



FROM THE ARCHIVE

The need to maintain an effective and credible nuclear deterrent through modernization of the U.S. nuclear weapons complex has generally enjoyed bipartisan support over multiple administrations; yet rapid progress in this area has been notably lacking. A decade ago, the National Institute for Public Policy published a report assessing the ability of the United States to produce new nuclear warheads and detailing numerous recommendations to improve the readiness posture of the nuclear enterprise. Those recommendations remain relevant today. A subsequent National Institute report highlighted significant changes in the international security environment and suggested the need for a more urgent approach to the need for nuclear modernization, refuting arguments in support of a minimal nuclear deterrent, and calling for a more flexible and adaptable U.S. nuclear force to meet growing security challenges. The late John S. Foster Jr. chaired the Senior Review Group for this study, and the Executive Summary reprinted here is but one small example of his leadership and outstanding contributions to U.S. national security. Taken together, these reports identify appropriate considerations for contemporary national security policy makers and demonstrate the enduring importance of sustaining the necessary capabilities to preserve peace and deter aggression in a dangerous world.

DOCUMENT NO. 1.

ASSESSMENT OF U.S. READINESS TO DESIGN, DEVELOP AND PRODUCE NUCLEAR WARHEADS: CURRENT STATUS AND SOME REMEDIAL STEPS¹

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Executive Summary

This report provides an assessment of the U.S. readiness posture to be able to design, develop, and produce new nuclear weapons, in particular the nuclear warheads. The first part of the report focuses primarily on policy-related issues, including the benefits of a healthy nuclear readiness posture, discusses the relevant nuclear weapon policies of three post-Cold War administrations, addresses lessons from an attempt to constrain U.S. nuclear warhead development activities, and summarizes findings of numerous studies of security issues relevant to this topic over the past two decades. The second part of the report addresses technical issues; it characterizes the current state of readiness to develop and produce new nuclear capabilities, identifies existing limitations, and provides recommendations to improve the U.S. nuclear readiness posture.

This report does not advocate any specific new nuclear capability. The focus is on a readiness capability to respond to adverse contingencies and the steps needed to

¹ Thomas K. Scheber, John R. Harvey, *Assessment of U.S. Readiness to Design, Develop and Produce Nuclear Warheads: Current Status and Some Remedial Steps* (Fairfax, VA: National Institute Press, August 2015), available at https://nipp.org/monographs_cpt/assessment-of-u-s-readiness-to-design-develop-and-produce-nuclear-warheads-current-status-and-some-remedial-steps/.



remediate an aspect of the U.S. security posture that, over the past two decades, has been documented repeatedly as being deficient. A healthy nuclear readiness capability would enable the United States to respond to a reliability failure in a nuclear warhead or weapon system type, to an emerging vulnerability as the result of new adversary capabilities, or to presidential direction calling for an increase in the U.S. inventory of weapons.

Why is Sustaining a Nuclear Weapon Development Capability Important?

With multiple and diverse security challenges for the United States and its allies, Department of Defense (DoD) officials have recently expressed alarm at the narrowing U.S. margin of technological superiority in military capabilities vis-à-vis potential adversaries. Former Secretary of Defense Chuck Hagel and current Secretary of Defense Ashton Carter have both called for greater innovation and creativity for defense technologies. Arguably, a military capability sector that clearly demonstrates a shrinking U.S. margin of capability is that of nuclear weapons—the National Nuclear Security Administration (NNSA) capabilities to develop and produce nuclear warheads and the DoD-developed delivery systems that carry those warheads.

Maintaining a readiness capability to develop new weapons or replacements for existing nuclear weapons is fundamentally about reducing risk in the future. Indeed, the 2009 report of the bipartisan Strategic Posture Commission cited the “unpredictable nature of the security environment” as one of the emerging challenges for the United States. Of significant concern was the “profound uncertainty about the future international roles of Russia and China” as well as uncertainty about the future roles of various rising powers. The Commission concluded that the United States needs “to hedge against the possibility that ... these factors might not turn out for the best and that new challenges for the U.S. nuclear strategy might emerge and, indeed, suddenly so.”²

Currently, shortfalls in the U.S. nuclear infrastructure—especially the intellectual infrastructure for warhead research and development—significantly degrade the ability of the United States to respond to challenges that could undermine the deterrence of adversaries and the assurance of allies. Establishing a nuclear weapon readiness program should be a national priority in order to provide resilience for new and unforeseen challenges ahead. The nuclear infrastructure and personnel could be called upon to diagnose and fix an unexpected reliability problem in a warhead type, replace older warheads with similar or different warhead types, increase the number of deployed warheads, or design with different military capabilities. Currently, it is not ready to respond.

² William J. Perry and James R. Schlesinger, et al., *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington, DC: United States Institute of Peace Press, 2009), p. 8.

A fully functioning and responsive development infrastructure would:

- Improve the credibility of U.S. nuclear capabilities in support of deterrence and assurance;
- Provide enhanced adaptability and resilience for the nuclear force to be able to respond to emerging challenges in a timely manner; and
- Enable the United States to reduce the overall size of the nuclear stockpile. Instead of relying on a large inventory of non-deployed warheads to manage risk and hedge against reliability problems, U.S. leaders would rely more heavily on the infrastructure and skilled workforce to be able to fix warhead problems quickly and, when needed, respond to new security challenges.

Summary of U.S. Post-Cold War Nuclear Weapon Policies and Readiness Posture

The administrations of President William J. Clinton and President George W. Bush agreed on the explicit policy of maintaining the ability to design and produce new nuclear warheads and weapons, when required. [...]

Maintaining a resilient nuclear capability was characterized by both administrations as a “hedge” against future uncertainties. Both administrations stated this requirement periodically and reflected this priority in their programmatic initiatives.

In its 2010 NPR, the Obama administration assigned highest priority to nuclear nonproliferation and reducing the role of nuclear weapons in U.S. national security strategy. The administration also promoted the vision of a nuclear-free world. At the same time, President Obama committed to sustain the reliability of nuclear warheads as long as those weapons are needed and to enhance safety and security features for nuclear weapons. The requirement to maintain a capability to develop and field modern warheads, or modify warheads to provide new military capabilities is implicit in President Obama’s commitment to sustain the nuclear stockpile. In a 24 May 2010 letter from Vice President Joseph Biden to Senators Kyl and Lieberman, Biden stated:

Admiral Mullen and General Kevin Chilton, Commander, U.S. Strategic Command, have stated that the current deterrence requirements are met with existing weapons systems capabilities. They have made clear that there is no military requirement for new warheads or new military capabilities—and equally clear that they and their successors would be obligated to state if they believed such a requirement arises in the future.³

Bottom line: Notwithstanding the fact that programmatic goals for nuclear capabilities have from time to time been scaled back to conform to fiscal limits and extant congressional support, the long-term goal of a healthy nuclear weapon development and production posture has been supported—explicitly or implicitly—by the current and previous two

³ Letter from Vice President Joseph Biden to Senator Jon Kyl and Senator Joseph Lieberman, 24 May 2010. (Emphasis added.)

administrations. Over the past two decades, however, U.S. capabilities to design, develop, and field modern nuclear warheads have not been exercised and, as a result, have deteriorated.

Numerous Studies over the Past Two Decades Cite the Need for Improved U.S. Readiness Capabilities for Nuclear Weapons

Over the past two decades, many studies of the U.S. nuclear readiness posture confirm the atrophy of nuclear skills in the United States. These studies include assessments conducted by the bipartisan Strategic Posture Commission, other congressionally-mandated studies and commissions, the National Research Council, and the Defense Science Board. The consistency of the findings on capability limitations is striking and includes the following:

- Important NNSA nuclear warhead development skills are not being exercised;
- DoD nuclear expertise is declining;
- Improvement is needed in NNSA-DoD coordination and integration; and
- Nuclear warhead production facilities are outdated and inefficient; some are decrepit.

Studies and reports over the past 20 years also provide consistent recommendations to remediate this situation.

Limitations of the Current U.S. Nuclear Weapons Enterprise

The finding that significant limitations exist in the current nuclear readiness posture is reaffirmed by recent interviews with former senior officials who served in the DoD, NNSA, or at national laboratories. Specific limitations include:

- **No Comprehensive Approach Exists to Sustaining Nuclear Readiness.** The current approach to sustaining critical nuclear skills is piecemeal. A comprehensive approach to improving and sustaining a nuclear warhead readiness and response capability is needed.
- **Not All Critical Skills and Capabilities Are Being Exercised.** Currently, the approach for life-extending warheads calls for options to either *refurbish* existing warheads, to *reuse* nuclear components from warhead designs previously in the stockpile, or to *replace* warheads or the nuclear components with previously tested designs. However, most warhead life extension programs (LEPs) today are of limited scope—primarily *refurbishment* LEPs—which exercise only a limited set of critical skills for nuclear warhead development and production. One study called the current approach “unsustainable.”
- **Lack of Balance between Computation and Experiments.** Currently, the nuclear warhead development community is overly dependent on computer simulation. As one designer has stated, “The codes always lie.” Without sufficient experimental

activities against which to test the results of computer simulations, new designers and engineers may not recognize where the computer codes break down and why. This over-dependence on computer simulation impedes the development of professional judgment that will be needed in the future when facing complex design challenges.

- **Infrastructure Modernization Delayed Repeatedly.** Modernization of critical nuclear facilities has been delayed. The U.S. nuclear infrastructure has not been fully operational for a quarter century. A September 2008 white paper signed jointly by Secretary of Defense Robert Gates and Secretary of Energy Samuel Bodman states, "...the United States is now the only nuclear weapon state party to the NPT that does not have the capability to produce a new nuclear warhead."⁴ In its 2009 report, the bipartisan Strategic Posture Commission stated that some facilities are "genuinely decrepit" and much still remains to be done to put in place a modern nuclear weapon infrastructure to serve national security goals for the long term.⁵ In addition, infrastructure modernization plans may not adequately address the need for reserve capacity to respond to unforeseen needs. Nearly all of the planned capacity to produce warheads over the next 25 years will be tied up with the life extension programs needed to sustain the existing stockpile. There is little, if any, margin left for unplanned tasks. As a result, the United States plans to maintain a larger stockpile of reserve warheads than desired in order to manage risk and provide options to respond to contingencies.

Recommendations to Improve the Readiness Posture of the Current Nuclear Enterprise

This report identifies several near-term actions that would help the United States to strengthen and maintain nuclear warhead development capabilities, including scientific and technical personnel, experimental capabilities, and manufacturing infrastructure needed to—if directed by the president—develop and field new or modified warheads.

A Bipartisan, Long-Term Commitment to a Resilient Nuclear Readiness Posture is Needed. Above all else, it is essential to restore a bipartisan consensus that supports maintaining a resilient nuclear weapons development and production capability, and routinely demonstrating that capability. Periodically communicating continued U.S. nuclear competency and the message that this is important to our nation is a critical component of deterrence and assurance. Bipartisan support in Congress and a dedicated partnership

⁴ Secretary of Defense Robert M. Gates and Secretary of Energy Samuel W. Bodman, "National Security and Nuclear Weapons in the 21st Century," September 2008, p. 19. (Unclassified report which was an edited and redacted version of a classified report sent to Congress in February 2008.)

⁵ Perry and Schlesinger, et al., *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States*, op. cit., pp. 47-51.

between the executive branch and Congress will be imperative to achieve this long-term goal.

Recommendation: Make explicit, as national policy, the national security goal of maintaining a resilient nuclear weapon development and production capability and exercising that capability periodically. This would demonstrate continued U.S. nuclear competency for both potential adversaries and allies. Bipartisan support in Congress will be imperative for this to succeed.

The People: Ensuring Weapons Design and Engineering Development Skills for the Long Term. It is fundamental in nuclear weapons work, as it is in other highly technical activities, that the skilled people—the scientists, designers, and engineers—will be unable to maintain critical capabilities absent opportunities to exercise them routinely on complex warhead design and development challenges. Over the past two decades, such opportunities have been few and far between.

At present, there are no military requirements for new warheads or for warheads with new military capabilities. How then can all critical skills be exercised? A more comprehensive approach is needed—one that exercises the entire design, development and manufacturing enterprise and advances a modern warhead design from initial concept through prototype development and flight testing to the point where one or a few are built, but not fielded.

In generating modern warhead designs, weapons scientists, working with their military counterparts, have traditionally conducted a Phase 1 warhead concept study leading to a Phase 2 feasibility and cost study. These are generally paper studies and, while important, do not fully exercise critical skills.

To maximize benefit for skill development, work must include at least parts of Phase 3 engineering development and Phase 4 production engineering associated with building and integrating actual hardware. The benefits of training young weapons scientists on innovative design problems would be compounded in value when the designer must iterate his/her work with systems engineers—in both NNSA and DoD—to weaponize a warhead design and with the production personnel who would actually have to build the prototype warhead.

One near-term action to more fully exercise skills involves restoring the original schedule for a LEP for one “common” warhead which would replace two aging warheads—one carried on intercontinental ballistic missiles, the other on submarine-launched ballistic missiles. (The proposed common-use warhead is referred to as the Interoperable Warhead-1 or IW1). Compared to other LEPs underway, the IW1 LEP presents a much more formidable design and development challenge for training a new generation of developers and would exercise a broader range of skills.

Recommendations: Actions that would help retain and advance needed skills and capabilities into the future for nuclear warhead design and engineering personnel include the following.

- Reverse the recent five-year delay to the IW1 LEP program in order to begin providing young weapons scientists and engineers a timely, important and complex design and development challenge.
- Accelerate activities, already underway, to certify, without nuclear testing, the safety and reliability of an older warhead primary that is modified with insensitive high explosives.
- Explore opportunities to introduce into future LEPs warhead features that facilitate ease of maintenance, enhanced surety, and certification without nuclear testing.
- Increase opportunities to train nuclear designers via the design and manufacture of a few prototype warheads, including warhead designs in ongoing programs to assess foreign nuclear weapon designs as called for in the 2015 National Defense Authorization Act (NDAA).⁶ Here, a modern warhead design would be taken from initial concept and paper studies through prototype development and flight testing. One or a few would be built, but not fielded.
- As part of nuclear counterterrorism efforts, increase opportunities for young designers to explore potential improvised nuclear device designs and means to render them safe.
- Fund a small program to enable designers to spend part of their time in “blue sky” thinking about what might be achievable in nuclear weapon technology. To help motivate innovation, this should be competitive in nature and challenge young designers and engineers at the two U.S. nuclear design laboratories to propose creative concepts.

Increase Use of Experiments with Advanced Diagnostics to Complement Computer Simulation. The challenge of training weapons designers and engineers has evolved due to the absence of nuclear testing and availability of new, extraordinarily powerful computing capabilities. More so than their predecessors, young designers rely more heavily on computer simulation, modeling, and calculations and tend toward overconfidence in the quality of the weapon physics embedded in the codes. One senior designer noted that “the codes always lie” and the job of the designer is to figure out where they can be wrong and when. A more balanced Stockpile Stewardship Program would include computer simulations and modeling backed up by a more comprehensive experimental program. The

⁶ The FY 2015 National Defense Authorization Act (NDAA)—*Section 3111. Design and Use of Prototypes for Intelligence Purposes*—reflects an implicit recognition of some of these issues. Section 3111 authorizes the national labs to “design and build prototypes of nuclear weapons to further intelligence estimates with respect to foreign nuclear weapons activities and capabilities.”

weapon physics models in the computer codes would be compared to experimental results in various warhead design configurations.

Indeed, the United States has developed modern experimental facilities with advanced diagnostics to conduct experiments that not only greatly advance the state of our knowledge about weapons physics and chemistry but can be used to test designer judgment as well. However, other priorities and, to a lesser extent, funding shortfalls have prevented young scientists from fully exploiting these facilities to conduct experiments to test their calculations. These facilities are not being fully utilized.

Recommendations: Actions to expand the use of experimental programs for training a new generation of stockpile stewards include the following.

- More fully utilize existing experimental facilities. Given that tight budgets are a fact of life, seek “more bang for the experimental buck” by: (1) assigning a higher priority to experiments; (2) operating more efficiently by reducing bureaucratic overhead and micromanagement that increases costs; and (3) *managing safety risks* rather than fruitlessly (and at high cost) seeking to eliminate them.
- Provide young weapon designers at Los Alamos National Laboratory more opportunities to exploit experiments at high energy density facilities in their training and later warhead design work. (Note: Such facilities are not located at Los Alamos.)
- Challenge young designers with “out of the stockpile box” problems and the opportunity for innovative experiments to test judgment. Challenge young weapons scientists to brief their predictions—perhaps in a lab-to-lab competitive environment—on the expected results of experiments before they are carried out. This so-called “pre-mortem” process would offer the potential for failure and, thus, would be valuable for building judgment.

Accelerate Infrastructure Modernization. A functioning and responsive nuclear warhead manufacturing infrastructure is essential to any plausible strategy to respond to unforeseen contingencies and is also an important component of efforts to train the next generation of warhead development personnel. The infrastructure problem (along with the deterioration of skills) has existed for more than two decades. This is not a problem caused solely by this administration or this Congress, but also by administrations and congresses before them.

The aging, inefficient infrastructure has caused stockpile LEPs to be more expensive and to take longer than would have been otherwise possible. For example, the W87 LEP, carried out in the late 1990’s and early 2000’s, was more expensive and took 15 years—much longer than anticipated—because of the need to restore capabilities for warhead secondary work at the Y-12 plant in Oak Ridge, Tennessee. Also, difficulty in restoring a lost capability to produce a special material called Fogbank delayed completion of the W76-1 LEP by several years.

Recommendations: Steps for modernizing the physical infrastructure are straightforward.

- Accelerate efforts to provide a capability to produce plutonium pits at a capacity of 50-80 pits per year at Los Alamos, New Mexico.
- Implement the revised approach identified by NNSA's Red Team⁷ to restore safe and environmentally sound highly-enriched uranium component manufacturing capabilities at the Y-12 plant in Oak Ridge, Tennessee. [...]

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DOCUMENT NO. 2. A NEW NUCLEAR REVIEW FOR A NEW AGE⁸

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Executive Summary

One of President Donald Trump's first actions after entering office was to direct Secretary of Defense James Mattis to "initiate a new Nuclear Posture Review 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."⁹ Secretary Mattis has since reportedly directed that the new Nuclear Posture Review (NPR) be completed in six months.¹⁰ This new 2017 NPR will be the fourth in a series, following the 1994, 2001, and 2010 NPRs.

⁷ Thom Mason, committee chair, Final Report of the Committee to Recommend Alternatives to the Uranium Processing Facility Plan in Meeting the Nation's Enriched Uranium Strategy (Oak Ridge, TN: Oak Ridge National Laboratory, April 15, 2014), available at http://www.lasg.org/UPF/UPF_Red_team_rpt_15Apr2014.pdf.

⁸ Keith B. Payne and John S. Foster Jr., et al., *A New Nuclear Review for a New Age* (Fairfax, VA: National Institute Press, April 2017), available at https://nipp.org/monographs_cpt/a-new-nuclear-review-for-a-new-age/.

⁹ Donald Trump, "Presidential Memorandum on Rebuilding the U.S. Armed Forces," *WhiteHouse.gov*, January 27, 2017, available at <https://www.whitehouse.gov/the-press-office/2017/01/27/presidential-memorandum-rebuilding-us-armed-forces>.

¹⁰ Rachael Karas, "Air Force nuclear chief: Mattis wants nuclear review completed within six months," *Inside Defense*, March 29, 2017, available at <https://insidedefense.com/daily-news/air-force-nuclear-chief-mattis-wants-nuclear-review-completed-within-six-months>.

This report—entitled *A New Nuclear Review for a New Age*—examines major questions and issues for consideration in the new NPR.

The forthcoming NPR will supersede its immediate predecessor, completed in 2010 under the Administration of President Barack Obama. Previous NPRs were issued in 1994 and 2001 to guide nuclear policy under the Clinton and Bush Administrations, respectively. Since the 2010 NPR, the global security environment has changed significantly. Existing US nuclear weapons and delivery systems have aged while potential adversaries have modernized their arsenals. The attitudes and perceived options of US allies in many cases are different as well. Taken together, these and other changes highlight the high priority of the new NPR and the need for well-informed discussions leading to new guidance.

This report examines the international security environment, goals of nuclear policy, technology issues, funding questions, the precedents set by earlier NPRs, the relevance of nuclear declarations and arms control efforts, and other key inputs, and offers recommendations for consideration in the forthcoming NPR.

This Executive Summary is organized according to the chapters in this report.

Security Environment

The world as seen from the United States looks very different today—and much more threatening—than it did at the time of the last NPR in 2010. Therefore, a new review of US nuclear policy and requirements must begin with a realistic assessment of the security environment and the challenges it poses.

The four countries whose leaderships and doctrines continue to be of greatest importance to US nuclear policy are the Russian Federation, the People's Republic of China (PRC), the Democratic People's Republic of Korea (DPRK), and the Islamic Republic of Iran. In addition, the potential terrorist-style actions of belligerent non-state actors continue to be of major concern. Each is considered in turn.

Russia. Long-standing US hopes for more constructive relations with Russia—which date to the collapse of the Soviet Union in 1991 and informed all three previous NPRs—have been dashed in recent years. President Vladimir Putin's regime in Moscow appears to be driven by the goal of re-establishing Russian hegemony in the former "Soviet space." In 2008, Russia invaded Georgia and since has effectively absorbed parts of Georgian territory. Russia's illegal 2014 occupation and subsequent annexation of Crimea, along with its ongoing military involvement in Eastern Ukraine, constitute fundamental challenges to the post-Cold War European peace. More recently, Russia intervened in the Syrian civil war in support of Syrian President Bashar al-Assad, and reportedly was aware in advance of Assad's deadly April 2017 use of chemical weapons against Syrian civilians. President Putin has stoked imperial nationalism at home, probably to draw attention away from domestic challenges and generate ongoing popular support for his regime's expansionist agenda.

Putin and his small inner circle—poised to continue controlling Russian defense and foreign policy for years to come—are inherently anti-Western and have named the United States and the North Atlantic Treaty Organization (NATO) as priority threats. Potential flashpoints between Russia and NATO span Eastern Europe and certainly include the Baltic states as well as the Middle East.

Russian leaders now appear to consider their country's nuclear capability as an enabler of expansionist regional actions. Developments in Russian doctrine elevate the potential role of nuclear weapons. Most ominously, reports indicate that Russia has developed an "escalate-to-win" approach that includes threats of nuclear first use and apparent planning for nuclear first use in regional conflicts—to demonstrate the extreme risks of Western resistance to Russian geopolitical gains.

Russia has put highest priority on modernizing strategic and non-strategic nuclear capabilities for the past decade—announcing more than 20 programs to develop and deploy new strategic nuclear systems or modernize Soviet legacy systems. These include multiple systems for every leg of the Russian nuclear triad as well as two possible systems extending beyond the triad: a hypersonic glide vehicle and a nuclear-armed and powered undersea delivery vehicle. These Russian developments pose unprecedented challenges to Western deterrence and assurance goals.

China. The Chinese Communist Party (CCP) under the leadership since 2012 of President Xi Jinping, asserts central control of Chinese national security and foreign policy. In recent years, while remaining an important US economic partner, China has redoubled its efforts to achieve hegemony in Asia and, correspondingly, continued its military buildup, including nuclear. China has made claims to nearly the entire South China Sea, in violation of international law and tribunal rulings—and even has disputed Japanese sovereignty over the island of Okinawa, where US military personnel remain stationed.

The precise size and nature of China's nuclear arsenal—like its nuclear doctrine—remain opaque. China certainly controls at least several hundred nuclear weapons—both strategic and theatre missiles—and is committed to nuclear modernization, including a new ballistic-missile submarine and a new generation of strategic bombers.

Official Chinese declaratory policy includes a no-first-use nuclear policy emphasizing the ability to survive a nuclear attack and respond with unacceptable damage on an enemy. However, there are considerable doubts about the reality of this expressed Chinese commitment to no first use; many analysts tend to believe that China's actual policies are more flexible.

North Korea. Post-Cold War hopes that the DPRK would collapse peacefully or slowly reform have not been realized. North Korea defies UN resolutions and international sanctions openly, with provocative military behavior and threatening rhetoric, including nuclear threats. North Korea's continued development of nuclear weapons and long-range ballistic missiles—linked to its overarching goals of regime preservation and unifying the

Korean peninsula under its control—place the regime in fundamental opposition to US and allied interests in the Pacific.

Under the solidified leadership of Kim Jong Un—the third in his family to control the country—North Korea’s nuclear forces appear to be increasing both in quantity and quality. The DPRK has tested a nuclear device five times in recent years and, while open estimates vary, the country may have enough fissile material to produce 50-100 weapons by 2020. It also remains committed to developing long-range missiles capable of reaching US territory.

Officially, North Korea claims that its nuclear capability is meant for defensive or retaliatory purposes, but its explicit nuclear threats appear to reflect hostile intent, and little is known with certainty about how the DPRK’s leaders might employ nuclear weapons. Certainly the regime continues to leverage its nuclear program for coercive diplomacy and to bolster its international standing.

Iran. Since the 2010 NPR, Iran has expanded its disruptive actions in the Middle East, including provocations against the United States, and continues to support terrorist organizations as well as the Assad regime in Syria. Iran’s theocratic regime—centered since 1989 on Supreme Leader Ali Khamenei—remains in firm control.

Despite the Joint Comprehensive Plan of Action (JCPOA), Iran retains the potential to become a nuclear power in relatively short order. The JCPOA does not limit potential nuclear delivery vehicles such as missiles, and Iran reportedly continues to invest heavily in their development. Its recent satellite launches suggest that long-range missile development remains part of these efforts as well. Technology sharing between North Korea and Iran also is of great concern.

Non-state actors. Open-source reports indicate that terrorist groups so far have been unsuccessful in obtaining a nuclear weapon or the materials needed to assemble one. Should this change, however, the threat to the United States and its allies could be immense and immediate—and so this possibility must remain a high priority in US nuclear thinking.

Summary conclusion. The expectation of a more benign nuclear threat environment embedded in previous nuclear reviews—an environment in which nuclear weapons and nuclear deterrence were expected to play ever-diminishing roles—has faded from view and should *not* serve as a planning assumption for the new NPR.

Purposes of US Nuclear Capabilities

The general purposes of US nuclear capabilities—and therefore the goals of nuclear policies—have been remarkably consistent over time and certainly since the first NPR in 1994. Three purposes are of particular importance: the *deterrence* of enemies, the *assurance* of allies, and *defense* or *damage limitation* in the event of war. In addition,

nuclear *nonproliferation* has taken on increasing prominence and indeed was identified as a top priority in the 2010 NPR. It is important to understand the ongoing salience of each of these purposes.

Deterrence. Defined by the US Department of Defense (DoD) as “the prevention of action by the existence of a credible threat of unacceptable counteraction and/or belief that the cost of action outweighs the perceived benefits,” deterrence has been a central purpose of US nuclear policy and capabilities. Going back to the 1948-49 Berlin crises and the 1962 Cuban Missile Crisis, considerable evidence exists that nuclear deterrence helps uniquely to prevent war or the escalation of conflict between countries. And even with regard to non-state actors, deterrence can help to dissuade adversary countries from providing technical or material assistance to dangerous groups.

In a highly-dynamic threat environment, to the extent possible, US deterrence policies must also be highly adaptable: capable of being “tailored” to the various requirements posed by a shifting spectrum of opponents and contingencies. Such adaptability, in turn, rests on the availability of a flexible nuclear-force posture that provides US presidents with a range of deterrent options that not only deter, but also could help limit damage to civilian populations and society in the event deterrence fails.

Assurance. While the primary audience for US deterrence messages are adversaries, nuclear assurance addresses itself to allies and partners—by creating or reinforcing confidence among them regarding the US ability and will to help preserve their security against external threats. The United States extends nuclear assurance commitments to more than 30 countries, particularly in Europe and Northeast Asia, where US nuclear policy provides confidence to allies that their security does not require their development of independent nuclear arsenals.

As with deterrence, assurance depends not only on the credibility of the US commitment but also on the flexibility of available options. While some allies may have doubts that the United States would risk all-out strategic nuclear war involving the American homeland to defend their territory, sub-strategic US nuclear and non-nuclear capabilities deployed in their vicinity can help provide important assurance effect.

Damage limitation. In the event that deterrence fails, damage limitation continues to be a US policy priority reinforced by nuclear capabilities. Numerous official policy documents in the past have identified damage limitation as a priority US goal, and the Obama Administration’s 2013 *Report on Nuclear Employment Strategy of the United States* implicitly identifies it as such.

A potential means of limiting damage is so-called “intra-war deterrence,” in which the priority goal during an ongoing conflict is to reestablish deterrence and thereby minimize escalation and damage to US and allied military, political, and societal assets. While reestablishing deterrence following initial conflict can never be considered a certain

outcome, it is most likely to be achieved if the United States has a range of limited nuclear and non-nuclear options at its disposal that can provide a response scaled to any level of attack. Active defenses, such as ballistic missile and air defenses, also may contribute to the goal of damage limitation.

Nonproliferation. Nonproliferation—preventing the adoption of nuclear weapons by additional countries or a numerical increase in the number of nuclear weapons—remains a vital goal. Proponents of using further US nuclear reductions and limitations to promote nonproliferation argue that US nuclear-force reductions contribute to decisions of other countries to forego nuclear weapons or to more seriously pursue nonproliferation. Yet, there is little to no evidence that supports this widely-claimed linkage; there is, however, considerable evidence (discussed later in this report) indicating that credible US nuclear capabilities contribute to the assurance of allies and thus to the goal of nonproliferation.

Summary conclusion. The 2010 NPR explicitly elevated nonproliferation “for the first time” to the highest priority of US nuclear policy, among other priorities, including deterrence and assurance.¹¹ It also identified a reduction in the roles and number of nuclear weapons as a means to promote its priority nonproliferation goal. Senior DoD officials identified “preventing nuclear proliferation and nuclear terrorism,” and “reducing the role of nuclear weapons in US strategy” as the top US strategic objectives, and stated explicitly that the Department of Defense assessed “deterrence requirements against these metrics.”¹² Correspondingly, then-Secretary of State Hillary Clinton said, “As part of the NPR, the Nuclear Posture Review, we are grappling with key questions... Will our deterrence posture help the United States encourage others to reduce their arsenals and advance our nonproliferation agenda? [And] How can we provide reassurance to our allies in a manner that reinforces our nonproliferation objectives?”¹³

There is now something of a consensus in Washington regarding the deterioration of the security environment since 2010, and senior DoD officials accordingly have identified US nuclear deterrence as the Department’s “highest priority mission.”¹⁴ The 2017 NPR should explicitly reestablish deterrence and assurance—coupled with preparations for damage limitation in the event of deterrence failure—as the priority goals for US nuclear

¹¹ U.S. Department of Defense, *Nuclear Posture Review Report* (Washington, DC: Department of Defense, April 2010), p. vi, available at

https://www.defense.gov/Portals/1/features/defenseReviews/NPR/2010_Nuclear_Posture_Review_Report.pdf.

¹² James Miller, Principal Deputy Under Secretary of Defense for Policy, as quoted in U.S. Congress, “The Current Status and Future Direction for U.S. Nuclear Weapons Policy and Posture,” *112th U.S. Congress*, House Armed Services Committee, November 2, 2011, p. 62, available at https://fas.org/irp/congress/2011_hr/nw-posture.pdf.

¹³ Hillary Clinton, “Remarks at the United States Institute of Peace,” *State.gov*, October 21, 2009, available at <https://2009-2017.state.gov/secretary/20092013clinton/rm/2009a/10/130806.htm>.

¹⁴ Ashton Carter, “Remarks by Secretary Carter to troops at Minot Air Force Base, North Dakota,” *Defense.gov*, September 26, 2016, available at <https://www.defense.gov/News/Transcripts/Transcript-View/Article/956079/remarks-by-secretary-carter-to-troops-at-minot-air-force-base-north-dakota/>.

policy. Nonproliferation remains important, but the emphasis on it as the priority goal “atop” US nuclear policy, and the corresponding prioritization accorded to the continuing reduction of US nuclear forces, should not be sustained. The realities of the contemporary threat environment and the corresponding prioritization of credible deterrence, assurance, and damage limitation goals are key factors for consideration in the new Nuclear Posture Review mandated by the Trump Administration.¹⁵ This alone is no small difference from the dominant post-Cold War nuclear policy narrative which has sought largely to limit and reduce US nuclear capabilities on a continuing and progressive basis.

Defining Adaptability

The current security environment, the purposes of US nuclear capabilities in response to that environment, and the reality of lengthy acquisition cycles for new weapons systems, combine to make *adaptability* an essential metric for US planning and nuclear capabilities supporting deterrence, assurance, and damage limitation.

Adaptability, as understood in this report, encompasses *flexibility* to adjust to different adversaries, contingencies, and employment plans, as well as *resilience*, which allows national leaders to adjust the force posture in response to adverse military, political, or technological changes.

In practice, several nuclear-force posture attributes reinforce flexibility and resilience. These include survivability (the ability of nuclear forces to withstand or escape attack); suitable range; ability to forward deploy (closer to adversaries and allies alike); prompt response capability; variable payloads (e.g., the ability of ballistic missiles and bombers to carry different types and numbers of weapons); assorted weapon yields; and high delivery accuracy.

In addition, several other factors enhance the resilience of the US nuclear force posture. The diversity and readiness of the existing force structure is a key factor, for example, including its “triad” of land-based, sea-based, and airborne delivery systems. The ability to adjust the size and alert levels of the deployed force—by bringing weapons out of stockpile if necessary, for example—is important as well. And, the potential to modify existing capabilities through straightforward hardware changes also can enhance adaptability.

Summary conclusion. Adaptability in general should be made a guiding metric for the evaluation of US nuclear policy, planning, and force structure; its preservation and enhancement in these elements should be a primary theme in the 2017 NPR.

¹⁵ The White House, “Presidential Memorandum on Rebuilding the U.S. Armed Forces,” *WhiteHouse.gov*, January 27, 2017, available at <https://www.whitehouse.gov/the-press-office/2017/01/27/presidential-memorandum-rebuilding-us-armed-forces>.

Considering US Nuclear Force Size: How Much Is Enough?

The size of a future US nuclear force is likely to be a key consideration in the forthcoming NPR. The specification of “how much is enough” in terms of nuclear force numbers has been an enduring question addressed in previous NPRs. A “minimalist” school of thought has long argued for no more than the force size necessary for a retaliatory threat to an opponent’s society, in response to an attack by that opponent. Such a threat is said to be adequate for US deterrence requirements while demanding a relatively small number of US nuclear weapons—typically ranging from a few dozen weapons to hundreds.

This report identifies a number of reasons to reject the minimalist approach to answering the question of US nuclear force sizing:

1. Declaring a low specific number of weapons as adequate for US deterrence needs because it meets the requirements to threaten an opponent’s society reflects a basic misconception of deterrence. No one can know the “minimal” number of nuclear weapons necessary to deter credibly; and even if known, the number likely would change on a continuous basis due to shifts in force structure, weapons technology, the opponent’s worldview, the stakes of the conflict, context, and numerous other factors. This is the reason deterrence strategies must be sufficiently flexible to be “tailored” to specific contexts, not predicated on a static minimalist concept.
2. A minimal number of weapons may not be sufficiently large and diverse to discourage first-strike strategies and planning by a determined opponent. The consensus of Democratic and Republican administrations for 50 years has been to maintain a diverse and, in some ways, overlapping triad of strategic nuclear forces to ensure the survivability of US forces, as is necessary for deterrence, and thus to discourage opponents from considering first-strike strategies, and to preserve credible deterrence even in the face of an opponent pursuing such a strategy.
3. The minimalist focus on threats to civilians and other societal targets as the measure of effective US deterrence capabilities is widely considered immoral, a violation of international law, and likely to be viewed as an incredible US deterrent by some opponents.
4. A minimal force number oriented to threatening societal destruction would provide little flexibility to hold at risk other assets that an opponent’s leadership might value more than civilian centers—such as military or political control targets. Thus, such a minimal deterrent could be inadequate and an imprudent approach to deterrence and assurance.
5. A minimal force would provide a future US president the most miserable option if deterrence fails—that of responding against an opponent’s society with remaining forces—at the expense of other targeting options that could more likely help limit escalation of the conflict and avoid further counter-strikes from the opponent.

6. A minimal nuclear force needed to threaten society likely would be seen as wholly insufficient for assurance by at least some allies under the US nuclear umbrella.

Summary conclusion. The US goal must be for nuclear deterrence and assurance to work as effectively as possible in all cases, and to limit escalation to the extent possible should deterrence fail. This demands the rejection of a minimalist approach. In the forthcoming NPR, recommendations regarding US nuclear force numbers should *not* aim for a hypothetical minimum derived from only the requirements for holding societal targets at risk, fixed budget numbers, or other static boundaries. The standards of adequacy for multiple nuclear policy goals in severe, diverse and shifting conditions can never realistically be considered fixed. Instead, numbers should be the product of a careful assessment of the dynamic security environment and US purposes within it.

Present and Planned US Nuclear Forces

The United States is in the initial stage of a planned nuclear-force modernization program. The program will encompass all elements of the force, require a budget of hundreds of billions of dollars over the next quarter century, and affect US capabilities for deterrence, assurance, and damage limitation for decades after its completion. This report outlines key components of present and planned US nuclear forces, and evaluates the changes expected from the modernization program against the metrics of adaptability described in the earlier section on that topic. (See the extensive supporting open references for this discussion in Appendix A). The report also considers aspects of technology development and the nuclear-weapons infrastructure that are in need of modernization.

For purposes of this Executive Summary, the potential impacts of key force changes are summarized with reference to the adaptability criteria:

Survivability. Force survivability is a matter both of escaping or withstanding attack (pre-launch survivability) and penetrating defenses that could impede an effective response (post-launch survivability). The force-modernization program, as reported, will not change the survivability level of US ballistic missile submarines (SSBNs) in port. Nor will it change the survivability of bombers and dual-capable aircraft (DCA) at air bases, or intercontinental ballistic missiles (ICBMs) in silos. The *Columbia*-class SSBN, however, is designed for greater *at-sea* survivability than its *Ohio*-class predecessor. The B-21 bomber, long-range standoff missile (LRSO), and F-35A DCA are all designed for greater post-launch survivability against advanced air defenses than their existing counterparts. And the planned ground-based strategic deterrent (GBSD) missiles are expected to be more survivable after launch than the existing Minuteman III.

Suitable range. Current submarine-launched ballistic missiles (SLBMs), ICBMs, and bombers have intercontinental ranges and—while the ranges of next-generation systems have not been revealed publicly—it is reasonable to expect that their ranges will be

similarly intercontinental. In the same way, the LRSO may be expected to have an intermediate range comparable to the current air-launched cruise missile (ALCM-B) and retired Advanced Cruise Missile. DCA typically have shorter ranges than bombers—and open-source estimates suggest the F-35A will be no exception—but can be forward deployed and refueled in flight to extend range.

Ability to forward deploy. Bombers and SSBNs are the forward-deployable legs of the US nuclear triad—and DCA can assume forward-deployment duties as well. Historically, both bombers and submarines have been sent abroad on visible “presence” missions to deter foes and assure friends. Other than possible concerns about their security in foreign locations or the revelation of their design elements, nothing would argue against the use of next-generation systems in similar ways. And, of course, the F-35A strike fighter should be entirely capable of assuming its predecessors’ forward-deployment roles.

Prompt response capability. Prompt response involves the ability to reach targets from long range in minutes rather than hours. As reported, this capability certainly will be sustained in next-generation ICBM and SLBM systems expected under the modernization program.

Variable payloads. Today, SLBMs and ICBMs are capable of carrying two types of reentry-vehicle warheads. Follow-on missiles envisioned in the modernization program could carry as many as three warhead types. The future bomber force, as reported, will continue to carry cruise missiles—LRSO missiles in place of ALCM-Bs—but there will be fewer types of gravity bombs as most variants of the B61 bomb are retired. The future bomber force also will retain significant “uploading” capacity—to take on additional warheads and bombs if conditions warrant.

Assorted weapon yields. This aspect of adaptability also will not change significantly, with future SLBMs and ICBMs reportedly still being armed with warheads of high (reportedly hundreds of kilotons or more) yield, while bombers reportedly will carry weapons of both high and low yields.

High delivery accuracy. Though improvements in the next generation seem likely, current SLBMs and ICBMs already boast accuracy reported to be within a few hundred feet of their intended targets. The modernization program is likely to impact the delivery accuracy of gravity bombs in a future force, since the follow-on B61-12 gravity weapon includes a guided tail-kit section designed to improve accuracy, as reported.

Technology development and rebuilding infrastructure. Beyond the replacement of aging weapons systems themselves—as planned in the modernization program—the United States also must grapple with the need to maintain and, in some cases, restart

technology-development efforts surrounding our nuclear forces and to rebuild necessary infrastructure.

Examples of technologies in which the United States may face the choice between competing or losing key competencies to adversaries include anti-ballistic missile defenses, cruise-missile technology and hypersonic delivery vehicles, space-control capabilities, non-nuclear offensive technologies such as railguns and lasers, and command-and-control systems.

In addition, as US production of nuclear weapons in recent decades has ceased, the larger intellectual infrastructure needed to design, manufacture, and produce nuclear systems also has atrophied—creating what a growing number of observers believe are risky gaps between US capabilities and those of adversaries whose nuclear-technology programs continued apace. The US nuclear-weapons stockpile today is the smallest since the Eisenhower Administration, and a comprehensive approach to sustaining overall nuclear readiness does not appear to exist. Addressing these areas of need will contribute to overall US flexibility and resilience.

The report also finds that accelerating replacement of the two critical US nuclear-material production facilities should be an urgent priority. The United States reportedly has not had a fully operational plutonium or uranium production complex since 1989.

Finally, US nuclear command, control, and communications (NC3) systems—including early-warning sensors, mobile and fixed command-and-control centers, and communications links between deployed nuclear forces and national leaders—remain in urgent need of modernization.

Summary conclusion. The existing US nuclear modernization program is critical to sustaining the adaptability of US nuclear forces needed to support the priority national goals of deterrence, assurance and damage limitation. The greatest virtue of the planned modernization program in this regard will be to preserve the flexibility and resilience inherent in the US nuclear triad for decades to come—as production lines reopen and new systems replace those whose practical lifespans are ending. The NPR also should consider possible changes to the current modernization program to achieve greater adaptability suitable for circumstances in which threats are emerging beyond what has been expected, more funding becomes available, new technological opportunities appear, or threat conditions dictate that US capabilities must be improved at a faster-than-planned pace.

Missile Defense

Ballistic Missile Defense (BMD) is widely recognized as a critical component of national and regional security, and has the potential to contribute significantly to deterrence, assurance, and damage limitation in a dynamic strategic environment.

Strategic missile defenses were severely restricted by treaty for 30 years on the assumption that they undermined “stable” mutual deterrence. However, missile threats

facing the United States and its allies have been expanding for decades, and homeland and regional defenses now are accepted as essential contributors to security. Indeed, BMD can support all three priority purposes of US nuclear capabilities in general:

Deterrence. BMD can contribute to deterrence in several ways. First, it may provide the United States with very useful alternatives to offensive preemption or retaliation in crises. This was the case, for example, in the days prior to North Korea's 2006 Taepodong-2 launch, when the deployment of a limited US homeland-defense system gave President Bush an alternative to a preemptive strike on the North Korean missile site (as was recommended by some at the time). Second, by helping to deny adversaries plausible limited nuclear first-use options against US allies and the US homeland, BMD can discourage even determined opponents from pursuing such dangerous strategies and deny their effectiveness in cases where opponents choose such strategies. Third, by relieving pressure to strike an adversary's launchers preemptively in crises, effective BMD also can buy time for leaders to pursue diplomacy or non-nuclear means of averting or limiting escalation in an emerging nuclear crisis. Finally, point defense for critical military assets at home and abroad can enhance the survivability of US and Western deterrence forces that an adversary otherwise might believe it could eliminate by preemptive attack—thereby strengthening deterrence and discouraging opponents from dangerous first-strike concepts.

Assurance. First, by reducing the potential costs of conflict with an ICBM-capable adversary, missile defense of the US homeland can improve the credibility of US security guarantees to allies by helping to counter an opponent's possible expectation that nuclear threats to the US homeland will work to decouple the United States from allies. Second, regional missile defenses help to reinforce assurance by providing local defensive capabilities while demonstrating the US security commitment. Finally, the cooperative process of developing and deploying missile defenses helps to build stronger alliance relationships and gives the United States a larger presence in, and commitment to, allies' security.

Damage limitation. Missile defenses can contribute to damage limitation by helping to discourage an adversary from escalating a conflict, and by providing a potentially meaningful degree of societal protection in many plausible conflict scenarios. BMD also can provide unique damage-limitation capabilities against the possibility of an accidental or unauthorized missile strike.

Finally, BMD can help provide a relatively near-term counter to the emerging North Korean missile threat—a defensive alternative to the option of a pre-emptive strike often discussed publicly. In addition, BMD may contribute to the goal of dissuading some adversaries from acquiring missile capabilities in the first place. For example, the prospect of strong US BMD against long-range ICBMs from Iran or North Korea could help

discourage their continued investment of scarce resources in the development of such weapons.

Summary conclusion. Far from being an impediment to deterrence, BMD has emerged as a potentially crucial element in support of deterrence—particularly with regard to smaller and more unpredictable nuclear adversaries. BMD can also contribute uniquely to US assurance and damage-limitation goals. The larger report offers detailed recommendations for consideration in the forthcoming NPR to help improve the contributions of BMD to deterrence, assurance, and damage limitation. These include, for example: improving and expanding US capabilities for homeland defense, including defense against cruise missiles and potentially hypersonic missiles; expanding and accelerating SM-3 capabilities; the fielding of a space-based layer of sensors for persistent “birth-to-death” missile tracking and discrimination; providing operational capability to the Aegis Ashore Missile Defense Test Complex in Kauai, Hawaii; and, *inter alia*, continuing readiness efforts for a possible East Coast BMD site.

Implications for Security in the NATO Region

After the collapse of the Soviet Union, NATO reduced but by no means eliminated the role of nuclear weapons in its military strategy and deterrence posture. In light of the resurgent threat from Russia, particularly since 2014, nuclear policy and its contribution to deterrence and assurance once again are major topics within the alliance. Moscow’s ongoing nuclear modernization programs and its emphasis on the nuclear first use or “escalate-to-win” option—effectively the threat or limited use of nuclear weapons to coerce NATO into backing down in a conventional conflict—create anxieties in NATO and a corresponding desire to strengthen deterrence and assurance. The forthcoming NPR and possible revisions of NATO’s 2012 Deterrence and Defense Posture Review (DDPR) are opportunities for clarity and direction.

The renewed adversarial relationship with Russia and the apparent narrowing of Western non-nuclear military advantages mean that the United States and NATO need to reexamine and possibly revise their nuclear policy and posture. Key issues include: the future of US nuclear forces designated for NATO, especially the US B61 bomb and the DCA used to carry it; changes to the alliance’s declaratory policy on the role of nuclear forces; involvement of additional NATO-member states in nuclear-sharing arrangements; and readiness levels and deployment locations throughout the alliance. The overarching deterrence goal in this regard is to deny Russia any plausible basis for perceiving exploitable political or military advantages that could lead Moscow to consider aggression or nuclear escalation against the West, even in crises.

This report includes the following recommendations for consideration:

1. In its forward-deployment decisions and declaratory policy, the United States and NATO must repeatedly make clear the indivisibility of the alliance and its nuclear

policy: that an attack on one is an attack on all, and that any Russian nuclear escalation against the West would be the worst possible course for Russia under any circumstances.

2. The B61 life-extension bomb, the B61-12, reportedly will be the only US nuclear weapon based in Europe with precision accuracy and a low-yield option. Therefore, it should not be subject to further procurement delays, but instead should be advanced to the extent possible.
3. Availability of the nuclear-capable F-35A aircraft should be accelerated in order to provide NATO with the stealth technology to counter Russian air defenses and thereby enhance its deterrence credibility.
4. Nuclear burden sharing—especially in the deployment and support of DCA—should be widened in NATO, particularly including the former Warsaw Pact countries of Eastern Europe.
5. The United States should consider deploying sub-strategic missiles at sea in the NATO region or on NATO territory to increase the adaptability of its nuclear deterrent.
6. The United States and NATO should prioritize creation of an integrated air and missile defense system for the alliance, in order to help make a limited Russian nuclear attack unacceptably difficult and risky.

Summary conclusion. US nuclear forces deployed in Europe must continue to serve the dual purpose of underpinning deterrence—by posing the threat of incalculable costs in the mind of a potential aggressor—and assuring allies in the face of nuclear coercion. Adjustments to US and NATO capabilities and declaratory policy to meet these essential purposes and advance Western adaptability should now be considered.

Implications for Asian Security

Asia continues to constitute a highly-dynamic security environment. With regard to US nuclear policy and posture, four imperatives stand out.

A nuclear- and missile-armed North Korea must be countered. This is a considerable challenge since—during the plausible time horizon of the forthcoming NPR—the DPRK reportedly could emerge with a nuclear force of between 60-100 weapons, deployed on a mix of short- and long-range delivery systems. Meanwhile, the country continues to be led by an eccentric, opaque and unpredictable dynastic regime.

US nuclear capabilities have long played a central role in the deterrence of North Korean aggression and the assurance of Asian allies, and will continue to do so. Forward-deployable strategic weapons in the US triad provide essential support for these goals—to

signal US resolve to North Korea and to allies, and to help limit escalation in the event of conflict. Additional US nuclear capabilities—DCA hosted at Japanese and South Korean bases—may be important for deterrence of the DPRK. In addition, the United States should retain the ability to deploy nuclear-capable bombers in the region and demonstrate the capability for stand-off attack with stealthy delivery systems such as the LRSO. A low-yield nuclear weapon that could be delivered promptly against defended North Korean airspace also should be considered.

Finally, as discussed previously, US and allied missile defenses must help counter North Korean missile threats and defend against missile attack if deterrence fails.

Chinese expansion at the expense of US and allied interests must be deterred. China's assertiveness in declaring control of contested islands and a widening swath of ocean has occurred in recent years alongside the expansion and modernization of its nuclear force. While China remains the least transparent of the P-5 nuclear powers, its historical reliance on a small fleet of silo-based ICBMs clearly has given way to a mix of silo-based and mobile ICBMs and sea-based SLBMs, as well as a possible role for a nuclear bomber. This shift will give China more nuclear options, and more discriminate nuclear options to deter and coerce the United States and allies in its bid for regional hegemony.

China's growing assertiveness, expanding nuclear posture, and uncertainties about its future course may well create new nuclear requirements for the United States and the corresponding need to determine whether, when, and how to deploy additional capabilities. The United States must sustain capabilities with the requisite flexibility and resilience to deter China at many possible levels of escalation, and limit damage should deterrence fail.

The assurance of US allies in Asia remains of vital importance. Assurance is based on allied confidence that the regional deterrence strategies of the United States, Japan and South Korea are credible and supported by the necessary US and allied capabilities. Formal extended-deterrence dialogues begun by the United States in 2010 have had a positive impact in this regard and should be continued. The United States should consider going further to implement "NATO-like" nuclear consultation with Northeast Asian allies. The United States also should continue to press Japan and South Korea for trilateral cooperation, which would likely have a powerful effect signaling resolve against potential Chinese and DPRK aggression, and thus contribute to deterrence.

Consideration of rising nuclear dangers in South Asia remains important. Though the United States does not have an alliance-based role in deterring aggression between India and Pakistan, US interests are involved. The possibility of a Pakistani nuclear weapon falling into the hands of terrorists is a particular concern. Therefore, US policy should continue to encourage dialogues between India and Pakistan on nuclear issues, and to

emphasize preparations for an emergency response to the loss of control of one or more Pakistani weapons.

Summary conclusion. As nuclear capabilities and military threats continue to grow in Asia, US nuclear forces will play a more important role in supporting key deterrence and assurance goals. Recommended here are considerations for strengthening the capabilities needed to support these goals and advance the adaptability of US forces and strategy.

Affordability of Nuclear Deterrence

The cost of US nuclear capabilities ultimately must be judged against the value they provide in support of US national goals—especially deterring war, assuring allies, and limiting damage if deterrence fails, particularly by preventing the escalation of conflict. In that light—and considering the likely consequences of a nuclear attack—the value of nuclear capabilities needed to support these goals may be judged as virtually infinite.

Infinite resources, however, are not available for any purpose, of course. And after decades of very limited investment in nuclear capabilities, today's estimated costs for the simultaneous modernization of the US nuclear triad appear especially daunting—reportedly ranging from roughly \$400 billion over the next 10 years to as much as \$1 trillion over the next three decades. Critics of such spending levels contend that nuclear forces are inappropriate to meet new 21st-century threats, should be minimized rather than upgraded to avoid wider global nuclear proliferation, and will lead to the starvation of needed investments in conventional forces.

In contrast, this report concludes that necessary investments in US nuclear-force modernization are, in fact, affordable and necessary; they should not rise beyond about five-seven percent of the US defense budget, even at the estimated peak of likely spending in the coming years—well within and even below historic US spending patterns for these forces and goals.

Moreover, critics of nuclear-investment costs greatly underestimate the unique value of nuclear forces in sustaining deterrence against the most dangerous threats and adversaries. US nuclear forces help deter existential nuclear threats to the homeland and to our allies. They provide a deterrent against the use of other types of weapons of mass destruction—including chemical and biological agents—against which the United States no longer possesses the ability to threaten comparable retaliation. They help cement US alliances by strengthening US security guarantees to allies and strategic partners. And, by deterring an opponent's escalation, they underpin the US goal of damage limitation in the event of conflict and the US freedom to use conventional forces effectively to protect American interests.

In the near term—in order to protect long-overdue investments in nuclear forces—this report recommends that Congress consider relief from the budgetary caps imposed (through so-called “sequestration”) by the Budget Control Act of 2011. If current budget

law is not amended, the new administration should use executive authority to exempt spending on nuclear forces from the mandatory sequestration cuts.

Over the longer term—to build the kind of public and intra-governmental consensus necessary to sustain investments in needed US nuclear capabilities—the report recommends considering novel budgeting approaches. These could include the creation of a mandatory nuclear-insurance policy—amounting to a fixed portion of defense spending—or the establishment of a “strategic deterrence fund” to cover modernization needs over longer periods of time and thereby create efficiencies.

More fundamentally, the report recommends countering a widespread lack of understanding in key US constituencies about the importance of nuclear capabilities. Senior-level political and military leaders must make a consistent and systematic effort to educate the US Congress, the general public, and the uniformed military about the overwhelming value of nuclear forces to the country’s priority security goals.

Summary conclusion. Funding the US nuclear force and modernization programs is both necessary and affordable. Failure to do so would increase the risk of intolerable consequences to the nation. Congress and the executive branch should assure steady investments, and US leaders should better inform Americans about the essential purposes and value of nuclear capabilities for credible deterrence, assurance and damage limitation.

Declaratory Policy

The primary purposes of declaratory policy are to signal US deterrence goals and expectations, including with regard to nuclear forces, and to help thereby deter foes and assure allies. Such statements form an essential component of US deterrence and assurance strategies, and their content and evolution should be considered as such in the forthcoming NPR.

Current US declaratory policy stems from the Obama Administration’s response to a 2009 review undertaken by the bipartisan Strategic Posture Commission (the “Perry-Schlesinger Commission”). At that time, the United States reasserted traditional positive security guarantees: the commitment to come to the aid of allies under attack. It also reasserted traditional negative guarantees, with a modification, promising not to employ nuclear weapons against countries that are parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) “and in good standing with their nuclear nonproliferation obligations.” The United States *rejected* declarations of “no first use” (the promise that the United States would employ nuclear weapons only in response to a nuclear attack) and “sole purpose” (the statement that the sole purpose of US nuclear capabilities is to deter nuclear attack). Instead of “no first use” or “sole purpose” declarations, the United States retained its traditional approaches of calculated ambiguity surrounding the employment of nuclear weapons and the application of nuclear deterrence to a spectrum of severe threats to the United States and allies.

This report concludes that the continued rejection of “no first use” and “sole purpose” declaratory policies is prudent. A no-first-use declaration would unsettle US allies and weaken deterrence by making conventional attack on an ally appear less risky. Correspondingly, it also would likely contribute to further nuclear proliferation incentives by undermining US assurance goals. A “sole-purpose” declaration would be extremely imprudent as long as significant biological, chemical, and large-scale conventional threats continue to exist as possible contingencies to be prevented via nuclear deterrence. The report also recommends retaining current US policies regarding nuclear-alert status and the option for “launch under attack.”

The United States, however, should consider greater clarity and specificity regarding its declaratory nuclear policy in some cases. In the face of Russia’s “escalate-to-win” concept and China’s increasing military power and expansionism, more specific deterrent threats may be needed to strengthen deterrence and assurance. This would involve the United States and allies more clearly articulating a consensus on nuclear deterrence policy and options to prevent various possible levels of escalation. Calculated ambiguity may remain, but deterrence at lower levels of possible escalation could be served by a variety of measures, including public signaling of NATO and allied cohesion and nuclear exercises.

The report also recommends that the United States clarify once again that it will maintain the capabilities needed to design, develop, produce, certify and, if necessary, deploy nuclear weapons in support of national deterrence and assurance goals. US intentions in this regard appear to have become uncertain in recent decades, potentially unsettling allies and leading adversaries to conclude that this is an advantageous area in which to challenge the United States.

Summary conclusion. Declaratory policy remains a vital component of nuclear deterrence and assurance goals. It should contribute to, not limit, US adaptability. Current US declaratory policy is appropriate to today’s security environment and does not require significant overhaul. However, consideration should be given to greater specificity and manifest allied cohesion regarding deterrence signaling, and the clear demonstration of US intent to maintain its nuclear capabilities into the future.

Arms Control and US Goals in the New Threat Environment

Arms control is a long-standing element of nuclear policy and its content and usefulness in the current security environment must be considered. In general, Russia has not been a cooperative or trustworthy arms control partner for many years. Russia has rejected recent US arms control overtures in strong terms, and both Russia and China currently pursue aggressive, expansionist foreign policies—backed by growing nuclear arsenals—at the expense of US allies. These conditions do not make for a promising arms control environment and suggest that a key requirement of US arms control efforts in the coming years must be to strengthen US deterrence, assurance and damage-limitation capabilities

by contributing to the adaptability of US nuclear capabilities, rather than seeking continued numerical nuclear force reductions in the pursuit of nonproliferation as the “top” nuclear policy objective. In addition, US allies and partners should be consulted closely on arms control efforts to reinforce the vital assurance goals of nuclear policy.

The report focuses heavily on the supposed linkage between continuing US nuclear reductions and the advancement of US nonproliferation goals. It does so because widespread belief that US nonproliferation goals demand continuing US nuclear reductions and limitations has had such a significant effect on US nuclear policy for many years. Contrary to this widespread belief, however, available evidence suggests strongly that the reduction of US nuclear capabilities and their limitation does not advance nonproliferation. Rather, it may in fact contribute to proliferation by motivating some allies under threat in the current environment (particularly in Asia) to consider acquiring their own independent nuclear deterrence capabilities. Instead of focusing the US arms control agenda on further US nuclear reductions for nonproliferation purposes, the United States should instead emphasize proven approaches to minimizing and countering proliferation, such as extending credible nuclear deterrence to allies, denying other countries the technology required to produce nuclear weapons, addressing the actual factors that motivate countries to pursue nuclear weapons in the first place, and pursuing a variety of defensive measures to protect against proliferation.

The report recommends consideration of a set of basic principles for the United States with regard to further arms control or limitation agreements, including:

1. Arms control should not be pursued for its own sake, and/or necessarily for the elimination of nuclear weapons, but rather to advance the traditional goals of arms control: reducing the probability of war, the consequences of war, and the cost of maintaining adequate defense capabilities. As such, a primary goal of US arms control policy now should be to advance the adaptability of US capabilities so as to strengthen their support for US deterrence, assurance and damage-limitation goals.
2. The US arms control agenda should not be bound by the 2013 US proposal for further reductions of up to one-third of US deployed strategic weapons.
3. If US-Russia nuclear arms control negotiations again become feasible, then non-strategic nuclear forces also must be included.
4. Effective verification and enforcement of agreements is essential, and the United States should not consider new arms control steps as long as Russia remains in stark non-compliance with existing agreements.
5. The United States should avoid re-establishing treaty limits on missile defense.

The report recommends that the United States continue adhering to the New START Treaty through its 2021 end date as long as Russia remains in compliance. If Russia does not comply with New START, then the United States should mitigate the consequences and

strengthen US adaptability outside the treaty as necessary. The Trump Administration also should review the existing US position in support of the Comprehensive Test Ban Treaty (CTBT); the National Nuclear Security Administration (NNSA) should, for the sake of prudence, be directed to improve its readiness for testing—even if there is no immediate need to resume nuclear testing.

Finally, the report endorses the pursuit of feasible cooperative endeavors with both Russia and the PRC, and points to participation in the Global Initiative to Combat Nuclear Terrorism (GICNT) as an example of possible avenues for cooperation.

Summary conclusion. The United States must be clear-eyed about its own arms-control goals, the intentions and trustworthiness of its arms control interlocutors, and the essential requirement for verification and enforcement of all existing and prospective arms control endeavors. Simultaneously, the United States should consider using available arms control venues and cooperative possibilities to explore new options to reduce the probability of war, the destructiveness of war, and the cost of sustaining adequate deterrence, assurance and defense capabilities.