-Pacific.[206] The net effect was that the United States and its allies and partners were getting relatively poorer compared with China and non-allies.

But these simple extrapolations are now in question. The pandemic has brought a global recession or perhaps even depression, which has combined with legacy economic weaknesses still there from the 2008 global financial crisis and with the negative economic effect of the growing U.S.-China economic and technological struggle. But their ultimate impact remains unclear. One possible pathway is for the worst hit countries to suffer the deepest economic contraction—with the United States, Brazil, Russia, perhaps India, and several African countries joining this list. Another scenario is that China's economy will be very hard to rebuild robustly because of the collapse

204 "Xi Focus: Xi Emphasizes 'Struggles' to Achieve National Rejuvenation," *Xinhuanet* (September 3, 2019). http://www.xinhuanet.com/english/2019-09/03/c_138362482.htm. Accessed September 18, 2020.

205 S. M. Tang, et al., *The State of Southeast Asia: 2020,* ISEAS-Yusof Ishak Institute (2020). https://www.iseas.edu.sg/wp-content/uploads/pdfs/TheStateofSEASurveyReport_2020.pdf. Accessed September 18, 2020.

206 International Monetary Fund, "World Economic Outlook, July 2019: Still Sluggish Global Growth," World Economic Outlook Update (July 23, 2019). https://www.imf.org/en/Publications/WEO/Issues/2019/07/18/WEOupdateJuly2019. Accessed September 18, 2020.

of domestic consumption,[207] in parallel with the collapse of its global export markets, with this being worsened by the economic impact due to restrictions placed on using U.S. and other allies' technology in Chinese production chains.[208] Consumer change that prefers not to buy Chinese tech and manufactured goods may also weaken the economy. Nevertheless, in the land of the blind, the one-eyed man is king, so if the Chinese economy recovers more rapidly and robustly than its competitors, then it will be a major attractant for multiple Indo Pacific states. This will lead to deeper integration with the Chinese economy despite the political costs of an assertive, hegemonic Beijing.

Put differently, the pandemic may upset a way of thinking that has prevailed in Southeast Asia. That way of thinking has been captured in the two most recent annual State of the Region surveys conducted by the Institute of Southeast Asian Studies. Their surveys of leaders in government, academia, and business reveals that those leaders hold two ideas simultaneously: (1) there is great economic benefit from close integration with the Chinese economy and (2) Beijing is almost certain to want a non-benign hegemonic role in the region. The second insight seems likely to endure. The first has now come into question. ASEAN's connectivity agenda is a path of economic integration that seems likely to increase Southeast Asian economies' already deep ties into the Chinese economy.[209] Its logic may be largely undisturbed by strengthening U.S.-China technological and economic competition and restrictions.

Understanding China's Strategy

Why harp on about leadership terms and economics in an assessment of deterrence postures? Chinese strategy is as much about political, economic, and technological influence as about coercion from military force.[210] The extent to which Indo Pacific states integrate with China's economy and technology may determine more about "deterrence postures" than military balances and postures. If ASEAN nations continue down their path of economic integration between themselves and into China's economy, including through adoption of big Chinese tech e-commerce platforms and infrastructure operating on Chinese digital systems, with growing presence of Chinese firms across critical and digital infrastructure,[211] then their ability and willingness to work with U.S.

207 World Bank, "China Economic Update – July 2020" (July 2020). https://www.worldbank.org/en/country/china/publication/china-economic-update-july-2020. Accessed September 18, 2020.

208 U.S. Department of Commerce, Bureau of Industry and Security, "Export Administration Regulations: Amendments to General Prohibition Three (Foreign-Produced Direct Product Rule) and the Entity List" (May 19, 2020). https://www.federalregister.gov/documents/2020/05/19/2020-10856/export-administration-regulations-amendments-to-general-prohibition-three-foreign-produced-direct. Accessed September 18, 2020.

209 ASEAN, *Master Plan on ASEAN Connectivity 2025* (August 2016). https://asean.org/storage/2016/09/Master-Plan-on-ASEAN-Connectivity-20251.pdf. Accessed September 18, 2020.

210 "Full Text of Xi Jinping's Report at 19th CCP National Congress," *Xinhuanet* (November 3, 2017). http://www.xinhuanet.com/english/special/2017-11/03/c_136725942.htm. Accessed September 18, 2020.

211 Fergus Ryan et al., *Mapping More of China's Tech Giants: AI and Surveillance*, Australian Strategic Policy Institute (2019). https://www.aspi.org.au/report/mapping-more-chinas-tech-giants. Accessed September 18, 2020.

partners and allies will fall over the next 10 years. The costs of supporting U.S. or allied forces operating in or through their states will rise.

5G is a good demonstrator. No Southeast Asian nation other than Vietnam has said it is not using Chinese 5G technology.[212] Malaysia has embraced it,[213] saying that the United States would use U.S. technology to spy on Malaysia, so it's just China doing the same. 5G technology will reach across governments, companies, and individuals in the countries adopting it, with software and systems providers gaining easier access than those needing to hack into these systems.

Similarly, proliferation of e-commerce platforms in Southeast Asia—like AliPay—create digital dependencies and data pathways for the controlling companies and the state who can compel their cooperation. Port infrastructure, power utilities, transport systems, and physical surveillance systems in cities all run on digital technology now—and a growing source of these in the Indo Pacific is China's big tech corporate world, not European, North American, Indian, Korean, or Japanese alternatives.

So, in any crisis or conflict, who are the combatants? It's not a simple matter of the force-on-force calculus of allied versus PLA military means. The military forces of the United States and its allies will confront a situation in which PLA forces are backed up by technological reach into places in the region that the United States and its allies may wish to operate from and through, and a PLA that is enabled by intelligence gathered from this technological reach and by the logistics and other capabilities of Team China operating with it. An indicator of this type of use of China's corporate actors is the fact that these companies[214] were the deliverers of "mask diplomacy"—with not much done by formal Chinese government channels including the PLA.

In sum, the relative economic integration of Indo Pacific nations with China or with the United States and its allies and partners must be an essential element of any 2030 deterrence net assessment.

Autonomy and Resilience

The deterrence balance of 2030 will also be affected by the extent to which the United States and its allies will able to sustain military operations and broader economic functioning in any crisis or conflict with the PRC, given its ability to interfere indirectly by exploiting vulnerabilities in the supply chain. States must become more resilient if they are to retain their autonomy despite Chinese attempts at coercion.

212 Tomoya Onishi, "Vietnam Carrier Develops Native 5G Tech to Lock out Huawei," *Nikkei Asian Review* (January 25, 2020). https://asia.nikkei.com/Business/Telecommunication/Vietnam-carrier-develops-native-5G-tech-to-lock-out-Huawei. Accessed September 18, 2020.

213 C.K. Tan and P. Prem Kumar, "Malaysia Will Use Huawei Tech 'As Much As Possible,' Says Mahathir," *Nikkei Asian Review* (May 30, 2019). https://asia.nikkei.com/Spotlight/The-Future-of-Asia-2019/Malaysia-will-use-Huawei-tech-as-much-as-possible-says-Mahathir. Accessed September 18, 2020.

214 "China Sends Planeload of Medical Supplies to Greece," *Greek City Times* (March 22, 2020). https://greekcitytimes.com/2020/03/22/china-sends-planeload-of-medical-supplies-to-greece/. Accessed September 18, 2020.

Here things may be more hopeful than six months ago, in the sense that the pandemic has graphically illustrated many nations' lack of capacity to get or make what they need in a crisis, motivating some states to take action. Already, some European states (e.g., France and Germany) have begun to respond by seeking to reduce clear vulnerabilities through regained strategic sovereignty.[215] Australia has made a similar choice and is now developing the means to supply itself with fuel, munitions, and advanced missiles.[216] This reflects a heightened sense of urgency following the fairly lethargic effort to create alternative supply chains for critical minerals[217] and semi-conductors.

But reversing vulnerabilities that took decades to grow will be slow and this is likely to be partial. U.S. and allied policies and trade interests are likely to constrain this development too.

The India Factor

Relations between China and India will be a critical factor in the 2030 balance. They seem likely to continue to deteriorate, given the growing nationalism in both populations[218] and increasing presence and preparations by both militaries on their contested border,[219] along with Beijing's deep cooperation with Pakistan.[220] Further PLA power projection and presence in the Indian Ocean will only complicate matters, as will the fact that Beijing has an unavoidable habit of demeaning India as a power and as an economy.

India has also added some substance to its "Look East" policy—primarily in its relations with Indonesia[221] and also Australia.[222] But despite converging interests in constraining Chinese power, relations between India and the other Quad members will

215 Mark Leonard and Jeremy Shapiro, "Strategic Sovereignty: How Europe Can Regain the Capacity to Act," European Council on Foreign Relations (June 25, 2019). https://www.ecfr.eu/publications/summary/strategic_sovereignty_how_europe_can_regain_the_capacity_to_act. Accessed September 18, 2020.

216 Australian Department of Defence, *2020 Defence Strategic Update and 2020 Force Structure Plan* (July 1, 2020). https://www.defence.gov.au/strategicupdate-2020/. Accessed September 18, 2020.

217 Australian Department of Industry, Innovation and Science, *Australia's Critical Minerals Strategy 2019* (2019). https://www.industry.gov.au/sites/default/files/2019-03/australias-critical-minerals-strategy-2019.pdf. Accessed September 18, 2020.

218 Pallavi Shahi, "India's Chinese App Ban is Just the Beginning," *The Diplomat* (July 1, 2020). https://thediplomat.com/2020/07/indias-chinese-app-ban-is-just-the-beginning/ and Steven Lee Meyers, et al., "In China-India Clash, Two Nationalist Leaders with Little Room to Give," *New York Times* (June 17, 2020). https://www.nytimes.com/2020/06/17/world/asia/china-india-border.html. Accessed September 18, 2020.

219 Nathan Ruser, "Satellite Images Show Positions Surrounding Deadly China-India Clash," *The Strategist* (June 18, 2020). https://www.aspistrategist.org.au/satellite-images-show-positions-surrounding-deadly-china-india-clash/. Accessed September 18, 2020.

220 China Pakistan Economic Corridor. http://www.cpec.gov.pk/. Accessed September 18, 2020.

221 Dipanjan Roy Chaudhury, "Indian, Indonesian Coast Guards Sign MoU to Uphold Rules-Based Order in the Indo-Pacific Region," *The Economic Times* (July 7, 2020). https://economictimes.indiatimes.com/news/defence/indian-indonesian-coast-guards-sign-mou-to-uphold-rules-based-order-in-the-indo-pacific-region/articleshow/76840243.cms. Accessed September 18, 2020.

222 "Virtual Summit with the Prime Minister of India," Transcript (June 4, 2020). https://www.pm.gov.au/media/virtual-summit-prime-minister-india. Accessed September 18, 2020.

be limited by the extent to which Hindu nationalism grows[223] and undermines India's credibility as a democratic, diverse political entity. In addition, defense cooperation will remain constrained by the weakness of the Indian defense ministry and by industrial protectionism in economic policy.

Military Balances

The rapid change of the Indo-Pacific's strategic and technological environments contrasts with the much slower rate of change of our military capabilities and strategies and also with the operating concepts for employing them.

In Australia's case, the government's recent strategic update seems to have done little to upset the longstanding plan to create a small force based around traditionally very capable surface ships, submarines, and aircraft. Almost all of the naval platforms involved will only begin to turn up around 2030 and later[224]—so they are irrelevant to deterrence over the interim period.

Similarly, U.S. force structures are ponderous. Defense department proposals to retire some existing platforms early to make investment room for new technologies have met expected Congressional resistance for multiple reasons.[225] There is little reason to think that this might change.

Japan and the Republic of Korea (RoK) also have very slow-moving force structures. In fact, the United States and all of its regional allies would struggle keenly in a time of war to push our industries to move rapidly to enable force sustainment at the scale required. The economic weakness the pandemic has created adds to these challenges. There may be some silver lining to an otherwise dark cloud if our governments tie in the defense industry to the economic stimulus and rebuilding programs. In Australia, there is growing public support for new approaches to manufacturing, including defense manufacturing, in light of the pandemic and poor strategic environment—a stark indicator of the population's awareness of the fact that trust in China to "act responsibly" has collapsed from 52 percent of Australians to 23 percent since 2018. [226]

223 Jayshree Bajoria, "'Shoot the Traitors': Discrimination Against Muslim's in India's New Citizenship Policy," Human Rights Watch (April 9, 2020). https://www.hrw.org/report/2020/04/09/shoot-traitors/discrimination-against-muslims-under-indias-new-citizenship-policy. Accessed September 18, 2020.

224 Australian Department of Defence, *2020 Force Structure Plan* (2020). https://www.defence.gov.au/StrategicUpdate-2020/docs/2020_Force_Structure_Plan.pdf. Accessed September 18, 2020.

225 Oriana Pawlyk, "KC-10 Tankers, B-1 Bombers Can Slowly Be Retired, Lawmakers Say," *Military.com* (June 24, 2020). https://www.military.com/daily-news/2020/06/24/kc-10-tankers-b-1-bombers-can-slowly-be-retired-lawmakers-say.html and Sam LaGrone, "Lack of Future Fleet Plans, Public Strategy Hurting Navy's Bottom Line in Upcoming Defense Bills," *USNI News* (June 18, 2020). https://news.usni.org/2020/06/18/lack-of-future-fleet-plans-public-strategy-hurting-navys-bottom-line-in-upcoming-defense-bills. Accessed September 18, 2020.

226 Lowy Institute, *Lowy Institute Poll 2020* (June 24, 2020). https://poll.lowyinstitute.org/themes/china. Accessed September 18, 2020.

In sum, there is a strategic need to create alternative places where the inputs required to sustain conflict can be produced, with missiles and munitions being key examples. To the extent governments have addressed such concerns, they have focused more on platforms than weapons. In war, our forces will quickly run short of missiles and munitions—a pattern already clearly evident in U.S. experience.[227]

This is a deep political and industrial policy issue, as sharing intellectual property and technology to allow Australia or Japan to co-produce say the new long-range anti-ship missile, as some have proposed,[228] would go against the grain of U.S. trade and industrial policy.[229] But the deterrent effect of having greater volume of missile production and the ability to resupply from more than one CONUS-based production center should be obvious.

On long-range strike capabilities in the Indo-Pacific, Australian policy now favors pursuit of greater offensive capabilities.[230] So far, interest has focused on deployable strike systems—that is, weapons launched from the sea or air and/or ground-launched systems that could be deployed outside Australian territory when agreed. But interest is growing in long-range strike systems that might be deployed in Australia and operated with Australian authorities (as opposed to U.S. systems under U.S. command and control).

Australia's objective in pursuing improved strike capabilities is to add offensive deterrent options against China and to do so in an alliance framework.

Credible Timeframes for Conflict

Xi is in a hurry, as we see with Hong Kong.[231] He has been more strident about forcible unification of Taiwan with the mainland and not passing the issue on to later generations[232] than his predecessors (he may see Taiwan as another dangerously glaring demonstration to mainland Chinese that it is possible to live under a vibrant and successful democratic system). The risk that he may seek forcible unification is

227 Aaron Mehta, "The US is Running Out of Bombs — and It May Soon Struggle to Make More," *Defense News* (May 22, 2018). https://www.defensenews.com/pentagon/2018/05/22/the-us-is-running-out-of-bombs-and-it-may-soon-struggle-to-make-more/. Accessed September 18, 2020.

228 Wikipedia, "AGM-158C LRASM." https://en.wikipedia.org/wiki/AGM-158C_LRASM. Accessed September 18, 2020.

229 Brendan Thomas-Noone, "Ebbing Opportunity: Australia and the US National Technology and Industrial Base," United States Studies Centre (November 25, 2019). https://www.ussc.edu.au/analysis/australia-and-the-us-national-technology-and-industrial-base. Accessed September 18, 2020.

230 "Address – Launch of the 2020 Defence Strategic Update," Transcript (July 1, 2020). https://www.pm.gov.au/media/address-launch-2020-defence-strategic-update. Accessed September 18, 2020.

231 "Why Beijing is Rushing to Push Through Hong Kong Security Law," *Financial Times* (June 28, 2020). https://www.ft.com/content/f1f14c2f-9642-4277-b6b8-5dec53f36d8d. Accessed September 24, 2020.

232 "Xi Says 'China Must Be, Will Be Reunified' as Key Anniversary Marked," *Xinhuanet* (January 2, 2019). http://www.xinhuanet.com/english/2019-01/02/c_137714898.htm. Accessed September 18, 2020.

increased with his reliance on nationalism as a tool[233] to help the Party[234] cope with enduring economic weakness and increasingly troubled foreign relations. Taiwan is key strategic territory that either empowers PLA power projection or, in democratic hands, enables constraint of China.

Taiwan is a special case in this assessment, because it is the most likely place where China may decide to use military force to achieve its goals before 2030, instead of primarily relying on its broader strategic approach of political, technological, and economic integration. If China does act to conquer Taiwan by force before 2030—and succeeds—then this would increase its ability to project military power against Japan. This would reduce Japan's ability to contribute to broader regional security because of the need to prioritize national defense. Conquering Taiwan would also mean that China's ability to project power beyond the first island chain would be far less constrained than it is now. Deterrence in the 2030s would become significantly more difficult and U.S. allies' confidence in extended deterrence would reduce.

Actions in response to Beijing's moves to assimilate Hong Kong into its mainland system are setting some of the environment and perceptions about the United States and other partners' willingness to deter Beijing from seeking the unification with Taiwan by force.

From a deterrence perspective, the steps that the United States and its partners and allies are willing to take against Beijing over the forcible ending of Hong Kong's freedoms are probably as strong a signal of determination to oppose a Chinese forcible takeover of Taiwan as any other signal they might send. Defining what is at stake over Taiwan as being about the bigger global contest between Beijing's assertive authoritarianism and democracy may be the way to add to the strength of deterrence here. It helps that this is true.

Overall Assessment

Deterring Beijing from reaching its objective of hegemonic power in the Indo-Pacific is as much an economic and technological challenge as a military one. This implies that any net assessment of the regional deterrence balance must be done not just on the narrow basis of military-to-military factors, but with a wider scope that includes Chinese big corporate actors like shipping lines, port operators, airlines, militia, and coast guards, among other factors. China's capacity to constrain U.S. and allied operations against it will also come from its reach into the technologies and digital infrastructure that regional nations will be operating—and here the continued path of economic integration with China's economy is a major factor to Beijing's advantage.

233 Jo Kim, "The Chinese People Step up to Enforce China's Nationalist Propaganda," *The Diplomat* (May 5, 2020). https://thediplomat.com/2020/05/the-chinese-people-step-up-to-enforce-chinas-nationalist-propaganda/. Accessed September 18, 2020.

234 Michael Shoebridge, "The Chinese Communist Party's Confected Outrage Machine," *The Strategist* (October 14, 2019). https://www.aspistrategist.org.au/the-chinese-communist-partys-confected-outrage-machine/. Accessed September 18, 2020.

If Beijing's economic and technological integration with Southeast Asia proceeds and results in tight connectivity based primarily on China's digital ecosystem, then by 2030, Southeast Asia will be a far less permissive political environment for U.S. and allied power than it is today.

The net effect is that China may not need to use force to obtain its strategic goals in Asia between now and 2030. By 2030, though, without a broader allied strategy of deterrence that includes political, military, technological, and economic components, China will be able to use military power in the knowledge that U.S. and allied options to oppose it will be more limited. Military deterrence will be less effective as a result.

On a strictly military level, Chinese anti-access area denial capabilities are making military operations against the PLA within the first island chain more costly, and more subject to the political will to accept casualties.

The momentum of change in the military balance in China's favor can be reversed by urgent moves to increase U.S. and allied ability to engage in sustained conflict and to operate from dispersed places and bases in addition to the big fixed locations within range of bulk Chinese military power. Urgent increases in U.S. and allied advanced missile and munitions production options, along with a rapid fielding of numerous autonomous and semi-autonomous systems to complement manned platforms is required and possible. But this will require political leadership and corporate leadership to embrace substantial policy change, including to long-held domestic industrial and trade policies and practices, for strategic reasons. Making these changes will contribute to deterrence by helping demonstrate the political will to build capabilities to constrain China.

The momentum of change in the military balance in China's favor can be reversed by urgent moves to increase U.S. and allied ability to engage in sustained conflict and to operate from dispersed places and bases in addition to the big fixed locations within range of bulk Chinese military power.

The pandemic has challenged the widespread assumption that the growth in China's military strength, economic and political leverage, and soft power would inevitably continue. This creates an opportunity of the United States and its allies to strengthen their own competitiveness. The crackdown in Hong Kong also brings an opportunity to reframe the discourse about what's at stake with China. What's at stake isn't simply a shifting power balance or an incremental gain or loss where interests are zero sum. What's at stake is the next world order and whether it will accord the democracies the autonomy and freedom that has defined them.[235] Alas, the pandemic has also brought into better focus the disarray in the U.S. political system and its inability to seize the current moment to shift trajectories to its advantage—and that of its allies.

235 Michael Shoebridge, "Diagnosing the Problem: It's About China, and It's More Than the US–China Show," *The Strategist* (July 28, 2020). https://www.aspistrategist.org.au/diagnosing-the-problem-its-about-china-and-its-more-than-the-us-china-show/. Accessed September 18, 2020.

Conclusions

Brad Roberts

Will the U.S. strategic posture be fit for purpose a decade from now? The essays in this volume, and the workshop discussions from which they are drawn, point to the following answers.

General Observations

In thinking about the future of this toolkit, it is useful to distinguish between the next strategic posture, of 2030, and the posture after next, of 2040. The next strategic posture promises to be an incremental improvement on the 2020 posture. But the posture after next could be substantially different. Today's investment decisions are down payments on both.

U.S. capabilities are improving as a result of significant investments and a purposeful exploration of emerging technologies. This is primarily a bottom-up process, shaped by technological possibility and funding availability. A top-down process would better align investments with operational requirements deriving from a military strategy tailored to the security environment. This would enable a comprehensive portfolio-management approach.

While the U.S. strategic posture is becoming more robust, it is also diversifying. In the Cold War, the terms "strategic" and "nuclear" were nearly synonymous. But missile defenses began to take on strategic functions, then counter-space capabilities, and now precision conventional strike and cyberspace are demonstrating strategic potential. As the strategic toolkit diversifies, synergies can be reaped. But new instabilities and vulnerabilities are also emerging, given the unfolding competition with Russia and China for strategic advantage in these domains.

The Nuclear Foundation

Overall, the United States and its allies can be cautiously optimistic that the U.S. nuclear posture will be fit for purpose in 2030. But the emphasis falls more heavily on caution than optimism.

By 2030, the nuclear deterrent will have been partially modernized but little changed; by 2040, it may include new and different weapons. But even the road to 2030 is uncertain. Modernization of the U.S. nuclear deterrent faces three major risks in the coming few years. The just-in-time nature of the program of record may prove unrealistic. Life extension programs to bridge the gap to replacement capabilities may falter. The bipartisanship necessary for the full program may slip away. The security environment may generate unwelcome surprises requiring new U.S. capabilities quickly. Thus, there

is a realistic possibility that the 2030 force may fall short of existing requirements; presumably these shortfalls will have been fully overcome by 2040.

Whether the arsenal of warheads and bombs in 2030 will be fit for purpose in 2030 is a matter of significant debate among American experts. It will be a life-extended version of the 2020 arsenal, which is itself a smaller and less diverse version of the 1990 arsenal. Its basic mix of capabilities was tailored for an adversary and military problems long past. On the other hand, this arsenal will be capable of putting at risk just about everything that an enemy leader might value.

Over the next decade or two, developments in adversary capabilities could tax the U.S. posture significantly. Russia and China are adapting their strategic postures to changing circumstances and in ways that are not entirely clear in 2020. The future missile defenses of one or both may call into question the viability of ballistic delivery of nuclear weapons. Their future abilities to find and fix dispersed U.S. systems and/or to disrupt their command and control may call into question the survivability of U.S. forces. If new U.S. nuclear requirements emerge as a result, the existing national infrastructure for the design, development, and production of new capabilities may be unavailable because it is already fully engaged with stockpile life extension activities.

Developments in the United States could add to the challenges along the modernization pathway. Just-in-time modernization of the warheads and their delivery systems requires also just-in-time modernization of the infrastructure. That process is underway but historically has not attracted sustained leadership focus and investment. Moreover, the bipartisan support necessary to these ends may not prove durable.

Arms control may also have a significant impact on the nuclear modernization pathway to 2030. Deeper reductions would reduce requirements, though probably not significantly between now and 2030. An end to arms control might increase them. But in the absence of an arms control framework, an arms race driven by a desire for quantitative supremacy by any of the three major powers seems unlikely between now and 2030, given economic factors constraining all of them, among other factors.

The United States also aspires to strengthen its hedge posture between now and 2030. But past unmet aspirations raise questions about future success. For three decades U.S. leaders have said they want an agile, responsive infrastructure as a hedge against technical and geopolitical surprises. But until recently they put their focus and money elsewhere. Instead, the United States has retained a large stockpile of reserve warheads for the sole purpose of hedging against surprise. The last decade provided various strategic surprises. More can be expected in the decade ahead, some of which may substantially shift thinking about the means and ends of nuclear deterrence. Technological breakthroughs may lead to disruptive results—an early question about the efficacy of ballistic trajectories, for example, or a loss of confidence in command and control because of adversary artificial intelligence (AI) capabilities. Unforeseen applications and adaptations of existing technologies may prove equally disruptive.

The nuclear command and control (NC2) system could be robust in 2030, as an effort to strengthen and adapt it to changing requirements proceeds between now and then. But it is also possible that this effort will falter in the face of significant technical challenges. A key question is whether the NC2 architecture will be well tailored for deterrence as opposed to war-fighting. For deterrence purposes, it must be robust under attack, effective in informing and enabling command deliberation, and functional in all domains and in all relevant political contexts (e.g., by enabling consultations with allies). Another key question is whether AI will strengthen or erode NC2's deterrence effectiveness. AI could help buy decision time for national leadership and improve situational awareness, thereby reducing pressures to launch under attack. But it might prove brittle and thereby fail to gain the trust of decisionmakers.

The Diversifying Strategic Toolkit

The introduction of supplemental capabilities into the U.S. strategic posture seems likely to continue and even accelerate in the decade ahead. New technical possibilities bring important new questions about "how much is enough?" and the purpose for which the posture should be "fit."

By 2030, the Ground-based Mid-Course Defense (GMD) system protecting the U.S. homeland against long-range missile attack is likely to have been improved incrementally, with the addition of the planned 20 new advanced interceptors to the existing fleet of 44 Ground-Based Interceptors (GBIs). It may also have been reinforced with an underlayer of shorter-range Aegis and THAAD systems. Some modest tailoring of the homeland defense to address the hypersonic threat with new sensors and interceptors is also likely. Some modest improvements to regional defenses may also occur, with possible new roles for directed energy weapons. By 2040, directed energy weapons and a significant move to space may have revolutionized the homeland defense.

The further development of U.S. missile defenses may be driven by a simple calculus of technology and money: that is, "we should have as much of the best available defensive technology as we can afford." A strategy-driven approach is more challenging to define. A central feature of strategy since 1999—to seek protection of the homeland from limited missile strikes—was recently set aside in law. The new push for the protection of the American homeland from larger scale strikes brings with it significant new questions about how much missile defense is enough. One is whether to compete with new developments in the missile postures of Russia and China. Another is whether to compete with rogue state forces if and as they gain the ability to conduct the larger-scale strikes that the United States has heretofore seen as beyond the scope of missile defense (because such strikes have been seen as deterrable by the threat of retaliation).

By 2030, the United States, Russia, and China are likely to have deployed hypersonic strike weapons, potentially in significant numbers. While a few of

these may be intercontinental in reach, the majority are likely to be medium- and intermediate-range and designed for theater-strategic functions. These new theater systems raise important questions about offense/defense and conventional/nuclear integration; accordingly, their fit with the regional deterrence architectures of the United States and its allies and with extended U.S. nuclear deterrence remains an open question. They also raise difficult new questions about how to protect strategic stability as competition intensifies.

By 2030, U.S. space capabilities will have become more strategic in potential effect; by 2040, they could become more decisively advantageous to the United States. This is in sharp contrast to the last decade, when long-standing U.S. advantages in space eroded as adversaries fielded counter-space capabilities. By 2030, the United States may have redressed the worst through augmentation strategies, hybrid architectures, and space control measures. By 2040, it can push further ahead of Russia and China—but not without some fundamental and revolutionary changes to the way it thinks about space as a warfighting domain and prepares for war in space and for space in war.

The combination of improving space-based sensors, cyber capabilities, and long-range precision strike implies a significant improvement of U.S. counter-force capabilities by 2030. Moreover, AI may yet have a revolutionary impact, especially beyond 2030. Russia and China have long anticipated and feared such U.S. improvements, especially in combination with improving U.S. missile defenses. After all, they argue, the combination must, sooner or later, call into question the viability of their deterrents. For well over a decade, Russia and China have been adapting their strategic postures and gearing up to compete. Their improving capabilities will have potentially significant implications for the design and posture of U.S. strategic forces in the late 2030s and 2040s.

On Integration

As the strategic toolkit diversifies, there is a rising premium on the ability to effectively integrate strategy, plans, and operations. This implies improved conventional-nuclear integration and also offense-defense integration—and much more. Over the last two decades, Russia has made significant headway on such integration, with new guidance, operational concepts, doctrine, planning processes, and exercises. China too has made many significant adjustments in the name of integrated strategic deterrence. The United States has only recently made such integration a priority. Some important progress has been made on conventional-nuclear integration to reinforce deterrence; but it is limited in nature and must be sustained over the long term. Offense-defense integration is less advanced, especially at the regional level with allies.

After three decades of not having to think much about the strategic dimension of modern war, there is a natural tendency to fall back on old ideas, including on integration. But integration isn't simply orchestrating conventional and nuclear strike

planning or preparing to fight on a contaminated battlefield. It now requires integration of all the non-nuclear means as well (not just general-purpose forces but also missile defenses, cyber space, outer space, and information warfare). The National Defense Strategic Commission found in 2018 that there is a dangerous absence of new strategic thought on the challenges of managing escalation in an all-domain context.[236]

Integration brings with it new questions about how much of each capability is enough in the overall mix. The old questions about how many nuclear weapons are enough or how much missile defense is enough were already complex enough in a multipolar environment. Answers should be informed by a basic concept for sizing and shaping U.S. strategic forces. But one does not seem to exist. For the post-Cold War period from 1990 or so to 2014 or so, U.S. strategic forces were sized and shaped according to the desire to negate rogue deterrents while preserving strategic stability with major powers; but this fits poorly in an era of major power rivalry and growing rogue forces. The updated 2018 U.S. concept for sizing and shaping conventional forces is a logical starting point for an updated strategic concept but is of limited utility for this purpose. Faced with a complex security environment and diversifying strategic toolkit, there is a logical allure of a simplifying approach. This may help explain the embrace of strategic dominance as a goal. On balance, this is an unhelpful simplification, as it is not plausible technically but nonetheless motivates unhelpful responses to American power. "Second to none" could be a better guide.

Comparative Perspectives

In the emerging strategic competition among Russia, China, and the United States, a net assessment of potential winners and losers in 2030 is very difficult to construct. It is easier to measure progress by each country in capability development than to measure success relative to an adversary. But progress does not equate with success. Success equates with shifting the balance of power and influence in a decisive way (or with preventing an adversary from doing so). This might be measured in terms of the military ability to seize and hold some gain. Or it might be measured in terms of the ability to set expectations and influence decisionmakers to achieve the intended deference to one's interests without fighting. Whatever its challenges, a strategic net assessment is urgently needed as a guide to strategy and capability development. Properly crafted, it would include all-domain expertise, clear metrics, allied expertise, both classified and unclassified components, and appropriately tailored war-gaming and red-teaming.

Despite a great deal of fluidity and uncertainty, it seems unlikely that the net balance of strategic power and influence will have shifted dramatically in favor of any of the three by 2030. Each will be able to look back on a record of progress in maintaining

236 *Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission* (November 2018).

a credible threat of nuclear retaliation. None should be able to conclude that it is in a position to seize and hold some gain bearing on a vital interest of another.

In 2030, Russia's leaders are likely to be satisfied that they have repaired the instabilities that they attribute to a U.S. strategic ambition for preeminence. They will have robust all-domain means to inflict punishment on the United States and its allies and also to protect themselves and many of their forces from crippling punishment in response. Moreover, they are unlikely to feel secure, to have abandoned a revisionist worldview, or to have set aside their conviction that any conflict with the United States will inevitably bring U.S. efforts for regime removal. They will work hard to continue to strengthen their position over the subsequent decade.

In 2030, China's leaders may be similarly satisfied that they have repaired the instabilities that they attribute to the U.S. strategic ambition for Absolute Security. They may also be satisfied that they have the military means to re-take Taiwan and prevail in other local informationized wars. Like Russia, they too will have robust all-domain means to punish and perhaps also to protect. But in 2030, their strategic focus may be pivoting onto a new set of challenges. The 2049 centenary will then be looming, bringing major questions about the types of conflicts for which China must next prepare. They will also be debating what use to make of China's new capabilities to project power much further from its shores. Of course, it is possible that this pivot may occur earlier, if and as China's foreign relations, especially with the U.S. and its allies, continue to deteriorate.

Despite a great deal of fluidity and uncertainty, it seems unlikely that the net balance of strategic power and influence will have shifted dramatically in favor of any of the three by 2030. Each will be able to look back on a record of progress in maintaining a credible threat of nuclear retaliation. None should be able to conclude that it is in a position to seize and hold some gain bearing on a vital interest of another.

Within the U.S. expert community, there is a good deal of disagreement about how U.S. leaders in 2030 are likely to assess the strategic balance. This disagreement reflects widely varying expectations about whether the United States will have gained or lost ground against China and Russia over the coming decade. Some technical experts anticipate significant progress in developing and fielding new capabilities; others are troubled by the sclerotic federal acquisition process. Some see a glass half full and filling; other see the glass as unlikely to fill, as the United States continues to lag Russia and China in adapting strategic postures to a changing security environment. Some see a United States with strong competitive instincts and pockets sufficiently deep to compete effectively; others see a country whose competitive capacity is limited by chronic political division and a dysfunctional economy and federal budget.

By 2030, the balance of central strategic forces among the United States, Russia, and China may have altered in various ways. But it is unlikely to have changed in a way that fundamentally calls into question the ability of the United States to retaliate in a devastating manner. The United States is likely to have a nuclear posture much like today's force. It is highly unlikely to be larger or more diverse; it may be somewhat smaller and less diverse. Russia will have a fully modernized force that is unlikely to be substantially different from today's force. China's force may be double its current size and fully modernized and its precise role and purpose are likely to remain ambiguous. In 2030 there will be significant uncertainties about where all three will be headed with force size and function in the decade to 2040. The imbalance that may be consequential in 2030 is the imbalance we're beginning to recognize in 2020: the imbalance in strategic thought about the requirements of effective deterrence in the kinds of conflicts we might face in an era of major power rivalry.

The extended deterrence balances in the Transatlantic and Transpacific Alliances look much more problematic. NATO has made important progress since 2014 in adapting its overall deterrence and defense posture to new Russian challenges, but its 2020 posture is not robust against the emerging Russian threat to the U.S. power projection strategy. Without significant new inputs, the theater/strategic balance is likely to degrade from a NATO perspective.

In East Asia, U.S. alliances have also made progress—but mostly vis-à-vis North Korea, not China. The conventional balance vis-à-vis China is worrisome and eroding. The United States and its allies must do more to compete to keep up, while making some hard choices about where specifically to compete and where not. The Pacific Deterrence Initiative, like the European Deterrence Initiative, makes a positive but limited contribution.

In both regions, there are many challenges on the road ahead arising from assertive and creative adversaries, emerging and disruptive technologies, and the need for comprehensive strategies that integrate political, military, and economic factors. Some are doubtful that the extended nuclear deterrent posture now in place but largely designed in the 1990s can be effective against emerging challenges. Allies too are tackling new questions about offense-defense and conventional-nuclear integration. They also struggle with renewed and deeper doubts about U.S. resolve to defend them whenever their vital interests might be at risk.

Closing Observations

Although they were not formally on our workshop agendas or a focus of these essays, two topics have regularly emerged in this process.

The first follows from recognition that strategic competition brings with it the possibility, even likelihood, of arms races. There are already signs of intensifying competition. Russia and China have competed to redress damage they believe the United States did to strategic stability during its "unipolar moment;" they have also begun to exceed the requirements of the status quo ante (the prior balance of

strategic force). In response, the United States is now deciding how to compete. Arms races are not necessarily a bad thing. An arms race may be necessary to redress a new instability or to signal, as an alternative to war, the resolve to stand up to a challenger. But arms races also bring uncertainty, fear, and temptation. They also come with risks—including, in the contemporary case, a heightened risk of crisis stability associated with the apparent need to strike first and hard to gain a decisive advantage early in a mounting crisis. In a free-for-all among three powerful actors, everyone might lose. This begs the question: is there an alternative to a strategic free-for-all? The collapse of the legacy arms control regime casts a dark shadow over this question, as does the failure so far to start meaningful dialogues among the three about possible future forms of strategic restraint and common security. But this only serves to underscore the urgency of finding practical means to mitigate dangers.

The second follows from recognition of the relative paucity of strategic thought so far developed about the problems for which strategic forces are relevant. In these workshops, strategy was defined as "underdeveloped." The policy discussion of hypersonic weapons was defined as "under-conceptualized." There were warnings of "preventable strategic surprise." There were calls for "a broader analytical agenda." Policymakers were described as "uninterested" in the dangers of arms racing. We need improved focus on the challenges of deterring and if necessary winning regional conventional wars against nuclear-armed adversaries capable of all-domain, trans-regional escalation. We also need improved understanding of how to manage and mitigate the risks of a strategic free-for-all. Together with its allies, the United States needs to become much more competitive with Russia and China in developing the needed strategic thought. This is one balance that can easily be restored by 2030—if U.S. leaders muster the political will.

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“The time is ripe to revisit questions about the future of the U.S. strategic posture. Next year, 2021, will bring a new defense strategy review and a return to basic questions of defense policy and posture by a new Congress and perhaps also a new administration. U.S. strategic forces, broadly defined here to include not just nuclear forces but also non-nuclear strategic strike, missile defense, and space and counter-space capabilities, can be expected to play a more prominent role in that process than in the past. This follows from the changing nature of modern warfare, the need to compete with and deter two major power adversaries who put a lot of stock in the strategic dimensions of modern war, and the need to address major concerns about U.S. deterrence strategy articulated in 2018 by the National Defense Strategy Commission.

To help inform the expected 2021 discussion, CGSR convened two workshops in summer 2020. One focused on the nuclear deterrent, including not just the nuclear triad but also the associated capabilities for command and control as well as for extended deterrence. The other explored the non-nuclear elements of the strategic posture and associated questions about how to ensure the needed integration of these disparate elements. Both looked ahead a decade to 2030 and then another decade to 2040. Both also explored developments in the strategic postures of Russia and China on a comparative basis. In follow up to the workshops, we identified some of the most important ideas for further elaboration. This volume is the result.”

Brad Roberts

From the Introduction

Lawrence Livermore National Laboratory

ISBN-978-1-952565-06-9