

# NUCLEAR FORCE ADAPTABILITY FOR DETERRENCE AND ASSURANCE:

## A PRUDENT ALTERNATIVE TO MINIMUM DETERRENCE



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Minimum Deterrence**

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# **Nuclear Force Adaptability for Deterrence and Assurance:**

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Minimum Deterrence**



# In Memoriam

On March 27, 2014, while this study was in its early stages, Dr. James R. Schlesinger passed away at the age of 85. Dr. Schlesinger served with enthusiasm and energy as the initial Chairman of the Senior Review Group for this work and the earlier 2013 publication in this series, *Minimum Deterrence: Examining the Evidence*. Dr. Schlesinger was very pleased with that earlier work and was comparably enthusiastic with the outline and direction of this follow-on study.

With Dr. Schlesinger's passing, we have lost an incomparable leader, brilliant scholar, sincere patriot, generous mentor and friend, and beloved family man. He dedicated his professional life to protecting the security of the United States and Western Civilization, and the results of his efforts are nothing short of monumental. During his government career he served under Republican and Democratic presidents, including as Chairman of the Atomic Energy Commission, Director of Central Intelligence, Secretary of Defense, and the first Secretary of Energy. In 1973, at the age of 44 and the height of the Cold War, Dr. Schlesinger became Secretary of Defense. He instituted important nuclear policy directions to strengthen the flexibility and credibility of U.S. forces for the purpose of deterring war and assuring U.S. allies. This study is indeed an extension of those directions and goals.

In David McCullough's biography of John Adams, America's second President, the author tells us that public service was "not a platitude" for Adams and his wife Abigail, but "a lifelong creed." The same surely can be said of Dr. Schlesinger. Recognition of Dr. Schlesinger's career of public service is well-reflected in the recent U.S. Senate Resolution in his honor, which passed with unanimous consent.

Following Dr. Schlesinger's passing, Dr. John Foster, Jr., former Director of Defense Research and Engineering, Department of Defense, and Director of the Lawrence Livermore National Laboratory, graciously agreed to step in as the Chairman of the Senior Review Group. He continued Dr. Schlesinger's earlier efforts on this study admirably, and I am enormously indebted to Dr. Foster for taking this work to completion with great expertise, enthusiasm and care. Dr. Foster and I consciously have worked to make this study one with which Dr. Schlesinger would be very pleased.

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\*The authors are responsible for the views expressed in this report; these views do not reflect the official policy or position of the National Institute for Public Policy, the Department of Defense, or any institution with which the authors are affiliated.

\*\*Senior Reviewers provided their comments on drafts of this report and may not be in agreement with each of its points or precise wording.



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## Preface

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In 2013, the National Institute for Public Policy released a monograph entitled, *Minimum Deterrence: Examining the Evidence*. A bipartisan team of world-renowned civilian and military experts, led by the late Dr. James Schlesinger, contributed to this study. It identified and assessed against available evidence numerous proposals for a policy of Minimum Deterrence. The general conclusions of *Minimum Deterrence: Examining the Evidence* were that the presumptions and arguments common to Minimum Deterrence do not fare well when examined against readily available evidence.

This monograph, *Nuclear Force Adaptability for Deterrence and Assurance: A Prudent Alternative to Minimum Deterrence*, is the second in a series examining the U.S. goals of deterrence, extended deterrence and the assurance of allies, and how to think about the corresponding U.S. standards of adequacy for measuring “how much is enough?” It begins to address the question, “If not Minimum Deterrence, then what?” by examining the manifest character of the contemporary threat environment in which the United States must pursue its strategic goals of deterring foes and assuring allies. Fortunately, there is considerable available evidence regarding the character of the contemporary threat environment and its general directions. Noted historians have compared this threat environment not to the bipolar Cold War, but to the highly dynamic threat environments leading to World War I and World War II. The uncertainties involved are daunting given the great diversity of hostile and potentially hostile states and non-state actors, leaderships, goals, perceptions, and forces that could be involved.

From that starting point, this study identifies general U.S. force posture qualities that are likely to enable the United States to deter and assure as effectively as possible, and should, therefore, help serve as useful guidelines for the U.S. nuclear force posture. Finally, this study links specific recommendations for possible actions and policies consistent with those guidelines.

As with the 2013 publication, this 2014 monograph reflects the work of many hands and numerous iterations. Senior Reviewers now led by Dr. John Foster, Jr., again took their task seriously and provided literally hundreds of points to be added or deleted, corrections, and helpful suggestions with regard to precise wording. I would like to thank them and my fellow authors of initial draft sections for their careful and patient work. Similarly, I would like to express my great appreciation to the Sarah Scaife Foundation and the Smith Richardson Foundation for making this monograph series possible.

*Keith B. Payne, Study Director*



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# Executive Summary

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## I. Introduction

In 2013, the National Institute for Public Policy released a study entitled, *Minimum Deterrence: Examining the Evidence*. It identified and assessed against available evidence numerous proposals for a policy of Minimum Deterrence. These proposals most prominently recommend that the United States prudently can and should reduce its deployed nuclear arsenal to low or very low numbers—ranging from only a handful of deployed weapons to approximately 1,000. The general conclusions of *Minimum Deterrence: Examining the Evidence* are that the presumptions and arguments common to Minimum Deterrence do not fare well when examined against readily available evidence, and that the logic underlying Minimum Deterrence proposals often reflects significant internal contradictions.

This study begins to address the question, “If not Minimum Deterrence, then what?” by examining the manifest character of the threat environment in which the United States must pursue its strategic goals of deterring foes and assuring allies. Fortunately, there is considerable available evidence regarding the character of the current threat environment and its directions. From that starting point the study identifies general U.S. force posture qualities that are likely to enable the United States to deter and assure as effectively as possible in that threat environment, and should, therefore, serve as useful guidelines for the U.S. force posture. Finally, this study links specific recommendations for possible actions and policies consistent with those guidelines.

## II. Threat Environment: A Building Block for U.S. Deterrence and Assurance Policies

There are numerous factors that should help shape the U.S. approach to deterrence and assurance. Perhaps the single most important factor is the character of the threat environment. The need for deterrence and assurance, and the character of the forces needed to support those goals must be responsive to the threat environment and trends in that environment, as well as allies’ perceptions of the environment. Thus, U.S. goals and knowledge of the actual threat environment should inform strategy, and strategy needs should drive force type, quantity and posture requirements.

The post-Cold War threat environment is highly dynamic and the attendant uncertainties that confound reliable threat forecasting loom very large. In place of the generally “ponderous and predictable” developments in the Soviet Cold War threat, the United States and allies now confront a mosaic of threats and potential threats of greatly-varying familiarity, intensity and lethality. As a 2009 Defense Science Board report concludes, “The potential for serious surprise has reached new levels and we as a nation must be prepared to deal with it in new ways.”<sup>1</sup>

Plausible threats exist from:

- the large nuclear powers that appear increasingly to find the international status quo unacceptable;
- smaller revisionist nuclear powers, such as North Korea;
- other hostile powers seeking nuclear capability, such as Iran;
- a wide variety of hostile and WMD-seeking terrorist organizations inspired by toxic nationalist and sectarian goals; and,
- the ever-present potential for non-linear military-technical and geopolitical developments that could significantly darken the threat environment quickly.

Noted historians have compared this contemporary threat environment not to the bipolar Cold War, but to the highly dynamic threat environments leading to World War I and World War II.<sup>2</sup> This characterization is reflected in numerous National Intelligence Council (NIC) reports and testimony by senior officials in the intelligence community.<sup>3</sup>

By way of comparison, the bipolar Cold War threat environment, while severe, was *relatively* familiar and constant from year to year. Even a brief look at contemporary developments in Russia, China, North Korea and Iran helps illustrate the reality that the emerging threat environment offers considerable opportunity for serious crises and conflicts now and in the future, including the potential for nuclear crises. The uncertainties involved are daunting given the great diversity of hostile and potentially hostile states and non-state actors, leaderships, goals, perceptions, and forces that could be involved.

### **The Implications of a Highly Dynamic, Uncertain Threat Environment for U.S. Deterrence and Assurance**

In the context of the significant uncertainties inherent in such a dynamic threat environment, U.S. deterrence and assurance strategies, and supporting nuclear forces need to be *adaptable* to a range of threat scenarios and plausible adverse military-technical developments: when potential threats are diverse, numerous, and increasingly unpredictable, U.S. deterrence requirements are likely to be correspondingly diverse and adaptable. In practice, this means that U.S. forces must be able to deter foes and assure allies over a broad range of scenarios, including those involving military, technical and geopolitical surprise. Different approaches to deterrence, including different types of U.S. deterrent threats and supporting forces, are likely to be more (or less) credible and effective depending on the specific opponent, stakes, and other details of the contingency/crisis. U.S. forces suited only to a narrow range of threats or to niche threats could easily leave the United States without the tools necessary for defense or deterrence in a highly dynamic threat environment.

Because U.S. nuclear forces tend to have operational life spans measured in decades, the U.S. nuclear force posture must be sufficiently adaptable to deter and assure as effectively as possible in a threat environment that will see many new developments, including surprising developments, over the course of decades. If so, the United States is less likely to be caught in crises with narrowly-functioning forces ill-suited for the threats that it must confront and deter.

The United States thus must seek, as a fundamental guideline, to give its nuclear force posture the level of adaptability practicable within legal, political and economic boundaries likely to

endure. This was recognized during the Cold War, but the much greater diversity of threats and dynamic character of the post-Cold War security environment now heightens considerably the need to do so.<sup>4</sup> These are the fundamental building blocks, derived from available evidence, for any prudent recommendations regarding U.S. force requirements and measures of adequacy.

The implications of establishing *adaptability* as a priority guideline for the size and composition of the U.S. nuclear arsenal are indirect, but unavoidable. The capacity of the United States to adapt its deterrence and assurance strategies to widely-differing circumstances will be affected by the size and character of U.S. forces. Greater numbers do not automatically equate to greater adaptability, but retaining adaptability at ever lower force levels becomes increasingly difficult and eventually is implausible at very low force levels. Force posture numbers and characteristics should follow from that basic consideration, and U.S. arms control goals should be shaped significantly by the same consideration.

### III. Requirements for a Flexible and Resilient Nuclear Force

The political and military uncertainties of the contemporary security environment point to the priority need for a U.S. nuclear force that can adapt to a range of plausible opponents, threats, conflicts, and technical challenges. The required adaptability is of two kinds: flexibility and resilience. Flexibility involves: 1) deliberate and adaptive planning for a variety of options to deter or counter attacks that present a grave danger to U.S. or allied security (nuclear strikes, extensive chemical or biological use, or overwhelming conventional offensives); and 2) forces with the diverse capabilities and the associated nuclear command and control necessary to support those deterrent threat options.

To provide flexibility, the U.S. nuclear force as a whole—Intercontinental Ballistic Missiles (ICBMs), Submarine-Launched Ballistic Missiles (SLBMs), heavy bombers, and shorter-range dual-capable aircraft (DCA)—require certain basic attributes. These include:

- **Survivability** – allows forces to withstand or escape attack on their bases and to evade or overcome enemy defenses. (Survivability can contribute both to flexibility and to resilience, but is discussed here primarily in terms of flexibility).
- **Intercontinental range** – prevents targets in enemy territory that are potentially critical for deterrence from enjoying sanctuary by virtue of being out of reach.
- **Ability to forward deploy** – allows U.S. nuclear-capable forces to deploy to locations in or near allied countries as a forward presence that can be important to both assurance and deterrence.
- **Prompt response capability** – permits the United States to hold a variety of targets at risk with a flight time of an hour or less which, in some situations, can be important for deterrence and assurance.
- **Variable payload** – provides the ability of bombers and ballistic missiles to carry different types and numbers of weapons, making possible a better matching of U.S. deterrent threats to supporting U.S. capabilities.
- **Assorted weapon yields** – allows the United States to hold at risk a wide range of target types for the purposes of deterring conflict or limiting its escalation in a variety of contingencies.
- **High delivery accuracy** – provides a critical determination of whether a weapon can hold a target at risk, as well as the yield needed to do so.



- **Nuclear command and control** – provides a robust, secure, survivable system for early warning, attack assessment, senior-leader conferencing, and force direction.

The other force quality necessary for adaptability in an uncertain world is resilience. Resilience in general is the ability to withstand, recover from, or adjust to adverse change in order to mitigate risk and maintain effectiveness.

The following are sources of resilience for the US nuclear force:

- **Strength in the extant force posture** – assures that the different elements that comprise the force structure—Ballistic Missile Submarines (SSBNs), ICBMs, bombers, and DCA—are not all vulnerable to a single type of attack. Also, peacetime alert of SSBNs and ICBMs contributes to resilience by providing insurance against a surprise attack. In addition, stockpile diversity hedges against problems with the safety, security, or effectiveness of a warhead or bomb type.
- **Adaptation within existing capabilities** – assures that the current nuclear force could be adapted to adverse military-technical or geopolitical changes through a number of measures that would not involve acquisition of new capabilities or the upgrade of existing delivery vehicles and weapons. The alert level of elements within the force structure could be raised to counter a new threat to prelaunch survivability, increase force preparedness, or help deter escalation of a crisis. Non-deployed weapons in the nuclear stockpile could also be uploaded on bombers and ballistic missiles in response to an increase in the offensive or defensive strength of an opponent, a stepped-up arms competition, or a confrontation that threatened to escalate to nuclear use.
- **Modification with hardware changes** – includes the option of adding better guidance systems for missiles (e.g., if targets become more hardened), upgraded defensive avionics for strike aircraft (e.g., if air defenses improved), and new or upgraded weapons to bombers or missiles (e.g., if targeting constraints made lower-yield weapons necessary).
- **Modernization of force elements** – allows for the new development and production for changes in quantity as well as quality in response to evolving threats.

#### **IV. Preserving and Enhancing Adaptability**

This report identifies actions the United States can consider to preserve and enhance adaptability for strategic forces. This discussion is by no means meant to be comprehensive. Rather, it offers an initial look at some possible U.S. actions consistent with establishing flexibility and resilience as priority guidelines for deterrence and assurance purposes. This list of possible actions can help defense planners with efforts already underway for nuclear force modernization, design concepts for next-generation replacement systems, and identification of goals for future arms control negotiations.

Next-generation nuclear forces are programmed to be in service until late in the twenty-first century. For example, *Ohio*-class replacement SSBNs are scheduled to be deployed until the 2080s. The natural question to consider is: “How much flexibility and resilience are enough to provide adaptability for deterrence and assurance in the decades ahead?” No definitive or static answer to that question is possible because requirements will shift with the threat environment, the extent to which allies feel assured, and the character of the opponents and contingencies in

question. Nevertheless, in a highly dynamic environment, a priority goal for the United States should be to provide as much flexibility and resilience as possible, within likely practical constraints.

To enhance the adaptability of nuclear forces, this report identifies potential actions for consideration and some pertinent “to dos” and “not to dos” in support of U.S. flexibility and resilience. It is impossible to know whether a failure to follow these would lead to the future failure of deterrence or assurance. But, without such actions the United States would likely be less able to adapt as may be necessary to shifting threat environments for the purpose of supporting the most effective deterrence and assurance strategies practicable.

Actions discussed in the report that can preserve and enhance *flexibility* include the following:

- **Survivability** – the nuclear triad should be retained to present great complexity and uncertainty to any adversary that might contemplate a disarming nuclear strike on the United States. The ability to disperse bombers and increase the alert rates of bombers and SSBNs in response to adverse technical or geopolitical changes preserves flexibility by maintaining the prelaunch survivability of the strategic nuclear force.
- **Diverse payloads and weapon yields** – currently, all U.S. nuclear weapons that provide low-yield options reside with the air-breathing weapon delivery systems. Flexibility would be enhanced by developing and certifying low-yield options for the ballistic missile legs of the triad—ICBMs and SLBMs. Also, modernization plans should include replacing or upgrading the B61-11 earth penetrating weapon.
- **Ability to forward deploy** – the United States should move ahead with nuclear certification plans for the F-35A and the B61-12 life extension program and ensure that the support infrastructure is in place for deploying DCA to threatened regions. One way to improve this flexibility-related attribute is for DoD to identify and prepare emergency nuclear weapon storage sites in appropriate regions, in addition to current European deployment sites.
- **Intercontinental range and delivery accuracy** – as forces are life extended and modernized, opportunities to improve accuracy further should continue to be a goal, whenever feasible. In particular, accuracy improvements should be included in planning for the follow-on ICBM and Long Range Stand-Off missile. Also, guidance and accuracy improvements for nuclear gravity bombs, the only “unguided” weapons in the U.S. nuclear arsenal, should be a goal.
- **Declaratory policy** – a “sole purpose” declaratory doctrine for nuclear forces or other formulations of a no-first-use policy should be avoided unless and until much more benign threat conditions exist.
- **Non-nuclear strategic capabilities** – conventional global strike offensive capabilities and ballistic missile defenses, when combined with nuclear capabilities, can provide more flexible options for the president during a crisis. Non-nuclear strategic capabilities—both offensive and defensive—should continue to be developed and, when ready, deployed.

Actions that can preserve and enhance *resilience* include the following:

- **Force structure composition and sizing** – over the near- to mid-term, an upload hedge capability and a non-deployed stockpile of warheads will be needed for the nuclear force to provide important options for resilience. Therefore, for at least the next decade—until the nuclear weapons complex is modernized and fully operational—arms control negotiations should include the goals of protecting the U.S. nuclear force structure and preserving a hedge capacity.
- **Next-generation weapon systems** – planning for nuclear force modernization should include the need for adaptability when developing replacements for existing nuclear weapons systems. Studies for nuclear force modernization, including the *Ohio*-class replacement SSBN, follow-on ICBM, Long Range Strike-Bomber, and Long Range Stand-Off missile, should consider an extra margin of weight and volume for potential future payload needs.
- **Nuclear command and control** – potential adversaries are actively developing cyber and counter-space capabilities to disrupt and deny U.S. command-and-control capabilities. The U.S. nuclear command-and-control system should be modernized to protect against obsolescence and emerging vulnerabilities. More detailed actions are outlined in the body of the report.
- **Nuclear weapon developments** – innovation at the national laboratories in nuclear weapon design, production and employment should be encouraged, not discouraged. The national laboratories should explore the potential for new development to sharpen technical skills, understand what adversaries might be developing, and be responsive to rapidly emerging needs. Low-cost studies and prototyping can provide benefits important for resilience.
- **Defense industrial base** – modernization of the nuclear weapons infrastructure—especially that supporting uranium and plutonium operations in the manufacture of nuclear warheads—should proceed without delay. In addition, development and production of non-nuclear strategic capabilities, discussed earlier for flexibility, can also enhance the responsiveness of the industrial base by sustaining activity in the industrial base for weapon guidance systems and solid rocket motors.
- **Arms control policies** – in addition to protecting force structure, hedge capacity, and a non-deployed stockpile, all future arms control initiatives should be examined carefully by a “red team” for potential unintended consequences that would degrade U.S. flexibility and resilience.

A more complete list of potential actions to preserve and enhance adaptability—flexibility and resilience—are summarized in Table ES-1 and discussed in greater detail in the body of the report.

**Table ES-1: Actions that Could Protect and Enhance Flexibility and Resilience**

Category	Action
<b>Force Structure</b>	
	Maintain the triad; preserve force structure
	Retain upload hedge capability, e.g., empty ICBM silos, ability to re-MIRV ICBMs
	Retain DCA (nuclear-capable F-35; B61-12)
	Designate and prepare contingency nuclear storage sites and bomber dispersal bases
<b>Force Modernization</b>	
	Modernize all triad legs
	Emphasize adaptability in modernization plans
	Base future force composition and size on policy goals for deterrence and assurance, recognizing the need for adaptability
	Upgrade accuracy of weapons
	NC2: Upgrade senior leader conferencing, early warning systems, and robustness of secure communications to strategic forces
	Develop prompt conventional global strike capabilities
<b>Force Posture</b>	
	Reject de-alerting proposals
	Maintain upload potential
	Develop ability to more quickly increase readiness of deployed DCA
	Use exercises/war games to evaluate options for adaptability
<b>Warhead Stockpile</b>	
	Retain non-deployed stockpile for hedge/upload
	Life extend or modernize B61-11 EPW
	Develop low-yield options for SLBMs and ICBMs
	Demonstrate competence for “new” nuclear capabilities
<b>Infrastructure</b>	
	Modernize nuclear warhead infrastructure
	Encourage innovation, studies, prototyping
	Develop non-nuclear capabilities
<b>Declaratory Policy</b>	
	Avoid “sole purpose” and “no first-use” policies, given their likely detrimental effect on flexibility and deterrence
<b>Arms Control</b>	
	In light of deterrence and assurance requirements, assess prospective arms control steps carefully, according to the priority goal of preserving or strengthening adaptability; identify and consider warily arms control steps and goals that would force tradeoffs degrading adaptability.



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## I. Introduction

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In 2013, the National Institute for Public Policy released a study entitled, *Minimum Deterrence: Examining the Evidence*. The study included a diverse and bipartisan Senior Review Group (SRG) chaired by the late former Secretary of Defense, Dr. James Schlesinger. The SRG included former commanders of the U.S. Strategic Air Command, the U.S. Strategic Command, and the Twentieth Air Force of the Air Force Global Strike Command; former directors of central intelligence; former senior leaders from the White House, the Senate, Defense Department and State Department; and noted academics.<sup>5</sup>

*Minimum Deterrence: Examining the Evidence* identified themes common to proposals for a policy of Minimum Deterrence; most prominent is that the United States prudently can and should reduce its deployed nuclear arsenal to low, or very low numbers—ranging from only a handful of deployed weapons to approximately 1,000. The purpose of *Minimum Deterrence: Examining the Evidence* was to assess the basic presumptions, logic and arguments common to proposals for Minimum Deterrence, and to compare these to available evidence.

The general conclusions of *Minimum Deterrence: Examining the Evidence* are that the presumptions and arguments common to Minimum Deterrence do not fare well when examined against readily available evidence, and that the logic underlying Minimum Deterrence proposals often reflects significant internal contradictions. In general, the Minimum Deterrence narrative is based upon explicit and optimistic hopes about opponent decision making and how deterrence will function. Those hopes reflect the projection of an informed, reasonable and prudent (per Western definition) worldview to all rational enemy leaderships despite the fact that available evidence demonstrates such expectations to be unduly optimistic.

Most fundamental to Minimum Deterrence proposals is the confident claim corresponding to these expectations that low or very low numbers of U.S. nuclear weapons are now, and in the future will be, adequate to support U.S. deterrence goals. For example, “Deterrence today would remain stable even if retaliation against only ten cities were assured.”<sup>6</sup> And, “Rather fewer than 100 warheads is sufficient to inflict a wholly unacceptable level of damage on a continental-sized economy, and suggests that—even for the most enthusiastic proponent of nuclear deterrence—maintaining an arsenal at higher than that level is unnecessary.”<sup>7</sup>

Such specific claims are the basic building block of the Minimum Deterrence narrative. They allow proponents to posit that moving to significantly lower numbers of nuclear weapons can be done without jeopardizing deterrence, now or in the future. In doing so, they claim to know the force levels that will be adequate for deterrence, and that those levels are much lower than the current U.S. arsenal; they claim to know what actions opposing leaders will and will not dare to undertake in the context of specific U.S. nuclear force numbers, and thus the precise U.S. force levels needed to deter.

These claims are essential to the Minimum Deterrence narrative because deterrence, including nuclear deterrence, has prevented war and the escalation of conflict and has been a priority U.S. national goal for decades.<sup>8</sup> Moving in a policy direction that could jeopardize U.S.

deterrence effectiveness would be imprudent at best, and widely recognized as such. Consequently, the Minimum Deterrence narrative typically asserts with confidence that its recommended nuclear force levels are adequate for deterrence, now and in the future.

Yet, abundant available evidence points unerringly to the fact that deterrence does not function mechanistically and, consequently, the confident predictions common to Minimum Deterrence that its recommended force levels will reliably provide adequate deterrent effect now and in the future are not supportable. Proponents of Minimum Deterrence do not, and cannot know in advance and with such precision, whether or how deterrence will function in diverse circumstances. Their assurances about deterrence working reliably at their preferred force levels are highly speculative, not a prudent basis for policy.

### **Beyond Minimum Deterrence: Where to Now?**

This current study does not focus much further on the troubling presumptions, logic and arguments common to Minimum Deterrence proposals, per se. Rather, the goal here is to expand on that earlier assessment of Minimum Deterrence and identify guidelines for the U.S. nuclear force posture that are consistent with the objectives of deterrence and assurance and are compatible with available evidence. Demonstrating the general absence of logical and empirical support for the Minimum Deterrence narrative is an important step given its longevity and political salience, but the necessary and obvious next step is to address the question: “If not Minimum Deterrence, then what?”

This study begins to address that question by examining the manifest character of the threat environment in which the United States must pursue its strategic goals of deterring foes and assuring allies. Fortunately, there is considerable available evidence regarding the character of the threat environment. From that starting point the study identifies general U.S. force posture qualities that are likely to enable the United States to deter and assure as effectively as possible in that threat environment and should, therefore, serve as useful guidelines for the U.S. force posture. Finally, this study links specific recommendations for possible actions and policies consistent with those guidelines.

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## II. Threat Environment: A Building Block for U.S. Deterrence and Assurance Policies

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There are numerous factors that should help shape the U.S. approach to deterrence and assurance. Some of these may be influenced by U.S. actions; others may be beyond U.S. control or influence. The United States must adjust its policies to such factors to the extent that it cannot predictably shape them as desired.

Perhaps the single most important factor in this regard is the character of the threat environment confronted by the United States and allies. For example, there would be no immediate need for deterrence or assurance, or for nuclear forces to support those goals, in a wholly and consistently benign international environment. But historical evidence over millennia suggests that expecting such a pacific international environment is wholly unrealistic. In contrast, in a more realistic and dynamic threat environment characterized by numerous openly hostile and aggressive powers armed with weapons of mass destruction (WMD), the deterrence of foes and the assurance of allies must be U.S. priorities; having the diverse forces needed to support those goals to the extent possible must be a key metric of their adequacy.

The point here is that the need for deterrence and assurance, and the character of the forces needed to support those goals, cannot be considered in a vacuum. They are not autonomous; they must be responsive to the threat environment and trends in that environment. Thus, a basic building block for the U.S. approach to deterrence and assurance that can be derived from available evidence must be the character of the contemporary threat environment and its direction. U.S. goals and knowledge of the actual threat environment should inform strategy, and strategy needs should drive force type, quantity and posture requirements.

Proponents of Minimum Deterrence recognize this linkage when they posit as a basic building block for the contemporary Minimum Deterrence narrative that Russia and China no longer are U.S. foes and thus U.S. nuclear deterrence considerations are “increasingly peripheral” to those relations.<sup>9</sup> This is an important starting point for Minimum Deterrence proponents because it enables the conclusion that the United States can prudently reduce its nuclear arsenal significantly. Because, so the argument continues, Russia and China are relatively benign powers and will remain so, there is no rationale for the current size of the U.S. nuclear arsenal.

With this basic point, Minimum Deterrence proponents tend to link their recommendation for deep force reductions to the presumption of a largely constant threat environment that corresponds to minimal deterrence force requirements. For example, as was stated in 2011, “It is assumed that international relations (both between Russia and the U.S. and with their potential adversaries) will not get significantly better nor worse than they are today.”<sup>10</sup>

The problem with this particular starting point is that the presumptions of benign relations with Russia and/or China and a constant, benign threat environment in general are contrary to much available evidence; even if such expectations were well grounded today, to forecast the continuation of such an amicable environment is wholly problematic. As Frank Kendall, the Obama Administration’s Undersecretary of Defense for Acquisition, Technology and Logistics, recently observed, “the trajectory for our relationship with China is uncertain today.”<sup>11</sup> Gen.



Martin Dempsey, Chairman of the Joint Chiefs of Staff, notes similarly that, “In the next 10 years, I expect the risk of interstate conflict in East Asia to rise.”<sup>12</sup> With regard to Russia, President Obama said in March 2014 that with the annexation of Crimea, “Russia’s leadership is challenging truths that only a few weeks ago seemed self-evident—that in the 21<sup>st</sup> century, the borders of Europe cannot be redrawn by force, that international law matters, that people and nations can make their own decisions about their future.”<sup>13</sup>

All reasonable minds hope that U.S. relations with Russia and China will move toward greater and greater amity, and such a direction is not impossible. But it is important not to mistake a hope and a possibility for a certainty. As is discussed below, considerable evidence now indicates U.S. and allied relations with both powers are moving in the opposite direction. Stating this reality is not to repeat a Cold War nostrum; it is to recognize contemporary evidence.

In addition, other potentially severe threats may emerge rapidly and unexpectedly. For example, Israel’s Strategic Affairs Minister, Yuval Steinitz, recently said that in 10 years time, Iran could have 50-100 nuclear warheads and missiles that could target the United States.<sup>14</sup> And, serious analyses of North Korean behavior conclude that North Korea engages in high-risk behavior, despite endangering its own security, in protection of its perceptions of intangible values such as the honor and dignity of North Korean leaders, past and present.<sup>15</sup> This dynamic makes North Korean behavior appear erratic and even “incomprehensible” to Western observers.<sup>16</sup>

The Cold War, while holding serious dangers, had the consistency of bipolarity. Despite some inevitable ambiguities, the main antagonist confronting the United States and allies, the Soviet Union, was *relatively* familiar and predictable to U.S. leaders, as was its leadership, the main outlines of its external goals, its alliance structure and its strategic forces. As President Clinton’s Navy Secretary, Richard Danzig, has observed, “The monolithic Soviet opponent was unusually predictable...Because the massive Soviet system became largely ponderous and predictable, the American system had unusual opportunities for forecasting.”<sup>17</sup> Given the continuing intensity and magnitude of the Soviet nuclear threat during that period, it is not surprising that the United States pursued sizable military capabilities for the purposes of deterrence and assurance, including nuclear capabilities.

In contrast, the post-Cold War threat environment is highly dynamic and the attendant uncertainties that confound reliable threat forecasting now loom very large. In place of the generally “ponderous and predictable” developments in the Soviet Cold War threat, the United States and allies now confront a mosaic of threats and potential threats of greatly varying familiarity, intensity and lethality. As a 2009 Defense Science Board report concludes, “The potential for serious surprise has reached new levels and we as a nation must be prepared to deal with it in new ways.”<sup>18</sup>

Plausible threats exist from:

- the great nuclear powers that appear increasingly to find the international status quo unacceptable;
- smaller revisionist nuclear powers, such as North Korea;
- other hostile powers seeking nuclear capability, such as Iran;

- a wide variety of hostile and WMD-seeking terrorist organizations inspired by toxic nationalist and sectarian goals; and,
- the ever-present potential for non-linear military-technical and geopolitical developments that could significantly darken the threat environment quickly. (The rapid takeover of all or part of Pakistan's nuclear arsenal by an Islamic terrorist organization or Sino-Japanese hostilities over disputed territories in the East China Sea are examples of such prospects).

In such a threat environment, U.S. requirements for deterring foes and assuring allies over the course of decades are likely to be shifting and dynamic. The claim that some minimal and essentially fixed set of U.S. nuclear capabilities will serve adequately now and in the future is virtually certain to be mistaken in some plausible threat contexts, if only because the requirements for deterrence and assurance can shift so dramatically, depending on the details of time and context.

In a recent discussion of deterrence, Thomas Schelling, a pioneer of U.S. deterrence theory, has captured main features of this emerging environment:

Now we are in a different world, a world so much more complex than the world of the East-West Cold War... Now the world is so much changed, so much more complicated, so multivariate, so unpredictable, involving so many nations and cultures and languages in nuclear relationships, ...that it is even difficult to know how many meanings there are for 'strategic stability,' or how many different kinds of such stability there may be among so many different international relationships, or what 'stable deterrence' is supposed to deter in a world of proliferated weapons.<sup>19</sup>

Noted historians have compared this contemporary threat environment not to the bipolar Cold War, but to the highly dynamic threat environments leading to World War I and World War II.<sup>20</sup> Whether such specific analogies are apt or not, it is unarguable that the contemporary threat environment is one of dynamic change, uncertainty and evolving severe threats. This characterization is reflected in numerous National Intelligence Council (NIC) reports and testimony by senior officials in the Intelligence Community.

For example, the NIC's 2004 report, *Mapping the Global Future*, states that "At no time since the formation of the Western alliance system in 1949 have the shape and nature of international alignments been in such a state of flux...The very magnitude and speed of change resulting from a globalizing world—apart from its precise character—will be a defining feature of the world out to 2020. Other significant characteristics include: the rise of new powers, new challenges to governance, and a more pervasive sense of insecurity, including terrorism." And, "Over the next 15 years, a number of countries will continue to pursue their nuclear, chemical, and biological weapons programs and in some cases will enhance their capabilities...Countries without nuclear weapons, especially in the Middle East and Northeast Asia, may decide to seek them as it becomes clear that their neighbors and regional rivals already are doing so. ...Developments in CW [chemical weapons] and BW [biological weapons] agents and the proliferation of related expertise will pose a substantial threat."<sup>21</sup>

The NIC's subsequent 2008 report, *Global Trends 2025: A Transformed World*, revised its earlier report to reveal even greater apprehension: it projects an increasing risk of nuclear

weapons use, and that, “We now assess the potential for conflict—both interstate and intrastate—over the next 15-20 years to be greater than we anticipated in *Mapping the Global Future*.” And, “The rapidly changing international order at a time of growing geopolitical challenges *increases the likelihood of discontinuities, shocks, and surprises.*”<sup>22</sup>

In more recent testimony before the House and Senate, the Director of National Intelligence, James Clapper, summarized his characterization of the international threat environment in similar terms: “Never has there been, in my almost 49-year career in intelligence... a more complex and interdependent array of challenges than we face today.”<sup>23</sup> And, “I will say that in my almost 50 years of intelligence, I do not recall a period in which we confronted a more diverse array of threats, crises and challenges around the world....The serious threat assessment illustrates how dramatically the world and our threat environment is changing.”<sup>24</sup> By way of comparison, the bipolar Cold War threat environment, while severe, was *relatively* familiar and predictable.

### **Some Plausible Threats and Conflicts**

The potential for threat developments in the contemporary environment that are surprising in origin, scope and/or intensity is, by definition, unpredictable in detail. But, such surprises for the United States have considerable precedent. As former Director of Central Intelligence and Defense Secretary Robert Gates has observed, “When it comes to predicting the nature and location of our next military engagements, since Vietnam, our record has been perfect. We have never once gotten it right, from the Mayaguez to Grenada, Panama, Somalia, the Balkans, Haiti, Kuwait, Iraq and more—we had no idea a year before any of these missions that we would be so engaged.”<sup>25</sup> The character of the post-Cold War threat environment heightens the challenge of “getting it right.”

It is possible to identify here the general outlines of plausible threats and threat developments to the United States and allies from Russia, China, North Korea, and Iran. Confrontations with these countries have the potential to involve nuclear crises.

### **Russia**

The future of Russia’s political development and foreign policy is not clear, but its current direction is reason for concern. Russian Prime Minister Dmitry Medvedev recently stated that, “we are slowly but surely approaching a second Cold War.”<sup>26</sup> This is illustrated by Russia’s unexpected 2008 war against Georgia, and its recent military occupation and annexation of the Crimea.<sup>27</sup> Vladimir Putin’s Russia has become increasingly authoritarian, nationalist, and militarist, with a worldview dominated by legacy Soviet hostility toward the United States and NATO.<sup>28</sup> Indeed, according to Russian open sources, Russia seeks to regain the power and influence the Soviet Union once enjoyed, dominate the former Soviet states and, if possible, Eastern Europe, and create a Russian-led “Eurasian Union.”<sup>29</sup> Russia is applying growing diplomatic, economic and, in some cases, military pressures to compel these states to accept Russian dominance. President Putin’s former chief economic advisor, Andrey Illarionov, has stated that Putin wants to “conquer” the Baltic States and Finland.<sup>30</sup>

Not surprisingly, Russia’s foreign policy is increasingly anti-American. Like its Soviet predecessor, Russia sees the United States and its allies as its main enemies and the central

thrust of its military planning is designed to intimidate or, if necessary, fight the United States and NATO.<sup>31</sup> In addition, Moscow has laid claim to the Arctic Ocean and threatens foreign navigation.<sup>32</sup> To reinforce this claim, Russia is reactivating Soviet-era Arctic bases and carrying out military activities in the Arctic Ocean.<sup>33</sup>

Russian objectives certainly create the possibility of crises and conflict with the United States, allies and friends in Europe and Central Asia. As former Defense Secretary Gates has recently observed, Russia is now challenging “the entire post-Cold War order.”<sup>34</sup> This is particularly worrisome because Russian nuclear doctrine envisions the possible employment of nuclear weapons in the event of conventional war, including in regional and local wars.<sup>35</sup> Senior Russian leaders frequently talk about a war with the West for natural resources or control over the Arctic Ocean resources,<sup>36</sup> and Russian military exercises frequently feature the first use of nuclear weapons.<sup>37</sup> The Russian perspective on nuclear weapons and their use contrasts starkly with that in Washington. As the National Intelligence Council concluded, “Nuclear ambitions in the US and Russia over the last 20 years have evolved in opposite directions. Reducing the role of nuclear weapons in US security strategy is a US objective, while Russia is pursuing new concepts and capabilities for expanding the role of nuclear weapons in its security strategy.”<sup>38</sup>

Russia has used both overt and covert means of coercion in pursuit of territorial objectives—again, most recently against Ukraine. Both President Putin and General Yuriy Baluyevskiy, who was Chief of the General Staff during the 2008 war against Georgia, have said that the Russian campaign against Georgia was preplanned and preauthorized.<sup>39</sup> It resulted in the virtual Russian annexation of two provinces of Georgia. There is considerable concern in the Baltic states and in Central Europe, including Poland, about Russian threats to use force against them, including Russian nuclear threats, and the potential for Russian military aggression.<sup>40</sup> This concern grew following the 2008 war against Georgia and has reached new heights with Russia’s seizure of Crimea. Ukrainian Foreign Minister Andrii Deshchytia recently observed that the latter aggression has created an “explosive” situation, and that the chances of war with Russia “are growing.”<sup>41</sup> NATO Secretary General Anders Rasmussen recently stated that, “we took for granted that the Cold War belonged to the past... there are [now] of course similarities that remind us of old fashioned Cold War attitudes on the Russian side.”<sup>42</sup>

Russia appears to have tested (since mid-2007) and produced new nuclear capabilities that can threaten U.S. allies and friends in violation of the 1987 Intermediate-Range Nuclear Forces (INF) Treaty.<sup>43</sup> And, in March 2014, in the midst of the Ukraine crisis, Russia reportedly conducted a “massive nuclear war exercise.”<sup>44</sup> Russia also is engaged in a comprehensive military modernization program of its nuclear and conventional capabilities that is unlike anything underway in either the United States or NATO, where, by contrast, military budgets are declining. While there are limits to the expansion of Russia’s military power—including a gross domestic product (GDP) roughly one-tenth that of the United States or the European Union—Moscow is, nonetheless, making substantial increases in military spending and military capabilities, with nuclear forces receiving first priority.<sup>45</sup>

In this regard, Russia has announced it is modernizing its entire nuclear triad, including: 1) modernization of 98 percent of its ICBM force by 2021 with three new ICBMs; 2) deployment of eight new Borey-class missile submarines carrying the new Bulava-30 SLBMs and the first of a new “5th generation” missile submarine by 2020; and 3) on-going modernization of existing

heavy bombers, including new nuclear long-range cruise missiles, and the delivery of the first of a new stealthy heavy bomber by 2023.<sup>46</sup> Russia reportedly is: 1) deploying new MIRVed SS-27 ICBMs; 2) testing for near-term deployment of the new RS-26 “ICBM” (possibly to be deployed as an intermediate-range missile); 3) developing a rail-mobile ICBM; and 4) developing a new “heavy” ICBM for deployment in 2018-2020.<sup>47</sup> Additionally, Russian Defense Ministry officials say Russia is developing new and improved types of nuclear warheads.<sup>48</sup> In the tactical nuclear field, Russia reportedly is deploying a new short-range nuclear missile and is testing a new medium-range cruise missile.<sup>49</sup> Finally, Russia says it is upgrading the Moscow ABM system and plans widespread deployment of a new system to counter ICBMs and SLBMs.<sup>50</sup> These modernization programs are unprecedented for Russia, rivaling the pace and scope of the Soviet Union’s robust Cold War nuclear efforts.

### ***The People’s Republic of China***

The future of the People’s Republic of China (PRC) is not clear, but, as with Russia, its current direction is reason for concern. China remains an authoritarian Communist state that increasingly relies on nationalism for regime legitimacy.<sup>51</sup> Beijing’s core national security goals are to preserve the communist regime; prevent the “independence” of Taiwan, which China has pledged to prevent “at any cost,”<sup>52</sup> and reunite the island with the mainland; recover disputed territories from its neighbors (or take them—depending on national viewpoint); dominate its neighbors through economic means and military muscle; displace U.S. influence and power in East Asia; and, increase its influence in global affairs.

China’s border disputes are with countries that are U.S. allies and friends—Japan, South Korea, Taiwan, the Philippines and India.<sup>53</sup> China is flexing its military muscle to settle these disputes in its favor. A recent example is China’s unilateral declaration of an Air Defense Identification Zone (ADIZ) over the East China Sea, which appears to be part of its strategy for backing its expansionist sovereignty claims in the area.

Growing Chinese assertiveness could lead to incidents in the air or at sea with Japan, South Korea, or the United States that could escalate to regional armed conflict with worldwide economic consequences.<sup>54</sup> The Deputy Chief of Staff for Intelligence and Information for the U.S. Pacific Fleet recently reported that, “the PLA [China’s People’s Liberation Army] has been given the new task to be able to conduct a short sharp war to destroy Japanese forces in the East China Sea following with what can only be expected . . . a seizure of the Senkakus.”<sup>55</sup> The potential for conflict here is real. As Indian professor Dr. Brahma Chellaney has observed, “Let’s be clear: At stake in the East China Sea are not just some flyspeck islands, but regional power balance, a rules-based order, freedom of navigation of the skies and seas, and access to maritime resources, including seabed minerals. If China gets its way, the path to a Sino-centric Asia would open.”<sup>56</sup>

Chinese spokesmen have publicly declared that war with Japan is now possible, and Japanese Prime Minister Shinzo Abe has compared contemporary Sino-Japanese relations to Anglo-German relations immediately prior to World War I.<sup>57</sup>

The dramatic growth of the Chinese economy has enabled double-digit increases in defense spending for the past two decades, which in turn have fueled an impressive buildup in conventional and nuclear forces. China maintains the world’s largest armed forces, which

appear to focus on improving the ability to invade Taiwan and to prevent U.S. armed intervention through “active defense,” an “anti-access/area denial” strategy.<sup>58</sup> China says its armed forces are designed to “fight and win ‘local wars under conditions of informatization,’ or high-intensity, information-centric regional military operations of short duration.”<sup>59</sup>

The Chinese military buildup involves both nuclear and conventional forces. It is increasing its already large force of ballistic and cruise missiles,<sup>60</sup> and nuclear weapons play an important role in China’s strategy of “active defense.” The Chinese refer to their nuclear weapons as “trump cards.”<sup>61</sup>

In November 2013, several major Chinese state-owned publications ran the same story illustrating the ability of the Chinese JL-2 submarine-launched ballistic missiles (SLBMs) and DF-31 intercontinental ballistic missiles (ICBMs) to attack major American cities; the 12 JL-2 missiles on a single Type 094 submarine alone reportedly could cause five-to-12 million American casualties.<sup>62</sup> In December 2013, Chinese state media touted the fact that CJ-10 cruise missiles can now be launched from China’s new H-6K strategic bombers “without even leaving Chinese airspace” and “can launch strategic missile attacks against US military facilities and those of its allies in the Western Pacific.”<sup>63</sup> Most recently, China tested an experimental hypersonic strike vehicle that, according to senior Defense Department officials, could pose problems for the United States in “five or 10 years.” It reportedly could carry nuclear weapons and be designed to defeat U.S. missile defenses and attack aircraft carriers at sea.<sup>64</sup>

### **North Korea**

The Kim regime in North Korea is a Stalinist dictatorship. The North Korean people are indoctrinated to keep “the strongest revolutionary faith in worshiping and protecting the leader...”<sup>65</sup> North Korean objectives are to retain the Kim family and its ideology in power; to gain the deference befitting a “great power”; to extract diplomatic and economic concessions from South Korea, the United States and others; and to establish a unified Korea under Pyongyang’s control.<sup>66</sup> North Korea uses military provocations to advance these goals,<sup>67</sup> and the prospects for severe crisis or conflict on the Korean Peninsula are real. As a recent report by the Center for New American Security concluded: “Northeast Asia is entering a period of dramatically heightened tension. Because an unstable North Korea might trigger renewed war on the Korean Peninsula, national security decision makers should assume an elevated possibility of deterrence against North Korea failing in the next one to five years.”<sup>68</sup>

North Korea pursues a “military first” policy with some 30 percent of GDP devoted to the armed forces.<sup>69</sup> This policy “has brought militarism to all aspects of North Korean life and has extended the military’s influence to sectors far beyond national security.”<sup>70</sup> North Korea literally lives on the brink of starvation but supports the most militarized society in the world.<sup>71</sup>

North Korea has been characterized as “ferocious, weak and crazy,”<sup>72</sup> and its leadership appears willing to accept great risks in defending what it perceives as the “honor” of the regime.<sup>73</sup> Nevertheless, the leadership clearly is calculating. It has launched military attacks against South Korea; further armed provocations or greater acts of aggression could lead to a major war on the Korean peninsula, in which the possibility of Chinese intervention cannot be excluded. Deficiencies in North Korea’s conventional capabilities likely increase the chances that it would resort to WMD use in such a conflict. North Korea has long threatened to strike its

neighbors' capital cities and, in 2013, made repeated nuclear threats against the United States.<sup>74</sup> The most dangerous North Korean military threats are its apparent WMD capabilities (nuclear, chemical and biological weapons), and its ability to launch a massive artillery barrage against Seoul during the early stages of a war.<sup>75</sup> North Korea has the potential to kill millions of people if it were to be undeterred from use of WMD.

North Korea may have between ten and dozens of nuclear weapons.<sup>76</sup> It has been developing ballistic missiles of all ranges (medium-, intermediate- and long-range), and nuclear, chemical and biological weapons (CBW) capabilities.<sup>77</sup> The government of South Korea says that North Korea has "approximately 2,500–5,000 tons of toxic agents such as nerve, blister, blood, and vomiting agents."<sup>78</sup>

### ***Iran***

The Islamic Republic of Iran is an authoritarian theocracy undergirded by a militant version of Shiite millenarianism. Iran's pronouncements are strongly anti-American and its expressed strategic goals include hegemony in the Persian Gulf region, opposition to the United States ("the Great Satan") and its presence in the Middle East, and the destruction of Israel. Former Central Intelligence Agency (CIA) Director Michael Hayden has stated that Iran "is the single greatest destabilizing element right now with regards to global security."<sup>79</sup>

Efforts by Iran to coerce U.S. allies and partners in the Gulf region and, prospectively, to cut off oil shipments moving through the Strait of Hormuz could lead to conflict with the United States. Of course, there is very serious concern among Iran's neighbors about its potential nuclear capability.<sup>80</sup> Director of National Intelligence, James Clapper, recently stated that Iranian technical advances have put it in the position "to eventually produce nuclear weapons... the central issue [is] its political will to do so."<sup>81</sup> Tehran could seek to use nuclear threats to coerce Israel and countries of the Gulf, greatly constrain U.S. freedom of action to support U.S. and allied interests in the region, and provide "top cover" for its support of terrorist groups, notably Hizballah, to advance its interests with great violence. Given statements by some of Iran's neighbors, there is concern a nuclear Iran would result in a "proliferation cascade" in the Middle East as neighboring countries seek their own security against Iranian nuclear weapons.<sup>82</sup>

Iran maintains a much larger military than neighboring countries. It is trying to build a defense industry capable of producing a wide range of military equipment; Tehran imports some Russian arms and technology, but purchases are limited by available resources. It is improving its capabilities for restricting access to the Persian Gulf through shore-based anti-ship missiles, sea mines, diesel-electric submarines, and patrol boats.<sup>83</sup> Support of terrorism is one of the main tools of Iranian foreign policy, which increases concerns about nuclear terrorism if Iran obtains nuclear weapons.

Iran's nuclear and missile programs are an obvious concern. There have been many reports over the years of Iranian nuclear cooperation with North Korea.<sup>84</sup> Iran is increasing the quality and size of its ballistic missiles force, reportedly with the help of North Korea,<sup>85</sup> and may have made "efforts to shrink a Pakistani [nuclear] warhead design to fit atop its ballistic missiles..."<sup>86</sup> In addition, Iran is seeking to improve the accuracy of its ballistic missiles.<sup>87</sup>

Finally, a 2005 State Department report concluded, “Iran has an offensive biological weapons program in violation of the BWC [Biological Weapons Convention],”<sup>88</sup> and that “Iran is in violation of its CWC [Chemical Weapons Convention] obligations because Iran is acting to retain and modernize key elements of its CW infrastructure to include an offensive CW R&D [research and development] capability and dispersed mobilization facilities.”<sup>89</sup>

This brief look at developments in just four states represents a far from comprehensive review of the contemporary threat environment; it simply helps illustrate the reality that the contemporary threat environment, including Russia and China, cannot realistically be described as benign or static. Available evidence points toward considerable opportunity for serious crises and conflicts now and in the future, including the potential for nuclear crises. There are a large number and wide range of severe, plausible threat scenarios which prudent U.S. policies cannot dismiss as otherwise. And, the potential—even likelihood—of wholly surprising threat developments must also be factored into U.S. considerations of deterrence and assurance requirements. The uncertainties involved are daunting given the great diversity of hostile and potentially hostile states and non-state actors, leaderships, goals, perceptions, and forces that could be involved.

### **The Implications of a Highly Dynamic, Uncertain Threat Environment for U.S. Deterrence and Assurance**

What are the implications for U.S. deterrence and assurance strategies and related U.S. force posture requirements of a threat environment so characterized by a broad range of severe plausible threats and the potential for surprising political and military-technical threat developments? The character of the threat environment and enduring U.S. security goals reflects the most basic building blocks that can be derived from available evidence for identifying metrics of U.S. adequacy in support of deterrence and assurance.

In the context of the significant uncertainties inherent in such a dynamic threat environment, a fundamental requirement for U.S. forces is that they are highly adaptable, with a premium on resilience and operational flexibility.<sup>90</sup> This principle, derived from the reality of the contemporary threat environment, is unarguable: U.S. forces must be adaptable in a timely way to a wide variety of plausible threats and contingencies because at any given point in time the United States will have only its forces in being to address threats and crises; i.e., they need to be adaptable because threat conditions are diverse and can change rapidly.<sup>91</sup>

In such a highly dynamic environment, U.S. forces suited only to a narrow range of threats or to niche threats could easily leave the United States without the tools necessary for defense or deterrence. Correspondingly, U.S. evaluation criteria for its forces must put a premium on timely performance across a wide range of scenarios and contingencies.<sup>92</sup> If so, the United States is less likely to be caught in crises with narrowly-functioning forces ill-suited for the threats that it must confront and deter.

During the Cold War, U.S. officials similarly recognized that U.S. deterrence strategies and supporting nuclear forces needed to be *adaptable* to a range of threat scenarios and plausible adverse military-technical developments. A fundamental requirement for deterrence, then noted by former Defense Secretary Harold Brown and other senior leaders, is that U.S. deterrence threats hold at risk a spectrum of assets valued by potential enemy leaderships, including those



assets most highly valued.<sup>93</sup> Correspondingly, as the late Secretary of Defense James Schlesinger said in 1974: “To be credible, and hence effective over the range of possible contingencies, deterrence must rest on many options and on a spectrum of capabilities...to support these options.”<sup>94</sup> In some cases, U.S. nuclear capabilities may be necessary, as recognized by Republican and Democratic administrations throughout the Cold War and after. In other cases, much more modest U.S. threats may suffice. In the contemporary threat environment, when potential threats are diverse, numerous, and increasingly unpredictable, U.S. deterrence capabilities likely will, correspondingly, need to be diverse and adaptable.

### **Adaptability for an Uncertain Future**

Today, the United States requires capabilities that, “can under *any* circumstances confront an adversary with the prospect of unacceptable damage, both to deter potential adversaries and to assure U.S. allies.”<sup>95</sup> In practice, this means that U.S. forces must be able to deter foes and assure allies over a broad range of scenarios, including those involving military, technical and geopolitical surprise. During the Cold War, the classic question posed regarding U.S. nuclear capabilities for deterrence was, “How much is enough?”<sup>96</sup> The obvious related question for today is, “How much adaptability is enough?” for deterrence and assurance, “under any circumstances,” given the contemporary threat environment.

The answer to that question, again, will be determined in large measure by the nature of the threats that actually emerge over time, and cannot be known with precision in advance. The adequate level of adaptability will change with the shifting character of threats and crises—there can be no static answer unless the threat environment itself is static. However, because U.S. nuclear forces tend to have operational life spans measured in decades, we know that the U.S. force posture must be sufficiently adaptable to deter and assure as effectively as possible in a threat environment that will see many new developments, including surprising developments, over the course of decades.

The United States thus must seek, as a fundamental guideline, to give its nuclear force posture the level of adaptability practicable within legal, political and economic boundaries likely to endure. As noted, this was recognized during the Cold War. The much greater diversity of threats and dynamic character of the post-Cold War security environment heightens considerably the need to do so.<sup>97</sup> To the extent that other priorities and goals drive U.S. planning, and force tradeoffs at the expense of adaptability, the potential degradation of the U.S. capacity to deter foes and assure allies must be recognized.

The implications of establishing adaptability as a priority guideline for the size and composition of the U.S. nuclear arsenal are indirect, but unavoidable. The capacity of the United States to adapt its deterrence strategies to widely-differing circumstances as appears necessary will be affected by the size and character of U.S. forces. Greater numbers do not automatically equate to greater adaptability, but retaining adaptability at ever lower force levels becomes increasingly difficult and eventually is implausible at very low force levels.

In short, no static, narrowly-conceived deterrent posture can reasonably be expected to deter diverse foes or assure numerous allies in a highly dynamic threat environment. Different approaches to deterrence, including different types of U.S. deterrent threats and supporting forces, are likely to be more (or less) credible and effective depending on the specific opponent,

stakes, and other details of the contingency/crisis. This is why deterrence, to the extent feasible, must be tailored to the specific circumstances and opponent, and U.S. deterrence strategies and forces must be sufficiently adaptable to be so tailored. Commanders of U.S. Strategic Command consistently emphasize that there is no “one size fits all” deterrent; they correspondingly identify flexibility and resilience as key metrics for U.S. forces,<sup>98</sup> as do senior officials in the Obama Administration and the administration’s most recent nuclear employment policy.<sup>99</sup> These key metrics, in turn, should help determine the quantity and qualities of U.S. forces.

U.S. strategies and supporting forces for allied assurance must similarly be tailored to the diverse and dynamic security concerns of numerous far-flung allies. Because U.S. allies confront such varied threats and often interpret their specific threat circumstances and security needs so differently, adaptable U.S. capabilities, including nuclear, without question, are key to meeting allied assurance needs. The U.S. forces necessary to assure allies likely overlap to an extent with those needed for the deterrence of foes, but they also can entail separate requirements that are uniquely valued by allies for assurance; i.e., there are both common and unique requirements for deterrence and assurance.<sup>100</sup> This reality further heightens the need for adaptable U.S. forces to meet the requirements for both deterrence and assurance.

In a highly dynamic and unpredictable threat environment, the fundamental claim of Minimum Deterrence proposals—that an ever-more-constrained set of U.S. Cold War-legacy nuclear capabilities will provide adequate and predictable deterrent effect and assurance—is a risky planning assumption. There is no reasonable basis for anticipating that it will hold, and considerable reason to anticipate that it will not. The counterpoint—that the shifting character of the threat environment demands *adaptability* as a fundamental metric for the adequacy of U.S. forces for deterrence and assurance—moves prudent U.S. planning for deterrence and assurance further and further away from Minimum Deterrence, which self-consciously seeks not flexibility, but ever-tighter boundaries, with restrictions on, and reductions in, U.S. nuclear forces and options. Indeed, some Minimum Deterrence proponents argue explicitly *against* U.S. nuclear force diversity, flexibility, and hedges against uncertainty because they see these characteristics as inconsistent with their goal of further deep reductions in U.S. nuclear forces.<sup>101</sup>

U.S. nuclear policies, however, must be designed to support U.S. national goals of deterrence and assurance—and must do so now in a highly fluid threat environment. These are the fundamental building blocks, derived from available evidence, for any prudent recommendations regarding U.S. force requirements and measures of adequacy. In such a threat environment, the priority goals of deterrence and assurance demand flexible and resilient forces that can adapt to diverse threat conditions so as to provide the most effective possible tailored deterrence of foes and assurance of allies. This is not a repetition of past Cold War arguments about “how much is enough?”, or about the prospective benefits or risks of arms control. Rather, it is to say that a priority measure of adequacy for the U.S. force posture now must be its capacity to adapt to meet the potential deterrence and assurance needs posed by a diverse, shifting and often opaque threat spectrum. Force posture numbers and characteristics should follow from that basic consideration, and U.S. arms control goals should be shaped significantly by the same consideration.



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### III. Requirements for a Flexible and Resilient Nuclear Force

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As emphasized above, the political and military uncertainties of the contemporary security environment point to the priority need for a U.S. nuclear force that can adapt to a range of plausible opponents, threats, conflicts, and technical challenges. The required adaptability is of two kinds: flexibility and resilience. With flexibility, the force can respond appropriately to acts of aggression short of war (through a show of force, for example) or to major attacks of varying origin, purpose, type, scope, scale, intensity, and duration. With resilience, the force in peacetime can maintain its required level of wartime effectiveness despite possible problems with delivery vehicles or weapons, new or intensified military rivalries, and improvements in the offensive or defensive capabilities of opponents.

These two force qualities support the related strategic goals of deterring coercion or attack against the United States and its allies, assuring allied countries of U.S. commitments to their defense and preserving U.S. freedom of action. Flexibility enables deterrent threats to be tailored to specific opponents, circumstances, and U.S. and allied objectives, which should help make those threats more credible and thus better able to deter foes and assure allies and partners. U.S. preparations for the flexible use of forces also offer possibilities to deter the escalation of violence in the event of conflict by providing options that minimize unintended damage and encourage opponents to observe restraints vis-à-vis the United States and allies.

In the face of adverse changes, resilience safeguards the ability of the force to pose tailored deterrent threats and to prevent attacks against the United States and its allies. Ensuring the resilience of the nuclear force can contribute to the assurance of allies by helping to demonstrate that neither technical problems with elements of the force nor developments by hostile powers intended to undercut force effectiveness can prevent the United States from meeting its security commitments.

#### **Flexibility**

Flexibility involves: 1) deliberate and adaptive planning for a variety of options to deter or counter attacks that present a grave danger to U.S. or allied security (nuclear strikes, extensive chemical or biological use, or overwhelming conventional offensives); and 2) forces with the diverse capabilities and the associated nuclear command and control necessary to support those deterrent threat options. The discussion here focuses on the second category, force attributes and command and control for flexibility.

Flexibility as a central requirement for U.S. nuclear deterrence forces dates to the early 1960s, when officials of the Kennedy Administration sought to add nuclear options in which strikes would be limited to military targets (notably enemy nuclear forces) and damage to urban-industrial areas would be avoided. Succeeding administrations further elaborated plans for options that varied in size and in the types, sets, and combinations of military, leadership, and economic targets.<sup>102</sup> Fifty years after the Kennedy initiative, and some 25 years into the post-Cold War period, the Obama Administration has similarly adopted strategy guidance that endorses “the flexibility to respond with a wide range of options to meet the President’s stated

objectives should deterrence fail” (and also calls for “deliberate planning for non-nuclear strike options” to augment those that are nuclear).<sup>103</sup>

There are a number of reasons flexibility is, and for decades to come will be, a key U.S. force requirement for deterrence and assurance:

- The uncertainties that characterize the security environment and the security commitments the United States extends to other countries are unlikely to shrink to the point where the nuclear force can be prepared for only a single contingency.
- The U.S. nuclear force has always been considered part of the deterrent to not only nuclear use but also nonnuclear attacks, notwithstanding decades-long efforts to reduce the role of nuclear weapons in U.S. strategy.<sup>104</sup>
- The specific deterrence or assurance goal and related military objectives to be supported by U.S. nuclear forces will change depending on the contingency; those guiding U.S. strategies vis-à-vis a nuclear peer, for example, could be distinct from those pursued against a regional power armed with weapons of mass destruction.
- The nuclear threat that deters an opponent with one set of characteristics (motives, beliefs, perceptions, risk tolerance, decision-making process, and the like) may not deter another, even in a similar strategic context. The U.S. capabilities that assure one ally or set of allies likewise may not assure other allies.
- If deterrence fails, flexibility would be essential for attempts to limit escalation of a nuclear conflict through appropriate combinations of objectives, plans, targets, and weapons. Because the adage “wars never go according to plan” would likely be especially true for a nuclear conflict, the U.S. nuclear force would need the flexibility to adapt as necessary to best deter escalation during a conflict following an initial failure of deterrence.
- The potential to limit conflict escalation, and thus damage to the United States, through flexible nuclear options can lend credibility to U.S. extended-deterrence guarantees to allies by limiting the risks the United States incurs in defending those countries.
- Consistent with the general preference Presidents evince for more rather than fewer alternatives, a prominent thread in the evolution of U.S. nuclear planning has been the development of a range of options for the Commander in Chief that are selective in application and controlled to the extent feasible in scope and effect.

To provide flexibility, the U.S. nuclear force as a whole—ICBMs, SLBMs, heavy bombers, and shorter-range dual-capable aircraft (DCA)—requires certain basic attributes. These include:

- survivability against enemy action;
- intercontinental range;
- ability to forward deploy to overseas locations;
- prompt response capability;
- variable payloads;
- warheads of different explosive yields;
- high weapon delivery accuracy; and
- effective command and control.

Each element of the force does not need to have each attribute; each element, however, should be found in the force as a whole so that it has a substantial measure of flexibility to deal with a range of nuclear-related contingencies. The attributes of flexibility are discussed in turn below.

### ***Survivability***

Survivability is a matter of the ability of forces to withstand or escape attack on their bases—ballistic missile submarine (SSBN) ports, ICBM silo fields, bomber and DCA airfields—and to evade or overcome enemy defenses—air defenses, missile defenses, and anti-submarine warfare (ASW) capabilities. Survivability can contribute to flexibility and to resilience, but is examined in this discussion primarily in terms of flexibility.

U.S. concerns about the survival of forces at their bases are likely to be greatest for possible crises with Russia and perhaps China. While U.S. on-alert bombers are highly survivable against preemptive attack, air defenses of both countries, as well as those of lesser potential opponents, would threaten to various degrees U.S. strike aircraft (bombers and DCA) and air-launched cruise missiles (ALCMs) delivered by bombers. Opposing missile defenses today do not present a comprehensive threat to U.S. ballistic missiles or cruise missiles, though this situation could change in the decades ahead.<sup>105</sup> While SSBNs at sea long have been the most survivable element of the U.S. nuclear force, foreign ASW activities make necessary a vigorous U.S. effort (the SSBN Security Program) “to anticipate potential threats and develop appropriate countermeasures.”<sup>106</sup>

Survivability is fundamental to flexibility. U.S. missiles or aircraft the enemy expects to destroy logically could contribute essentially nothing to a U.S. retaliatory deterrent threat, whether that deterrent was tailored to the particular contingency or not. Force elements with a high level of prelaunch survivability could contribute to deterrence credibly and be withheld, adding to the U.S. capability to adapt to the changing conditions of a crisis or conflict. A major drawback of launch under attack to offset the vulnerability of silo-based ICBMs to large-scale ballistic missile attack is that it might save U.S. missiles from initial destruction, but not benefit flexibility. It would preclude the survivability needed to withhold forces during a conflict and thereby the potential for measured, deliberate steps to mitigate pressures to “use or lose” those forces. The potential to reestablish deterrence even following the initial outbreak of conflict may depend on those attributes vice the need to launch forces under attack rapidly to avoid their destruction.

It is important to note that the 450 silos currently housing U.S. ICBMs may present a dauntingly large set of aimpoints for any opponent contemplating an attack against the U.S. strategic nuclear force. Two high-accuracy, high-yield ballistic missile warheads might need to be expended against each U.S. silo to ensure a high probability of destroying the ICBM force. And, when U.S. ICBMs are single-warhead missiles, only one U.S. warhead would likely be destroyed for each two employed by an opponent. This may help to ensure that the price of such an attack is considered prohibitive for an opponent and thus contribute to deterrence. In addition, a steep reduction in silo numbers could create pressure to rely on a launch-under-attack tactic for survivability, with its attendant risks and rigidities.

While the Obama Administration plans to deploy 400 ICBMs under the New START Treaty, the contribution of a relatively large number of silo-based ICBMs to deterrence suggests that caution should be exercised in reducing the size of the ICBM force further and that, as planned,

all silos be preserved. Options for enhancing ICBM survivability, such as mobility or a preferential missile defense of silos, should be kept open for the future to reinforce deterrence and provide an alternative to relying on launch under attack, thereby sustaining the flexibility offered by the missiles.

### ***Intercontinental Range***

Intercontinental range is suited for a geopolitical situation in which strategic nuclear forces (SLBMs, ICBMs, and bombers) are based in the United States, while potential opponents and many U.S. allies under threat are in Eurasia. All elements of the strategic nuclear force have intercontinental range. Intercontinental range prevents targets in enemy territory that are potentially critical for deterrence from enjoying sanctuary by virtue of being out of reach; this attribute is especially important where targets are located well within the interior of geographically large opponents and secure forward bases are not available for U.S. nuclear-capable strike aircraft. By the same token, intercontinental range contributes to survivability by permitting the basing of bombers and land-based ballistic missiles far from theaters where forward-deployed U.S. forces might be vulnerable to air or missile strikes.

For some potential contingencies, avoiding overflight of certain areas by U.S. missiles or bombers might be helpful to prevent dangerous reactions by third parties. The flexibility of ICBMs is limited in this regard. ICBMs would need to overfly Russia to threaten targets in China and, on minimum-energy trajectories, Russia and China to cover targets in North Korea or Iran.<sup>107</sup> Intercontinental-range bombers as well as DCA, on the other hand, could be routed from U.S. bases or forward deployed in order to observe overflight restrictions, and SLBMs, with their range and mobile basing, could be launched from many different azimuths, including those that did not pass over sensitive areas. It is interesting to note this flexibility attribute can also have assurance value. Since the 2010 U.S. decision to retire the nuclear-armed Tomahawk land-attack missile, some South Koreans have expressed fear that the United States might be unwilling to use ICBMs or SLBMs to defend against major aggression by the North because of the possible danger of overflying Russia or China. Explanation of the overflight flexibility of bombers and SLBMs could help alleviate this concern.<sup>108</sup>

### ***Ability to Forward Deploy***

The ability to deploy U.S. nuclear-capable forces to locations in or near allied countries allows a forward presence that can be important to both assurance and deterrence. The value of a U.S. forward military presence for assurance and deterrence is well recognized. Forward-deployed forces not only add to the armed strength in or near allied countries, but also signal the strong interest of the United States in the security of those countries and its readiness to act in their defense. Forward deployment of nuclear-capable forces, and the cooperative burden sharing with allies that accompany such deployments, reinforce the important perception of the indivisibility of U.S. and allied security and the assurance of allies provided by the U.S. “nuclear umbrella.”

Deployment of nuclear forces for forward presence could be permanent or temporary. A notable example of permanent deployment is the changing set of nuclear capabilities the United States has maintained in NATO-Europe for the past 60 years. Today those capabilities consist of “a few hundred” B61 gravity bombs stored in a number of allied countries and available for

delivery by U.S. and allied dual-capable aircraft (F-15Es, F-16s, Tornados and, in the future, F-35As).<sup>109</sup> In a 2012 review, NATO as a whole endorsed a continuation of this nuclear presence on the Continent, pending the possibility of reciprocal steps with Russia to reduce the nonstrategic nuclear weapons of both sides.<sup>110</sup> While there have been calls for some quarters within the Alliance for complete withdrawal of the nonstrategic nuclear weapons assigned to NATO, including by current and previous senior U.S. officials,<sup>111</sup> the newer members of NATO in Central and Eastern Europe see them as valuable for anchoring the “transatlantic link” with the United States, especially the U.S. extended-deterrence guarantee, helping to prevent Russian intimidation or attack.<sup>112</sup> In light of Russian aggression against Ukraine, the Alliance as a whole is likely to place greater importance on the contributions of nonstrategic nuclear weapons to assure and deter.

In Asia, the United States had a permanent nuclear presence in South Korea for more than 30 years before withdrawing nonstrategic weapons from the peninsula in 1991. The North Korean nuclear weapons program and a series of provocations by Pyongyang have caused some South Koreans in recent years to call for the return of U.S. nuclear arms.<sup>113</sup> Neither the South Korean nor the U.S. government supports this step, but in March 2013, the United States did send a small number of nuclear-capable B-52H and B-2 bombers on nonstop, round-trip missions to South Korea, where the aircraft conducted mock bomb runs as a display of force intended to assure the South and deter the North.<sup>114</sup> In addition, a “small number” of nonstrategic nuclear weapons stored in the United States under certain conditions could forward deploy with U.S. dual-capable aircraft to South Korea or other overseas locations.<sup>115</sup>

It should be noted that in one instance an SSBN was used in a temporary, visible, forward deployment to demonstrate the U.S. nuclear commitment to an ally. A Polaris missile submarine paid a two-day visit to a Turkish port in April 1963 as one of a series of measures by the United States to reassure Ankara of the U.S. extended-deterrence guarantee following the Kennedy Administration’s decision to withdraw nuclear-armed intermediate-range ballistic missiles from Turkey, a move that was part of the resolution of the Cuban missile crisis the previous October.<sup>116</sup> As the Polaris port call and the other examples suggest, the United States should maintain the ability to deploy nuclear-capable forces to overseas locations, for a short time or possibly an extended period, as a means of sending a deterrent signal to adversaries and providing a sign of assurance to allies.

### ***Prompt Response Capability***

Clearly not all U.S. nuclear deterrent threats or assurance measures are likely to require prompt response capabilities. Some types of deterrent threats, however, may need to be directed against time-sensitive targets. These targets could include a variety of military capabilities highly valued by an opponent. For example, a capability to hold an opposing leadership’s protected military-political assets at prompt risk could serve deterrence by threatening to frustrate the war plan and war aims of the adversary (i.e., deterrence by denial). Prompt U.S. response capabilities can also contribute to assurance, as has been stated explicitly by some allied officials.<sup>117</sup>

Elements of the current U.S. nuclear force support a prompt response capability. The time to target for ICBMs is roughly 30 minutes. SLBMs could reach targets in that amount of time or less, depending on target location, SSBN launch position, and missile trajectory. U.S.-based



bombers and bomber-carried ALCMs are not generally considered “prompt” as described here, with flight times measured in hours. Deploying bombers and DCA to areas closer to enemy territory could reduce their flight times.

### ***Variable Payloads***

The ability of bombers and ballistic missiles to carry different types and numbers of weapons makes possible a better matching of U.S. deterrent threats to supporting U.S. capabilities than otherwise would be the case. In addition, these delivery vehicles can be loaded with weapons and countermeasures useful for penetrating enemy defenses that threaten the credibility of a U.S. nuclear response.

Bombers have an advantage over ballistic missiles in this flexibility attribute in that their payloads are less constrained both in weight and volume. Each bomber can carry a few tens of thousands of pounds of payload, whereas ICBMs and SLBMs have throw-weights an order of magnitude less.<sup>118</sup> (Throw-weight includes the weight—reentry vehicles, post-boost vehicle, penetration aids—carried by the boost stages of a ballistic missile.) Similarly, the space within a bomber weapons bay is less confined than that under a missile nose cone. (Note, too, that the B-52H can carry weapons not only in its internal bay but also on wing pylons.) Consequently, nuclear-armed bombers historically have had the wider variety of weapons—gravity bombs of varying types, sizes and yields; earth-penetrating weapons; short-range attack missiles for suppressing air defenses; and cruise missiles—as well as aerial decoys for confusing and saturating opposing radar networks. Bomber payloads, moreover, are more readily changed than those of ICBMs and SLBMs.

Today, B-52H bombers would likely be armed exclusively with cruise missiles with which the nonstealthy aircraft could strike targets without penetrating enemy air defenses. The stealthy, penetrating B-2 can be loaded with two types of gravity bombs (the B61 and B83), including a variant of one (the B61 Mod 11) that is the only earth-penetrating weapon in the nuclear arsenal. (This variant currently is scheduled for “eventual retirement.”)<sup>119</sup> The Minuteman III ICBM and Trident D5 SLBM each can carry two different types of warhead: the W78 and W87 ICBM warheads, and the W76 and W88 SLBM warheads. Missiles also can be loaded with assorted penetration aids for countering missile defenses. Dual-capable aircraft have one type of gravity bomb (the B61) in three variants. Long-term plans, it should be noted, call for reducing the types of both gravity bombs and ballistic missile warheads.<sup>120</sup>

The flexibility offered by ballistic missiles with single-warhead payloads is worth noting. Minuteman III has the capacity to be armed with multiple (three) warheads, but during the past several years all or nearly all missiles of this type have been downloaded to a single-warhead configuration to comply with arms control limits and “enhance the stability of the nuclear balance by reducing the incentives for each side to strike first.”<sup>121</sup> (The bulk of the ICBM force, however, will retain the capacity to be uploaded with additional warheads.)<sup>122</sup> Single-warhead missiles have a flexibility that in certain circumstances could be advantageous for flexibility and deterrence. For example, while a ballistic missile with multiple warheads would have to deliver all of those weapons against aimpoints within a particular elliptical area (or “footprint”), each single-warhead Minuteman III could threaten one target located within a much larger area. Single-warhead ICBMs could be helpful to U.S. deterrent threats involving small numbers of

targets or response options prepared ad hoc. Payloads for bombers likewise could be adjusted for single targets, but the aircraft lack the prompt strike capability of ballistic missiles.

### ***Assorted Weapon Yields***

A nuclear stockpile with weapons of assorted explosive yields is an important part of the ability to hold at risk a wide range of target types for the purposes of deterring conflict or limiting its escalation. Such a stockpile aids the development of diverse deterrent threat options suited to a variety of contingencies. High-yield weapons (a few hundred kilotons or more in TNT equivalent), in combination with high delivery accuracy (a circular error probable—a measure of miss distance) of a few hundred feet or less, can be used to threaten targets protected with steel-reinforced concrete or underground construction, including silos, tunnels housing missiles, and bunkers sheltering leadership elements.<sup>123</sup> (Some underground facilities, however, can only be destroyed with earth-penetrating nuclear weapons.)<sup>124</sup> Weapons with lower yields have value in threatening other types of targets while at the same time offering greater possibilities for causing less unwanted damage.

Avoiding unwanted damage would be important for at least three reasons:

- First, the law of armed conflict places restrictions on deliberate harm to noncombatants and damage to civilian objects, which understandably is viewed as morally unacceptable, and U.S. nuclear planning is done in compliance with those constraints.<sup>125</sup>
- Second, to the extent opponents believe that U.S. leaders would be paralyzed for fear of causing damage to civilian population and infrastructure, U.S. options that minimize such unwanted damage—including options involving lower-yield weapons—should add credibility to U.S. deterrent threats.
- And, third, as discussed earlier, limiting unnecessary damage to an opponent could help limit escalation of a conflict, which in turn could limit damage to the United States and allies.

In the current stockpile, both types of ICBM warheads are high yield, as are the two types for SLBMs.<sup>126</sup> Gravity bombs for strike aircraft provide a variety of yields “from megaton to subkiloton.”<sup>127</sup> The warhead carried by the bomber-delivered ALCM reportedly has high and low yield options.<sup>128</sup>

### ***High Delivery Accuracy***

As suggested above, weapon delivery accuracy and explosive yield are closely related as attributes of flexibility. Accuracy and yield together are critical determinants of whether a weapon can hold at risk a given target. Improvements in accuracy to an extent can offset reductions in yield. For example, according to a senior Defense Department official, plans to equip a new variant of the B61 gravity bomb with a guided tail kit for better accuracy will allow the weapon to achieve the same military effects “of today’s highest-yield versions, while incorporating the smallest yield design available.” (This B61 Mod 12 bomb is intended for delivery by both B-2 bombers and dual-capable aircraft.)<sup>129</sup> Lower yields offer the aforementioned benefits for flexibility. And even without yield reductions, highly accurate weapon delivery could reduce the chance of unintended damage that might fuel escalation of a

conflict. High delivery accuracy can serve the credibility of deterrent threats—including those that assure and protect allies—and efforts to limit escalation in a conflict.<sup>130</sup>

U.S. nuclear weapons systems, especially Trident D5 SLBMs and bomber-delivered cruise missiles, have high delivery accuracies, although their accuracies are not comparable to those achieved by precision-guided conventional weapons, which have miss distances measured in tens rather than hundreds of feet. The nuclear-armed ALCM is “highly accurate” because of its terrain contour-matching guidance system.<sup>131</sup>

### ***Nuclear Command and Control (NC2)***

A critical component of a flexible nuclear force is the command-and-control system that links the force with presidential authority. Robust, secure, survivable systems for early warning, attack assessment, senior-leader conferencing, and force direction are needed to support the flexible employment of forces. This capability is needed independent of the number of delivery systems and warheads deployed. Control of nuclear forces must be assured even under the enormous stress of a nuclear crisis. The basic elements of today’s nuclear command and control (NC2) architecture include:

- launch detection satellites and ground-based radars for early warning of attack;
- facilities to interpret early warning information;
- air, ground-mobile, and fixed command and control posts; and
- communications systems provided by satellites, landlines, and other capabilities.

Fielding and modernizing NC2 systems rely on certain key principles, including dual phenomenology (both infrared sensor and radar detection) for ballistic missile early warning and threat assessment, redundant communications links, and hardening of systems against nuclear weapon effects.

To address many years of relative neglect of NC2, coupled with delays in major programs, significant investment today is focused on sustaining and modernizing the so-called “thin line”—that part of the NC2 architecture that must function even after a nuclear strike on the United States.

In addition to the needs of the “thin line,” other improvements may be needed for the NC2 system of the future. While it will remain important to consider the performance of NC2 with regard to Cold War-type threats, U.S. defense planners must also anticipate, as discussed in Section II, a much more dynamic security environment featuring multiple potential sources of conflict with peer competitors, as well as the emergence of nuclear-armed regional powers. Such an environment poses more varied and complex conflict scenarios which could be, somewhat counterintuitively, potentially more stressing to NC2 than Cold War-type threats. This derives from three emerging developments: 1) increasing capabilities of a number of countries (not limited to only Russia and China) for attacks on U.S. satellites; 2) increasing foreign capabilities for global conventional strike; and 3) the fact that U.S. communications satellites are becoming more and more dual-purpose assets, providing command and control for conventional as well as nuclear operations.

Consider the impact of a regional conflict that escalates to a global conventional level 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. Conventional attacks on tactical communications capabilities—an attack on an Advanced Extremely High Frequency (AEHF) satellite, for example—could also degrade nuclear communications provided by that satellite. Escalation to nuclear use during such a conflict could thus occur within the context of severely degraded NC2.

In future conflicts, in which nuclear forces may be degraded, and which have the potential for further escalation, a president is likely to seek a broad range of consultations with senior advisors, allied leaders, and possibly even with adversaries. Credible, survivable, and enduring connectivity with forces, under the most stressing environments and conditions of warning and alert, both enables flexible force execution under presidential authority, and conveys an important message that U.S. forces cannot be neutralized by attacks on the NC2 system.

## **Resilience**

The other force quality necessary for adaptability in an uncertain world is resilience. Resilience in general is the ability to withstand, recover from, or adjust to adverse change in order to mitigate risk and maintain effectiveness.<sup>132</sup> For U.S. nuclear forces, the adverse change could take the form of unfavorable geopolitical developments, operational challenges, or technical difficulties. For example, U.S. relations with Russia or China, each a nuclear-armed great power, could worsen to the point of an increased likelihood of conflict and a greater degree of competition in the military sphere. As noted above, such a development certainly is plausible. Another possibility is that improvements in opposing offensive or defensive capabilities could undermine the survivability or effectiveness of one or more elements of the U.S. nuclear force. With regard to technical difficulties, a significant defect could appear in an entire warhead type, or delivery vehicles of one type could experience a common structural, mechanical, or electronic problem. Dangers along these lines have occurred in the past and could recur in future years, perhaps with limited warning.

The resilience to deal with threatening political, military, and technical changes can be found in: 1) the U.S. nuclear force posture as it exists today; 2) that posture modified by remedial measures short of added hardware; 3) upgrades of existing delivery vehicles or weapons; and 4) the development and deployment of next-generation arms. The choice of alternatives from these general categories will be determined not only by the particular threat to be met and the feasibility and cost of different options, but also by the time available for taking action. Given the timelines involved, the alternatives for adapting to the exigencies of a crisis lasting days or weeks will be more limited than those for adapting to the challenges of an extended military rivalry.

## **Sources of Resilience in the Nuclear Force**

**Strengths of the extant force posture.** There is some resilience inherent in the current nuclear force posture that is a function of its force structure, alert levels, nuclear weapons stockpile and employment doctrine. The different elements that comprise the force structure—SSBNs, ICBMs, bombers, and DCA—are not all vulnerable to a single type of attack. An opponent's ballistic missiles with high-accuracy delivery and high-yield warheads could threaten

U.S. silo-based ICBMs, weapons storage sites, aircraft at main operating bases, and in-port SSBNs. Air defenses could endanger the in-flight survivability of U.S. bombers, cruise missiles, and DCA, but not that of ICBMs and SLBMs. (The Russian S-500 surface-to-air missile system now under development reportedly will have some capability against both air-breathing delivery vehicles and payloads from intercontinental-range ballistic missiles.)<sup>133</sup> Similarly, missile defenses could intercept some number of ballistic missile payloads, but not necessarily aircraft or cruise missiles.

As a consequence, opponents seeking to conduct comprehensive disarming attacks against the U.S. nuclear force face a complex, multifaceted problem requiring that resources be divided among various offensive and defensive capabilities. Improvements in one offensive or defensive capability would not place at risk the entire U.S. force.<sup>134</sup> At the same time, a force structure with different elements means that a technical difficulty affecting one element (perhaps airframe fatigue in a bomber type, diminished reliability of a guidance set for ICBMs, or trouble with a propulsion system for SLBMs) would not afflict the force across the board. In short, the triad of SSBNs, ICBMs, and bombers is a fundamental source of force resilience.

Part of the nuclear force is kept on high alert in peacetime. The ICBM alert rate is “near 100 percent.”<sup>135</sup> Of a total fleet of 14 SSBNs, 12 are deployable and roughly half of those are at sea at any given time, though not all of those are on full alert.<sup>136</sup> Bombers, however, have not been on alert since 1991, the year of the Soviet collapse,<sup>137</sup> although training and exercises for generating bombers to an alert status are carried out. Like bombers, a number of dual-capable aircraft in Europe were once maintained on alert during peacetime, with the ability to takeoff on nuclear missions within minutes, but their alert level has been greatly reduced since the late 1980s, with DCA “readiness requirements” now measured in months.<sup>138</sup> Keeping SSBNs and ICBMs on day-to-day alert helps demonstrate to friends and foes the operational credibility of U.S. deterrent threats, while contributing to the proficiency of submarine and missile launch crews. The high alert rate of ICBMs makes it possible for SSBNs and bombers to be maintained in peacetime at lower alert levels and deployed in more cost-effective ways.

In terms of resilience, peacetime alert of those forces helps to provide insurance against the possibility, however remote, of a surprise attack and also the possibility that U.S. command authorities would not order a higher level of alert prior to an attack, perhaps because the signs of an impending conflict appeared ambiguous or they feared the move would provoke escalation of a confrontation. In general, these are reasons to avoid dependence exclusively on force elements that must have warning and timely alert for their prelaunch survivability.

The nuclear weapons stockpile contributes to force resilience through its composition and size. Stockpile diversity hedges against problems with the safety, security, or effectiveness of a warhead or bomb type. Failure of one type would not leave the United States without a nuclear capability. Though less varied than in the past, the stockpile still contains a mix of several types of weapons. At present, there are two SLBM warhead types (W76 in two variants and the W88), two ICBM warhead types (W78 and W87), two bomb types for bombers (B61 in two variants and the B83), one warhead type for the ALCM (W80), and one bomb type for dual-capable aircraft (B61 in three variants).<sup>139</sup> The current plan for the long term is ultimately to reduce the number of weapon types from seven to five: three warheads for ICBMs and SLBMs, a single variant of the B61 (B61-12) for both bombers and DCA, and a modified existing warhead for the ALCM follow-on (the Long Range Stand-Off missile).<sup>140</sup> Should some weapon

types experience a serious problem, there are a sizable number of non-deployed warheads and bombs in the stockpile that might—depending on the nature of the problem—serve as replacements until a technical fix was found. W78 warheads might replace W87 warheads on ICBMs, for example, or deployment of more ICBM and bomber weapons might mitigate the loss of W76 warheads on SLBMs. (No substitution would be perfect, however, given the differences among weapon types, including their means of delivery.) As discussed below, non-deployed weapons in the stockpile also are available for uploading ballistic missiles and bombers in response to certain plausible changes in external threats.<sup>141</sup>

***Adaptation within existing capabilities.*** If necessary, the current nuclear force could be adapted to adverse military-technical or geopolitical changes through a number of measures that would not involve acquisition of new capabilities or the upgrade of existing delivery vehicles and weapons. These measures could include a change in tactics. For example, in response to improvements in Soviet air defenses in the late 1950s, notably the appearance of surface-to-air missiles able to intercept aircraft at high altitudes, U.S. bombers shifted from high- to low-altitude penetration of those defenses. Additional forward deployments are another kind of adaptive measure. Selective reallocation of tasks among force elements is yet another measure for responding to unfavorable developments. If, say, the effectiveness of bombers and cruise missiles to support deterrent threats were degraded significantly, greater reliance might be placed on ballistic missiles to support some U.S. response options. Along with the foregoing, increased alert level and weapon uploading are two other alternatives that would lend resilience to the existing nuclear force.

The alert level of elements within the force structure could be raised to counter a new threat to prelaunch survivability, increase force preparedness, or help deter escalation of a crisis. For example, when a threat to Strategic Air Command bases from Soviet long-range bombers and ICBMs emerged, again in the late 1950s, one-third of the bomber fleet was placed on routine ground alert (aircraft loaded with bombs and ready for takeoff), and a portion flew airborne alert sorties (a number of bombers were in the air at all times); these alert measures were of particular importance because the strategic nuclear force then was composed almost entirely of bombers.<sup>142</sup>

During the Cuban missile crisis, in which President Kennedy rated the odds of war at “somewhere between one out of three and even,”<sup>143</sup> additional bombers stood ground alert, one-eighth of B-52s were on airborne alert, medium bombers dispersed from their main bases to nearly three dozen military and civilian airfields, ICBM readiness was increased, SSBNs moved to launch positions, and nonstrategic aircraft and missiles assumed a higher alert status.<sup>144</sup>

To help deter Soviet intervention in the 1973 Arab-Israeli war by giving Moscow indications the United States was, as Secretary of State Henry Kissinger put it, “assembling our forces for a showdown,” more bombers were placed on ground alert, bombers that had been based on Guam for conventional operations in the Vietnam war returned to the United States, ICBM readiness increased, and a few more SSBNs were sent on patrols.<sup>145</sup>

Today, a heightened alert of the strategic nuclear force, for whatever reason, would most affect the bomber and SSBN fleets. Bombers, off alert for more than two decades, could be returned to ground-based alert status along with their tanker aircraft, and possibly even dispersed.

Additional SSBNs could be “surged” in a crisis to join those at sea.<sup>146</sup> Nearly all ICBMs, in contrast, already are on alert.

Non-deployed weapons in the nuclear stockpile could be uploaded on bombers and ballistic missiles in response to an increase in the offensive or defensive strength of an opponent (including a technological breakthrough), a stepped-up arms competition (including an opponent’s breakout from a nuclear arms treaty), or a confrontation that threatened to escalate to nuclear use. The ability to upload in fact could serve as a deterrent to each of those eventualities; frequent Russian discussions of U.S. upload capability offer some evidence of its deterrence potential.<sup>147</sup> In the New START ratification debate, U.S. uploading was described by Obama Administration officials, and by Sen. John Kerry, then-chairman of the Foreign Relations Committee, as an option that would discourage Russia from cheating on the treaty.<sup>148</sup> If, as considerable evidence suggests, Moscow currently is not abiding by the terms of the Intermediate-Range Nuclear Forces Treaty, the United States has a host of possible response options. Ultimately, uploading U.S. forces in response to violations might help to encourage Russian compliance with the agreement if that cannot otherwise be achieved or, if necessary, help offset the consequences of Russian noncompliance.<sup>149</sup>

The current administration and its two immediate predecessors took pains in their force planning and arms control positions to preserve force structure with capacity for uploading additional bombs and warheads. Besides its value in compensating for major technical problems with deployed weapons or delivery vehicles, this hedge was first adopted during the Clinton Administration out of concern that Russia might return as a hostile and threatening power.<sup>150</sup>

In its 1994 Nuclear Posture Review (NPR), the Clinton Administration determined that, in the words of then-Defense Secretary William Perry, “the United States needed to hedge against a reversal of reforms and the nuclear reduction process and a return to an authoritarian military regime in Russia hostile to the United States.”<sup>151</sup> While taking the position that “Russia is not the Soviet Union, nor is it an enemy,” the George W. Bush Administration justified an upload capability as insurance against the “re-emergence of a hostile peer competitor.”<sup>152</sup> For the Obama Administration, the hedge is required in the event of “a change in the international landscape,” in particular “a geopolitical surprise” that would “alter the U.S. calculus about the necessary composition of the deployed force.”<sup>153</sup>

Were there to be a renewed military rivalry with Russia or the appearance of another major threat, it would take many years before the United States could deploy new missiles, bombers, or nuclear weapons. As a consequence, the upload hedge is based on the existing force and stockpile. The Secretaries of Defense and Energy in the last year of the Bush Administration wrote that “the United States does not have the ability to produce new nuclear weapons” and that “in the absence of a production capability for new warheads, the United States retains a significant stockpile of non-deployed legacy weapons as a hedge against technical failure of a warhead type and against adverse geopolitical or operational developments that could require augmentation of the force.”<sup>154</sup> This statement was reaffirmed in the 2010 NPR and remains true today.<sup>155</sup>

**Table 1: Upload Potential of the Deployed U.S. Strategic Nuclear Force with the New START Force Structure**

Delivery Vehicle	Routine Force Loading			Uploading		
	Number of Delivery Vehicles	Weapons Per Delivery Vehicle	Total Weapons	Weapons Capacity Per Delivery Vehicle	Total Weapons Capacity	Upload Potential
Trident D5 SLBM	240	4 W76 or W88	960	8 W76 or W88	1,920	960
Minuteman III ICBM	400	1 W78 or W87	400	1 W87 or 3 W78	1,000 <sup>(b)</sup>	600 <sup>(d)</sup>
B-52H Bomber	41	0 ALCM w/ W80 <sup>(a)</sup>	0	12 ALCM w/ W80	528 <sup>(c)</sup>	528
B-2 Bomber	19	0 B61 or B83 <sup>(a)</sup>	0	16 B61 or B83	304	304

**Notes**

- (a) On a day-to-day basis, deployed bombers are not loaded with nuclear gravity bombs or cruise missiles, although these weapons are kept in storage facilities in or near bomber air bases.
- (b) Three hundred Minuteman III ICBMs can carry up to three warheads. Each remaining missile can carry only a single warhead.
- (c) Each B-52H can carry up to 20 ALCMs, but there are no more than 528 ALCMs currently in the inventory. This makes for an average of 12 ALCMs per B-52H.
- (d) In addition to the 400 deployed Minuteman III silos and their deployed missiles, 50 silos will be retained in a non-deployed but “warm” status, with their non-deployed missiles kept in storage. If the missiles were returned to the silos, and each missile armed with three warheads, the upload potential of the Minuteman III force would increase by 150 weapons.

**Sources**

*Number of Delivery Vehicles*

- Department of Defense, “Fact Sheet on U.S. Nuclear Force Structure under the New START Treaty,” April 8, 2014.

*Weapons Per Delivery Vehicle Without Uploading*

- *SLBMs*: Bureau of Arms Control, Verification, and Compliance, Department of State, “New START Treaty Aggregate Numbers of Strategic Offensive Arms,” January 1, 2014; and National Nuclear Security Administration, Department of Energy, *FY 2014 Stockpile Stewardship and Management Plan* (Washington, D.C.: National Nuclear Security Administration, Department of Energy, June 2013), p. 2-2.
- *ICBMs*: Amy F. Woolf, *U.S. Strategic Nuclear Forces: Background, Developments, and Issues*, RL33640 (Washington, D.C.: Congressional Research Service, October 22, 2013), p. 12; and National Nuclear Security Administration, Department of Energy, *FY 2014 Stockpile Stewardship and Management Plan*, op. cit., p. 2-2.
- *Bombers*: Edward L. Warner III, secretary of defense representative to post-New START negotiations, written response for the record, Senate Foreign Relations Committee, *The New START Treaty (Treaty Doc. 11-5)*, S. Hrg. 11-738, 111<sup>th</sup> Cong., 2d sess. (Washington, D.C.: GPO, 2010), pp. 265-266; and National Nuclear Security Administration, Department of Energy, *FY 2014 Stockpile Stewardship and Management Plan*, op. cit., p. 2-2.

*Weapons Capacity Per Delivery Vehicle*

- *SLBMs*: Woolf, *U.S. Strategic Nuclear Forces: Background, Developments, and Issues*, op. cit., p. 19.
- *ICBMs*: Woolf, *U.S. Strategic Nuclear Forces: Background, Developments, and Issues*, op. cit., p. 11; and Government Accountability Office, *ICBM Modernization: Approaches to Basing Options and Interoperable Warhead Designs Need Better Planning Synchronization*, GAO-12-831 (Washington, D.C.: Government Accountability Office, September 2013), p. 6.
- *Bombers*: Department of the Air Force, *U.S. Air Force Long-Range Strike Aircraft White Paper* (Washington, D.C.: Department of the Air Force, November 2001), p. A-1; and Maj. Gen. Roger Burg, USAF, director of strategic security, Office of the Deputy Chief of Staff for Operations, Plans, and Requirements, Headquarters U.S. Air Force, prepared statement in Senate Armed Services Committee, *Department of Defense Authorization for Appropriations for Fiscal Year 2008, Part 7*, S. Hrg. 110-201, Pt. 7 (Washington, D.C.: GPO, 2008), p. 56.

*“Warm” Status of Non-Deployed Silos and Missiles*

- “Senior defense official” cited in Robert Burns, “US Will Cut Deployed Nuke Missile Force By 50,” Associated Press, April 8, 2014.

Table 1 shows that the SLBMs, ICBMs, and bombers of the force planned within the limits of the New START Treaty would have the capacity to carry many more weapons than the numbers in their usual payloads. Uploading all deployed ballistic missiles, for example, would more than double the number of weapons they carry. The time needed to upload elements of the strategic



nuclear force would vary from weeks for bombers, months for SLBMs, and a few years for ICBMs.<sup>156</sup> According to the Defense Department, “[p]reference will be given to upload capacity for bombers and strategic submarines,” perhaps because of their shorter timelines, greater capacity (see table) and, in some cases, better prelaunch survivability than ICBMs.<sup>157</sup>

It should be kept in mind that upload potential is not equivalent to the number of weapons that actually could be uploaded. That number depends on both the size and makeup of the weapons stockpile. The stockpile currently has approximately 5,000 warheads.<sup>158</sup> At present, some 1,600 of those warheads already are loaded on deployed ICBMs and SLBMs.<sup>159</sup> As mentioned earlier, another “few hundred” gravity bombs are assigned to DCA. Of the remaining 3,000 or so weapons, a portion are inactive (non-operational) weapons that would not be available for uploading until limited life components were replaced (notably tritium-related components for boosting explosive yields to required levels); reactivation could take from six months to up to two-to-five years.<sup>160</sup>

In addition, the number of warheads or bombs of a particular weapon type in the non-deployed stockpile may be smaller than what would be necessary to take full advantage of the capacity available for uploading. Each B-52H bomber, for example, is capable of carrying 20 W80-armed ALCMs, but there are not enough ALCMs in the inventory to equip all operationally deployed B-52Hs with that number of missiles.<sup>161</sup> Similarly, while more W76 warheads could be uploaded on SLBMs, “[a]ll of the Navy’s W88 warheads are either operationally deployed or retained as spares to be used when deployed weapons are withdrawn for maintenance.”<sup>162</sup>

Although little more can be said at an unclassified level about U.S. upload capability, Defense Department officials have characterized the number of weapons that could be uploaded as “more than sufficient under New START.”<sup>163</sup>

**Modification with hardware changes.** Modification of existing delivery vehicles or weapons is another way of adapting the nuclear force to deal with changes in external threats. This could be done through such things as better guidance systems for missiles, upgraded defensive avionics for strike aircraft, and addition of new or upgraded weapons to bombers or missiles.

The B-52H fleet offers a good example of this form of resilience. Despite improvements in opposing air defenses, these bombers have remained in the nuclear force for more than a half century through, among other modifications, electronic countermeasure enhancements to defeat radars, short-range attack missiles to destroy surface-to-air missile sites and other targets (the missiles were removed from service in 1990), and two types of cruise missiles (the ALCM and now-retired advanced cruise missile) to enable bombers to strike targets from outside an air defense perimeter.

In the case of the ICBM leg of the strategic nuclear triad, the Minuteman III in its four-decade service life has had its original W62 warhead replaced by higher-yield W78 and W87 warheads that have increased lethality against hard targets.<sup>164</sup>

With regard to SLBMs, the W76 warhead for the D5 missile currently is undergoing a life extension program that includes the incorporation of a new arming, fuzing and firing system that provides “the detonation function at the correct fuzing height.”<sup>165</sup> Some years ago, the then-Director of Navy Strategic Systems Programs explained that “[w]ith the accuracy of D5 and Mk

4 [Mark 4, the reentry body containing the W76 warhead], just by changing the fuze in the Mk4...you get a significant improvement. The Mk4, with a modified fuze and Trident [D5] accuracy, can meet the original hard target requirement.”<sup>166</sup> As previously discussed, maintaining some capability to hold at risk or neutralize hard targets is valuable for flexibility and potentially for deterrence. Certain types of warhead modifications, it should be noted, would require work performed by a nuclear infrastructure that over time has been reduced in capacity and that now is only partially functional at any one time. Modification of a warhead type could take many years from concept development through completion. The time required would depend on the complexity of the modification, the number of warheads to be modified, and the status of the infrastructure.

In addition to modifications in delivery vehicles and weapons, some future combination of exigency, time, and money might make it necessary and feasible to increase the number of existing bombers that were operationally available (perhaps including, in extreme circumstances, aircraft previously converted to a conventional-only role) and restore and reload SSBN launch tubes and ICBM silos removed from accountability under New START.<sup>167</sup>

**Modernization of force elements.** If the existing force in part or in whole, even with the type of adjustments and modifications described, could not adapt adequately to evolving threats, the acquisition of new submarines, missiles, aircraft, or weapons could be deemed necessary. Force modernization through new development and production would allow for changes in quantity as well as quality. This modernization sometimes may be the only solution to a problem, but it typically is a lengthy and expensive route to resilience. According to the Defense Science Board, “it takes 20 years to field a replacement [for a nuclear delivery vehicle] from a ‘dead start.’”<sup>168</sup> Likewise, for a new bomb or warhead, the “construction and deployment time to a first weapon could take two decades or longer,” assuming a revitalized nuclear weapons complex.<sup>169</sup> With regard to expense, the next generations of SSBNs, bombers, and ICBMs will each likely have acquisition costs in the several tens of billions of dollars.

Resilience was essential for the U.S. nuclear force during the Cold War, when the Soviet Union made move after move with offensive and defensive deployments to gain advantages that undercut U.S. deterrent capabilities. U.S. force modernization, in turn, was a key part of resilience during those decades. The across-the-board strategic force modernization program in the late 1970s and early 1980s, for example, was undertaken in response to unfavorable geopolitical change (the end of détente and more aggressive behavior by Moscow), increased operational challenges (posed by the concomitant Soviet military buildup), and problems related to the aging of U.S. capabilities following the U.S. nuclear buildup of the early 1960s. The strategic force modernization efforts now planned—the Trident replacement SSBN, the Long Range Strike-Bomber, the Long Range Stand-Off missile, and the successor to the Minuteman III—are set in a less well-defined security context.<sup>170</sup> They appear not to be geared to competitive interactions with a particular opponent. Rather, they constitute an updated version of the current force, which will supersede that force when it finally becomes superannuated during the next two to three decades. As such, modernization at present appears driven more by the need for resilience against the effects of age than by a specific external threat, as was the case during the Cold War. Given the dynamic character of the threat environment, it is possible, of course, that at a future point force modernization again could be shaped largely by requirements related to deterring a particular adversary or a combination of adversaries.

Both modernization and modification of the nuclear force obviously depend on the nuclear weapons complex that produces and sustains the warhead stockpile, and the portion of the defense-industrial base (research facilities, manufacturing plants, and skilled workforce) that develops, builds, and maintains the submarines, missiles, aircraft, and component parts that make up the force. This diverse productive capacity, then, is also a source of resilience, and ensuring its health must be a critical task.

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## IV. Preserving and Enhancing Adaptability

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Previous sections of this report discussed the case for adaptability—flexibility and resilience—to help support deterrence and assurance for an uncertain future, and identified attributes that can provide adaptability. This section identifies actions the United States can consider to preserve and enhance adaptability for nuclear forces. This discussion is by no means meant to be comprehensive. Rather, it offers an initial look at some possible U.S. actions consistent with establishing flexibility and resilience as priority guidelines for deterrence and assurance purposes. This list of possible actions can help defense planners with efforts already underway for nuclear force modernization, design concepts for next-generation replacement systems, and identification of goals for any future pertinent arms control negotiations.

### How Much Adaptability is Enough?

The natural question to consider is: “How much flexibility and resilience are enough to provide adaptability for deterrence and assurance in the decades ahead?” As noted earlier, no definitive or static answer to that question is possible because requirements will shift with the threat environment, the extent to which allies feel assured, and the character of the opponents and contingencies in question.

One way to explore the potential adequacy and value of flexibility and resilience is through scenario war games and exercises. The U.S. Strategic Command conducts strategic force exercises such as Global Thunder and Global Lightning to evaluate procedures and readiness. These or other events could be used to explore scenarios that involve various threat developments, including new enemy capabilities or technical malfunctions in U.S. capabilities, and to help consideration of what types and levels of flexibility and resilience would have proved most valuable for deterrence and assurance. In 2010, then-Commander of U.S. Strategic Command, Gen. Kevin Chilton, stated in open testimony that the accountable deployed warhead ceiling of the New START Treaty, 1,550, is the lowest level he could endorse to preserve necessary U.S. force flexibility and diversity.<sup>171</sup>

In a highly dynamic environment, a priority goal for the United States should be to provide as much flexibility and resilience as possible, within likely practical constraints. U.S. leaders may choose to place priority on goals *other than* deterrence and assurance and emphasize guidelines *other than* flexibility and resilience. If so, the U.S. capability to support deterrence and assurance goals will be less than otherwise would be the case and the United States will run the risk of pursuing deterrence and assurance in less than the most effective manner practicable. In advance of setting alternative priorities, U.S. leaders should recognize and consider the potential tradeoffs involved, i.e., the degradation of the U.S. capacity to prevent war, sustain alliances, and counter WMD proliferation.

### Practical Constraints

A variety of practical constraints and planning assumptions will limit the possible near-term actions to enhance the adaptability of nuclear forces. At present, these constraints include

political, fiscal, legal (arms control commitments), and fact-of-life force posture considerations. For example:

- *Political*: A loose consensus will likely be sustained within and between the executive and legislative branches on a continued role for nuclear forces and some level of modernization. However, details of specific weapon-related programs and possible further reductions will be contentious.
- *Fiscal*: Overall funding for nuclear force sustainment and modernization is not likely to exceed the CBO estimate of about \$300-350 billion for 2014-2023.<sup>172</sup>
- *Legal*: New START will remain in force until it expires in 2021 (or 2026, if extended).<sup>\*</sup> The United States will likely continue to observe its commitments under the New START Treaty, the INF Treaty, and the U.S. Presidential Nuclear Initiatives of 1991 and 1992.
- *Nuclear-Capable Delivery Platforms and Vehicles*: The menu of modernization alternatives for existing weapons systems will remain limited for the near-to-mid term to the *Ohio* replacement submarine, the life-extended D5 SLBM, the Long Range Strike-Bomber, the Long Range Stand-Off missile, the Minuteman III successor, and the F-35A. The open questions are whether pursuit of these systems will be sustained and what number of systems of each type will be procured.
- *Nuclear Stockpile*: Planned stockpile modernization will focus primarily on life extension programs for existing warheads, safety and security upgrades, and consolidation of warhead types.
- *Infrastructure*: The aging Department of Energy (DOE) production infrastructure for nuclear warheads will not be fully operational unless and until long-term efforts to modernize plutonium and uranium facilities are completed.

These expectations may prove prescient, or not. As the discussion in Section II above emphasizes, the unfolding threat environment is highly dynamic and any straight line projections about the future are likely to be more or less off-the-mark. If, for example, Russian foreign policy continues to develop in increasingly aggressive directions, and/or if recent U.S. concerns about Russian arms control violations are exacerbated by findings of blatant, material violations, one or more of the above-listed expectations could easily no longer be relevant. In this regard, unlike the Minimum Deterrence narrative, the integrity and logic of the approach to deterrence and assurance presented in this study—one that highlights the importance of U.S. adaptability—is *not* predicated on a preferred, optimistic future. Rather, this approach focuses on the need to recognize the fragility of predictions about the future in a dynamic environment and the great value of the U.S. capacity to adapt to shifting threats and requirements. One or more of the above-listed conditions can and should be set aside or revised in a future study and the potential effects of that change examined as an excursion from this effort.

An initial look at near-term actions which could help protect and enhance flexibility and resilience is discussed below. Again, this look is far from a comprehensive review of actions that the United States could consider. It is, instead, an initial illustration of possible actions that could follow from an emphasis on flexibility and resilience, and would need to fit within the likely practical constraints identified above. For example, U.S. actions will need to adjust to current budget realities, or those budget realities themselves would need to be adjusted to

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<sup>\*</sup> New START ceilings include a limit on accountable warheads of 1,550 and a limit on deployed strategic launchers (bombers and missiles) of 700. The actual number of deployed warheads will be higher given the bomber counting rule that equates only a single weapon with each bomber.

accommodate critical actions. To the extent that the latter is necessary but not feasible, tradeoffs would need to be made among those possible steps intended to protect and enhance flexibility and resilience.

The following suggestions for consideration include some pertinent “to dos” and some “not to dos” in support of U.S. flexibility and resilience. Do we know that a failure to follow these would lead to the future failure of deterrence or assurance? No, we do not. But, the United States would likely be less able to adapt as may be necessary to a shifting threat environment for the purpose of supporting the most effective deterrence and assurance strategies practicable.

### **Flexibility in the Existing Nuclear Force**

The flexibility-related attributes discussed earlier are provided currently by a collection of one-of-a-kind weapon delivery systems and an aging, life-extended stockpile of different types of nuclear warheads. Currently, flexibility may be viewed as somewhat fragile because a systemic technical problem or operational effectiveness degradation in one leg of the nuclear force could eliminate or degrade significantly one or more aspects of flexibility. Countries such as Russia and China may seek to constrain U.S. force flexibility by increasing capabilities to attack U.S. deterrent forces offensively, thereby reducing the survivability of U.S. deterrent forces and limiting U.S. deterrent threat options.

### **Preserving and Enhancing Flexibility**

Given the importance of flexibility for deterrence and assurance in a dynamic and uncertain environment, the United States should make a conscious effort to preserve existing nuclear force capabilities that provide flexibility and, where possible, enhance flexibility for the future. Specific actions that can contribute to this goal are discussed below.

### ***Survivability***

For survivability, retaining a nuclear triad will be important. All legs of the triad contribute to overall survivability. ICBMs should continue to be maintained at a high alert rate and retained in numbers large enough so that no nuclear-armed adversary can be confident of a disarming first strike on U.S. land-based forces. Analysis of alternatives for the follow-on ICBM should consider basing options that would enhance survivability. Strategic bombers should continue to be based at multiple air bases, be prepared to maintain a ground alert—perhaps for an extended period—if the threat to their prelaunch survivability increases, and have the ability to disperse and deploy if warranted. This bomber readiness could be particularly important as a hedge against an unexpected technical problem in another leg of the triad. SSBNs should be of sufficient number and readiness to meet national requirements and to keep about half at sea at all times. In general, ballistic missile submarines on patrol have been assumed to be survivable; however, there are no guarantees that a determined adversary will not be able to develop a combination of technology advancements and operational procedures to track and attack U.S. SSBNs, even when deployed. This would be particularly true if reductions or elimination of one or both of the other legs of the triad enabled an adversary to devote more resources to ASW. In 2012, the Chief of Naval Operations, Admiral Jonathan Greenert, cautioned that SSBN survivability should not be taken for granted. Greenert said, “The rapid

expansion of computing power... ushers in new sensors and methods that will make stealth and its advantages increasingly difficult to maintain above and below the water."<sup>173</sup>

To aid survivability, the nuclear triad should be retained to present great complexity and uncertainty to any adversary that might contemplate a disarming nuclear strike on the United States. The ability to increase the alert rates of bombers and SSBNs in response to adverse technical or geopolitical changes is a form of resilience that preserves flexibility by maintaining the prelaunch survivability of the strategic nuclear force. In addition, the ability to disperse bombers should be exercised periodically.

### ***Payloads and Weapon Yields***

Plans currently call for the inventory of nuclear warheads to be reduced in number and type. A life extension program for B61 bombs will replace four (of five) versions of the B61 with a single, life-extended version—the B61-12. Also, two warhead types will be replaced by the development of a replacement warhead that is compatible with both ICBMs and SLBMs.

At present, there are no plans to life extend B61-11 and B83 bombs; a Department of Defense (DoD) official indicated that both could be retired.<sup>174</sup> Both bombs possess unique attributes that contribute to the diversity of U.S. response options and, therefore, flexibility. The B61-11 is the only nuclear earth-penetrating weapon in the U.S. inventory; the B83 is the only megaton-class nuclear weapon.<sup>175</sup> Eliminating the B61-11, the only nuclear earth-penetration capability in the U.S. arsenal, could harm deterrence goals by strengthening adversary perceptions that leadership and other valuable assets would be invulnerable when in hardened underground facilities. Therefore, it would be prudent for the United States to maintain such a capability to hold these facilities at risk to support deterrence. B61-11 earth penetrating weapons (or a suitable replacement) should be included in plans for modernization.

Plans to consolidate four types of B61 bombs into a single variant and to retire the B61-11 and B83 will reduce flexibility by decreasing the diversity of weapon yields and by reducing the maximum yield for B61s. Instead of multiple B61 variants, each with different yields, nuclear planners will have only one type of B61 bomb to consider for target planning. According to one source, the B61-12 bomb will have a maximum yield that is less than the highest yield B61 version that it replaces.<sup>176</sup> A DoD official maintains that the increased accuracy of the B61-12 will offset the reduction in yield and will maintain the "current military capabilities of B61 weapons."<sup>177</sup> If flexibility for future contingencies is a priority goal, DoD and NNSA should keep open the option of deploying nuclear gravity bombs with a higher maximum yield than planned for the B61-12. Options include retaining the B-83. A bomb with a higher maximum yield would mitigate the possible degradation of accuracy should adversary countermeasures or U.S. technical problems negate the modest accuracy improvement planned for the B61-12.

At present, all nuclear weapons that provide low-yield options reside with the air-breathing weapon delivery systems.<sup>178</sup> Flexibility would be enhanced by developing and certifying low-yield options for the ballistic missile legs of the triad—ICBMs and SLBMs. Relatively low-cost modifications to existing warheads such as deploying "primary only" versions of warheads, could help provide this option. Once certified, these warheads—modifications of existing warheads—could be deployed to provide varying mixes of weapon yields on ballistic missiles in support of deterrence. If one or more problems with the air-breathing nuclear forces occurs,

having other low-yield options readily available for deployment would provide the flexibility to restore quickly a broad range of weapon yields for the deployed force. For the reasons discussed in the section on attributes for flexibility and resilience, this option would help ensure that the United States could employ low-yield nuclear options on any leg of the triad. This could help strengthen deterrence by making U.S. threats more credible in the minds of adversary leaders. Nervous allies who are watching Russia, China, and others develop new nuclear capabilities, including low-yield weapons, could also find such a U.S. capability to be assuring.

### ***Ability to Forward Deploy***

As noted earlier, forward-deployed nuclear forces in or near allied countries provide tangible evidence of strong U.S. interest in the security of those countries and readiness to provide for their security. Therefore, the ability to base U.S. nuclear capabilities in or near the territory of U.S. allies should be retained. This calls for proceeding with modernization plans for the DCA capability over the near- to mid-term, moving ahead with nuclear certification plans for the F-35A and the B61-12 life extension program, and ensuring that the infrastructure is in place for deploying from home bases. In addition, resilience would be improved if the readiness level of deployed DCA units could be increased more quickly. Streamlined procedures for readiness upgrades and periodic exercising of this option could be valuable in this regard.

The ability to forward deploy nuclear-capable heavy bombers is also valuable, but does not obviate the value of DCA. The New START Treaty prohibits the basing of strategic offensive arms outside the national territory of each country, but does permit bombers to be forward deployed on a *temporary* basis.<sup>179</sup> New START requires a variety of formal notifications in advance of and following such deployments.<sup>180</sup> One way to improve this flexibility-related attribute for forward deployment is for DoD to identify and prepare emergency nuclear weapon storage sites in appropriate regions. Advance preparations could include the installation of infrastructure and security features that could be activated, when needed. As noted earlier, emergency deployments to Northeast Asia or the Middle East might be needed sometime in the future to strengthen deterrence and assurance.

### ***Intercontinental Range and High Delivery Accuracy***

Strategic forces currently possess intercontinental range and some weapons have high delivery accuracy. As forces are life extended and modernized, opportunities to improve accuracy further should continue to be a goal, whenever feasible. In particular, accuracy improvements should be included in planning now underway for the follow-on ICBM and Long Range Stand-Off missile. Also, guidance and accuracy improvements for nuclear gravity bombs, such as modifications similar to those for the B61-12, should be a goal.

### ***Declaratory Policy***

For decades, U.S. declaratory policy for nuclear weapons has not limited U.S. nuclear deterrence to nuclear threats. Rather, U.S. policy has been intended to support the deterrence of a broader range of threats and, thereby, contribute also to the assurance of allies. In 2009, the bipartisan Congressional Strategic Posture Commission concluded that abandoning this long-standing policy would be unsettling to some allies and could undermine some aspects of deterrence.<sup>181</sup>



However, recently some Minimum Deterrence proposals for large cuts in U.S. nuclear forces have called for a conscious narrowing of roles for the nuclear force to affirm the adequacy of small numbers. One such proposal is for a U.S. declaratory policy for nuclear weapons referred to as “sole purpose,” that is, the United States should “reserve for nuclear weapons just one mission: To deter the use of nuclear weapons.”<sup>182</sup> This is an alternative formulation of a “no first-use” declaratory policy, also advocated by Minimum Deterrence, that would, as the name suggests, preclude the U.S. first use of nuclear weapons under any circumstances.

A “sole purpose” or “no first-use” declaratory doctrine could eliminate the intended deterrent role for U.S. nuclear weapons against any non-nuclear threat, including chemical and biological weapons (CBW) threats. Such a declaratory policy, if seriously undertaken, could severely limit the flexibility of U.S. deterrence efforts by precluding the option of applying nuclear deterrence to potentially severe non-nuclear threats, including those posed by an opponent’s biological or chemical weapons. Thus, sole purpose would potentially degrade deterrence against severe non-nuclear threats; it also could degrade assurance for allies who are concerned about such threats. The 2010 NATO *Strategic Concept* did not adopt “sole purpose,” and instead commits members to “ensure that NATO has the full range of capabilities necessary to deter and defend against any threat.”<sup>183</sup> If preserving or advancing flexibility is deemed a priority guideline for the United States, a “sole purpose” nuclear doctrine must be rejected unless and until more benign threat conditions no longer pose these potential deterrence and assurance tradeoffs—particularly vis-à-vis biological threats. This appears to have been the conclusion of the 2010 NPR regarding “sole purpose.”<sup>184</sup>

### ***Non-Nuclear Strategic Capabilities***

Non-nuclear capabilities such as prompt long-range offensive weapons and ballistic missile defenses can also contribute to flexibility. Offensive capabilities, such as prompt global strike, are still being evaluated and have not yet been deployed. As General Robert Kehler, then-commander of U.S. Strategic Command, noted in 2013:

Today, the only prompt global strike capability to engage potentially time-sensitive, fleeting targets continues to be ballistic missile systems armed with nuclear weapons. We continue to require a deployed conventional prompt strike capability to provide the President a range of flexible military options to address a small number of highest-value targets....<sup>185</sup>

If deployed, U.S. conventional prompt global strike capabilities would provide increased flexibility by adding to the diversity of explosive yields for prompt U.S. strategic deterrent threats. In some situations, this could strengthen deterrence by making more credible the potential of a prompt U.S. offensive response to adversary action. Depending on the situation, it may appear much more credible for a U.S. President to employ a prompt conventional weapon, and not have to deliberate over whether or not to cross the nuclear threshold.

Promising concepts for non-nuclear, intercontinental-range offensive weapons appear to include long-range missiles carrying hypersonic delivery vehicles and non-nuclear payloads that could be based on SSGNs (*Ohio*-class submarines converted to carry cruise missiles) and newer *Virginia*-class attack submarines,<sup>186</sup> or air-launched from heavy bombers. Candidates for air-

launched, long-range conventional missiles that would provide enhanced flexibility include derivatives of the X-51A Waverider missile, which could be carried under the wing of a B-52H.<sup>187</sup> Congress has declined to fund a relatively low cost and near-term conventional warhead option for the Trident SLBM. And, the average annual congressional appropriation for the “Prompt Global Strike Research” combined program from fiscal year (FY) 2008 to FY2013 has been \$148.10 million, while the Defense Department request for FY2014 was only \$65.4 million. If conventional prompt global strike is to become a viable option for increased flexibility in the future, then it will likely need much more support from Congress, the White House, and the Defense Department.

Defenses also can contribute to flexibility; the availability of ballistic missile defenses provides a greater range of options for the President. For example, in the event that intelligence is received regarding preparations for the launch of a ballistic missile by a country such as North Korea, the president could have several possible options, including: a preemptive strike with nuclear or, if available, prompt conventional weapons; or, waiting and relying on U.S. defenses while holding any offensive response in reserve. Such a defensive option could be credible and helpful to avoid escalation. It also could help to assure protected allies, and deny opponents any anticipated value in striking or threatening to strike the United States, i.e., deterrence by denial.

### **Resilience in the Existing Nuclear Force**

On the positive side of the resilience ledger, the current nuclear force and employment strategy manifest some attributes that support resilience. Specifically, the force is resilient to some technical failures. In the event of a reliability failure of a type of warhead or a weapons system, some non-deployed warheads could be deployed to compensate. Protecting this aspect of resilience in the future will be dependent on retention of force diversity, upload capacity in the different legs of the triad, and a stockpile of non-deployed warheads.

On the negative side, the supporting infrastructure generally is not highly responsive to changing needs that depend on prompt action by the defense-industrial base for hardware modifications, modernization of weapons or warheads, or new production. Many elements of the development and production infrastructure for strategic forces ground to a halt after the Cold War, and some remain idle.

Unfortunately for resilience, trends show little prospect for near-term improvement. Warheads in the non-deployed stockpile are old and those retained will require life extension programs to remain viable; current efforts to restore full functionality to the warhead production complex will not be complete for a decade or more.

### **Preserving and Enhancing Resilience**

Important considerations for force sizing include the numbers of weapons and unique capabilities needed for deterrence, assurance, and for responding to deterrence failure. *Minimum Deterrence: Examining the Evidence* discussed how a force that is designed to support only the policy goal of deterrence can differ significantly in composition and size from a force with capabilities for a more comprehensive set of policy goals.<sup>188</sup> For the future, as

emphasized above, another consideration—resilience—becomes increasingly important and also should be included as a priority factor in planning force size and composition.

### ***Force Structure Composition and Sizing***

As discussed earlier, the triad and DCA provide a diverse collection of capabilities in the existing force. Uncertainty over what might be important in the future for deterrence and assurance caution against eliminating any leg of that force; we cannot know in advance what aspect of the force might be adaptable to best support deterrence and assurance. Therefore, the triad and DCA should be retained to preserve resilience.

Currently, total force capacity and upload capacity are being reduced as the result of arms control treaties and deliberate downsizing. Once New START reductions are fully implemented (by February 2018), the total capacity of the force will have been reduced by approximately 600 warheads.<sup>189</sup> In addition, DoD plans call for each *Ohio*-class replacement SSBN to be equipped with 16 SLBM launch tubes, instead of the 24 launch tubes on each *Ohio*-class SSBN. As a result, for a force of 12 deployable SSBNs, the total warhead capacity of the future SSBN force will be 768 less than the capacity of the current force of *Ohio*-class SSBNs. New START reductions combined with SSBN modernization plans will likely decrease the total capacity of the nuclear force by approximately 1,000 warheads.<sup>190</sup> This makes it all the more important to maintain the upload capacity of the remaining force and to ensure that follow-on ballistic missiles and the next-generation bomber have reserve capacity that can be used for uploading.

Over the past two decades, the United States has relied on an upload hedge while the nuclear weapons research and production complex was being resized, reconfigured, and modernized. The completion of that difficult task is still a decade or more away. At least in the near- to mid-term, sufficient numbers of existing delivery platforms, extra capacity for a hedge, and a non-deployed stockpile of warheads will be needed to provide important options for resilience. Therefore, for at least the next decade, arms control negotiations should include the goals of protecting the U.S. nuclear force structure and preserving hedge capacity.

For example, empty Minuteman III silos will be kept in a “warm standby” status.<sup>191</sup> This option is preferred by the Air Force as a means of saving costs and retaining the integrity of the command-and-control system for ICBMs,<sup>192</sup> but it also could contribute to resilience if unfavorable developments required the deployment of additional land-based ballistic missiles. When needed, either missiles intended for testing or new missiles produced on an expedited basis could be placed in the silos. Steps to remove SLBM launch tubes from accountability under the New START limits should not be irreversible. The ability to increase the number of warheads on ICBMs and SLBMs should be retained. With regard to the bomber force, options should be retained for augmenting the force with additional nuclear-capable B-52Hs if such a step proves warranted by adverse international, military, or technical changes.

In addition, consideration should be given to measures that would reduce the time needed to upload the strategic nuclear force. Confrontations with the potential to escalate to the nuclear level could have a duration of weeks rather than months, let alone years. Capabilities to upload more weapons in a shorter period and to support sustained bomber alert postures not only could increase force preparedness, but also could help deter confrontations or their escalation.

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### **Force Modernization and Next-Generation Weapon Systems**

Planning for nuclear force modernization should include the need for adaptability when developing replacements for existing nuclear weapons systems. A 2013 Naval Studies Board (NSB) report examined options to respond to capability surprise. The advice was directed at general purpose naval forces, but it is also applicable for resilience for strategic forces. The NSB recommended that future weapon delivery systems be designed to facilitate resilience “to include the capacity for quickly adding or modifying capability.” The report also stated that the force will likely need to adapt in ways that cannot currently be envisioned.<sup>193</sup> For strategic forces, this suggests that planning for next-generation weapons systems should consider resilience as an important design requirement. One feature that would facilitate adaptability in the future is for designs for future weapons not to constrain payload weight and volume to only that needed for the current inventory of highly optimized warheads. Studies for nuclear force modernization, including the *Ohio*-class replacement SSBN, follow-on ICBM, Long Range Strike-Bomber, and Long Range Stand-Off missile, should consider an extra margin of weight and volume for potential future payload needs. Where feasible, including this margin would be prudent and would contribute to resilience. The follow-on ICBM, for example, should not have a payload so constrained that it can only carry a small, single warhead. By the same token, the Long Range Strike-Bomber, like the B-52H and B-2, should have a payload measured in the few tens of thousands of pounds and be capable of accommodating various types of weapons. In addition, DoD planning should include the need for upload capacity for the future nuclear force. Finally, DoD should also keep open the option of producing *Ohio*-class replacement SSBNs beyond the 12 now planned.

**Nuclear command and control.** The nuclear command-and-control systems should be modernized to protect against obsolescence and emerging vulnerabilities. Potential adversaries are actively developing cyber and counter-space capabilities to disrupt and deny U.S. command-and-control capabilities. For deterrence, it likely is important for the United States to stay ahead of the threat and for foes to be aware that U.S. NC2 capabilities can survive their intrusions. Modernization of portions of the NC2 system are already under way and should continue as a priority. In particular, efforts that should be continued without further delay include: the evolution of survivable satellite communications to Advanced Extremely High Frequency satellites; providing survivable communications to forces (for example, low-frequency and extremely-high frequency terminals for B-2 operations, command-and-control updates for Minuteman III missiles); deployment of modern early-warning satellites (Space-Based Infra-Red System satellites); and, improved conferencing for senior leaders.

Over the longer term, in order to provide the president with more flexible and resilient NC2 options suited to the spectrum and complexities of potential future crises and conflicts, modernization programs for NC2 should address:

- Improved senior leader conferencing capabilities, to include high-quality voice, video and data transmissions that are resilient in stressed environments.
- Options for resilient communications to hedge against loss of satellite communications to conventional anti-satellite (ASAT) attack. Options include small, single-purpose “cheap-SATs” to replenish lost communication, or Global Positioning System (GPS) functionality and long-range airborne communications relay networks that could be deployed on short notice.

- Examination of systems and technologies needed to detect emerging threats, such as close-in submarines, and to provide early warning of cruise missiles launched from those submarines.

**Nuclear weapon developments.** The 2010 NPR,<sup>194</sup> and other official documents, establish a policy prohibiting any research and development of new nuclear capabilities.<sup>195</sup> While senior U.S. military leaders have stated that no new nuclear capabilities are needed at this time,<sup>196</sup> this self-limiting U.S. policy has not been reciprocated by others. In addition, it has generated unproductive policy commentary over what represents a “new” capability. Legalistic arguments over what is “new” diverts attention from more pertinent policy deliberations over what capabilities are needed to deter and assure and how these capabilities might need to adapt in the future.<sup>197</sup> Senior U.S. officials should be explicit that, although there may be no DoD requirement for the development of new nuclear weapons at this time, the United States retains the option and capability to do so, if needed.

To enhance resilience, innovation at the national laboratories in nuclear weapon design, production and employment should be encouraged, not discouraged. The national laboratories should explore the potential for new development to sharpen technical skills, understand what adversaries might be developing, and be responsive to rapidly emerging needs. Encouraging creativity through low-cost studies and prototyping can provide benefits for resilience as well as helping to understand what nuclear innovations are actively being developed and produced by U.S. adversaries. Periodically, the laboratories should be able to “certify” a prototype warhead design in order to exercise nuclear design skills that, otherwise, will continue to atrophy. For the United States, low-cost studies and prototyping would help reestablish some ability to respond to unforeseen needs for the nuclear force. One example of a low-cost prototype that would enhance flexibility and resilience is a higher yield version of the B61-12. The ability to deploy such an option without lengthy development would be important if the planned accuracy upgrade for B61s is not achieved. In addition, some concomitant benefits for deterrence and assurance may result from the awareness that U.S. nuclear weapon research is not dormant.

**Warhead stockpile.** In order to be able to respond to technical failures in the force and adverse geopolitical developments, a stockpile of non-deployed warheads will continue to be important. As noted earlier, the United States has relied on an upload hedge supported by non-deployed warheads while the goal of a reconfigured, modernized, operational nuclear weapons complex is still a decade or more away. Therefore, for at least that time, the stockpile of non-deployed warheads should be maintained and available to support an upload hedge capability.

**Defense-industrial base.** At present, the status of the infrastructure for strategic weapon systems and warheads is widely varied. Some elements, such as cruise missile design and production, are fully operational, while others, such as production of plutonium components for nuclear warheads, are still many years away from reestablishing a full operational capability. The U.S. solid rocket motor industrial base is dramatically less capable than it was during the Cold War, casting some doubt on the U.S. ability to build a new generation of missiles in a timely way should the need arise.

This lack of a fully operational infrastructure for nuclear delivery systems and warheads results in the United States not being resilient to challenging situations that necessitate timely hardware modifications, weapon modernization, or new developments. Concern over this aspect of

resilience is heightened by new nuclear weapon development and production by potential adversaries, including Russia and China. With fully operational and active production lines for weapons systems and warheads, these countries are much better able to respond to changing needs than is the United States. Modernization plans for the nuclear weapons complex and sustainment of critical technologies in the defense-industrial base are important aspects for resilience. Modernization of the nuclear weapons infrastructure—especially that supporting uranium and plutonium operations in the manufacture of nuclear warheads—should proceed without delay.

For plutonium component production, NNSA should continue to work toward the existing goal of 30 plutonium pits per year by 2021 and up to 80 pits per year by 2030.<sup>198</sup> Plans for production facilities should be modular so that, if a larger production rate is needed, capacity could be expanded more readily to meet the need.

**Non-nuclear strategic capabilities.** Development and production of non-nuclear strategic capabilities also could contribute to resilience. Resilience is enhanced by active development programs and production capabilities for strategic offenses and ballistic missile defenses. In particular, the development and production of advanced conventional weapons could contribute to the responsiveness of industrial capabilities for guidance and navigation technologies for nuclear and conventional offensive weapons, as well as for solid rocket motor production readiness for offensive and defensive weapons.

In short, to enhance resilience, nuclear force planning should protect force structure and upload capacity, restore operability and innovation to the supporting industrial base, and retain a stockpile of non-deployed warheads—at least until all of the industrial capabilities of the nuclear weapons complex are fully functional. In addition, the United States should continue efforts to develop and deploy non-nuclear capabilities, both offensive and defensive.

### **U.S. Arms Control Policies**

U.S. arms control policies can contribute to or undermine the flexibility and resilience of U.S. forces. In principle, arms control could help, for example, by limiting an opponent's capability to threaten the survivability of U.S. forces. This was a near-constant, if elusive, U.S. goal during the Cold War for SALT and START. As a bipartisan group of senior officials, John Deutch, Jim Woolsey and Brent Scowcroft, observed in this regard in 1983:

Our major effort over 17 years of arms control negotiations on strategic offensive systems has been dedicated to preserving the survivability of our own silo-based ICBMs. To this end we have used, and wasted, much negotiating leverage in trying to get the Soviets to agree to restrictions on their large MIRVed ICBMs. They have noted our concern about survivability and have cheerfully made it worse with their massive investments in the programs we most want to restrict.<sup>199</sup>

Arms control also could avoid undercutting flexibility and resilience by preserving U.S. options that are key to these force characteristics. The key point here is that advancing, or at least protecting, U.S. adaptability should be a primary guideline for U.S. arms control policies. The 2002 Moscow Treaty, for example, did so to some extent by avoiding ceilings on strategic launchers, even while establishing much lower warhead ceilings for U.S. and Russian

operationally deployed strategic warheads. This helped to preserve the U.S. capacity to reconstitute forces in the future, if necessary. Correspondingly, as noted by senior officials in the Obama Administration, the U.S. potential to reconstitute nuclear forces can help deter an opponent's violation of arms control limits.<sup>200</sup>

All arms control initiatives should be examined carefully for potential unintended consequences that would degrade U.S. flexibility and resilience. Doing so could help to avoid repetition of past unfortunate experiences. For example, the SALT I Interim Agreement was believed in Washington to place a fixed ceiling on Soviet "heavy" ICBM launchers. However, the actual treaty language lacked an effective, specific definition of a "heavy" ICBM, and the Soviets subsequently exploited that omission by deploying far more heavy ICBMs than expected by the United States, significantly challenging the survivability of U.S. ICBMs and other important forces.<sup>201</sup> A serious Red Team effort to avoid such unintended consequences in the future should be an integral part of U.S. arms control policy intended to contribute to flexibility and resilience.

In 2012, then-Commander of Air Force Global Strike Command, Lt. Gen. James Kowalski, cautioned that any further reductions, "need to be bounded by the realpolitik of international relations."<sup>202</sup> Indeed, the pace and apparent intent attending contemporary Russian nuclear modernization, the near-complete absence of transparency attending Chinese nuclear programs, and the considerable potential for rapid and surprising threat developments, suggest strongly that a priority objective of U.S. arms control policy should be to advance or preserve the adaptability of U.S. forces. Several immediate suggestions follow from an overarching guideline that U.S. arms control policy consciously seek to support deterrence and assurance goals by advancing or safeguarding flexibility and resilience. For example, in principle U.S. arms control policy could:

- Help preserve U.S. force survivability across the triad by constraining the deployment of opponents' counterforce capabilities;
- Help preserve U.S. DCA deployment options abroad, including in NATO-Europe, Northeast Asia, and the Middle East;
- Help preserve U.S. flexibility via a "freedom to mix" and, correspondingly, avoid extensive sublimits on U.S. systems in any further reductions;
- Avoid legally "locking in" reductions for long periods of time that would constrain the U.S. capacity to adapt to future changes in the threat environment in any new negotiated ceilings;
- Avoid limitations that would compel U.S. forces to rely for their survivability on practices that work against flexibility, such as launching ICBMs on warning or under attack, or on ICBMs that must "dash" on warning (one concept considered in past U.S. efforts to find a survivable basing mode for the MX or *Peacekeeper* ICBM);<sup>203</sup>
- Avoid treaties or agreements that would lock in further restrictions on the U.S. force reconstitution capacity until it is clear that such steps will be unnecessary;
- Avoid further cuts in force structure until next-generation missiles and bombers are in production. Without operating production facilities, further reductions would take many years to reverse and would limit resilience and flexibility. The same holds true of non-deployed nuclear warheads; and,
- Avoid negotiated limits on non-nuclear capabilities that could particularly undercut adaptability, potentially including limits on BMD and conventional prompt global strike.

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In the event that priorities *other than* deterrence and assurance take precedence in the formulation of U.S. arms control policy, and the prospective requirements for deterrence and assurance are subordinated in tradeoffs among priorities, U.S. arms control policies could work against flexibility and resilience and thereby effectively reduce the U.S. capacity to deter foes and assure allies. It is important for U.S. policy makers to recognize in advance such tradeoffs and their significance when presented with priorities other than deterrence and assurance in the formulation of U.S. arms control policy.

For example, Minimum Deterrence proposals often assert that in order to advance the goal of nuclear nonproliferation the United States must further deeply reduce the number of U.S. nuclear weapons, including the withdrawal of U.S. nuclear forces deployed to NATO-Europe. While the supposed beneficial linkage of further U.S. nuclear reductions to the advancement of nuclear nonproliferation is inconsistent with much empirical evidence,<sup>204</sup> such reductions could easily lead to the degradation of deterrence and, according to some allies, to the degradation of their assurance.<sup>205</sup>

### Summary

Table 2 provides a concise summary of the foregoing recommendations to help protect and enhance the adaptability of the U.S. nuclear force. The actions to support flexibility and resilience are organized in the table according to whether they pertain to the nuclear force structure, the modernization of the force, its posture (alert level and upload status), the associated stockpile of warheads, the defense-industrial base and nuclear infrastructure that support the force and stockpile, declaratory policy, or the potential limits on delivery systems and warheads of arms control measures.



Table 2: Actions that Could Protect and Enhance Flexibility and Resilience

Category	Action
<b>Force Structure</b>	
	Maintain the triad; preserve force structure
	Retain upload hedge capability, e.g., empty ICBM silos, ability to re-MIRV ICBMs
	Retain DCA (nuclear-capable F-35; B61-12)
	Designate and prepare contingency nuclear storage sites and bomber dispersal bases
<b>Force Modernization</b>	
	Modernize all triad legs
	Emphasize adaptability in modernization plans
	Base future force composition and size on policy goals for deterrence and assurance, recognizing the need for adaptability
	Upgrade accuracy of weapons
	NC2: Upgrade senior leader conferencing, early warning systems, and robustness of secure communications to strategic forces
	Develop prompt conventional global strike capabilities
<b>Force Posture</b>	
	Reject de-alerting proposals
	Maintain upload potential
	Develop ability to more quickly increase readiness of deployed DCA
	Use exercises/war games to evaluate options for adaptability
<b>Warhead Stockpile</b>	
	Retain non-deployed stockpile for hedge/upload
	Life extend or modernize B61-11 EPW
	Develop low-yield options for SLBMs and ICBMs
	Demonstrate competence for “new” nuclear capabilities
<b>Infrastructure</b>	
	Modernize nuclear warhead infrastructure
	Encourage innovation, studies, prototyping
	Develop non-nuclear capabilities
<b>Declaratory Policy</b>	
	Avoid “sole purpose” and “no first-use” policies, given their likely detrimental effect on flexibility and deterrence
<b>Arms Control</b>	
	In light of deterrence and assurance requirements, assess prospective arms control steps carefully, according to the priority goal of preserving or strengthening adaptability; identify and consider warily arms control steps and goals that would force tradeoffs degrading adaptability.

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## Notes

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- <sup>1</sup> Defense Science Board, *Capability Surprise Volume I: Main Report* (Washington, D.C.: Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics, September 2009), p. 1.
- <sup>2</sup> See for example, Victor Davis Hanson, "China's Version of the Old Imperial Japan," *The Washington Times*, January 9, 2014, p. B-3. See also the comments by Margaret MacMillan in, Ian Johnston, "Is it 1914 All Over Again?," *The Independent*, January 5, 2014, available at <http://www.independent.co.uk-that-started-wwi-says-a-leading-historian-9039184.html>.
- <sup>3</sup> National Intelligence Council, *Global Trends 2025: A Transformed World*, (Washington D.C.: GPO, November 2008), pp. x, 3, 62, available at [http://www.dni.gov/files/documents/Newsroom/Reports%20and%20Pubs/2025\\_Global\\_Trends\\_Final\\_Report.pdf](http://www.dni.gov/files/documents/Newsroom/Reports%20and%20Pubs/2025_Global_Trends_Final_Report.pdf). (Emphasis added).
- <sup>4</sup> As is well-recognized in, Department of Defense, *Deterrence Operations Joint Operating Concept*, Version 2.0 (December 2006), pp. 7-8, available at [http://www.dtic.mil/futurejointwarfare/concepts/do\\_joc\\_v20.doc](http://www.dtic.mil/futurejointwarfare/concepts/do_joc_v20.doc).
- <sup>5</sup> See Keith B. Payne, James Schlesinger, et al., *Minimum Deterrence: Examining the Evidence* (Fairfax, VA: National Institute Press, 2013).
- <sup>6</sup> Bruce Blair, et al., "Smaller and Safer," *Foreign Affairs*, Vol. 89, No. 5 (September/October 2010), p. 10.
- <sup>7</sup> Gareth Evans and Yoriko Kawaguchi, *Eliminating Nuclear Threats: A Practical Agenda for Global Policymakers*, Report of the International Commission on Nuclear Non-proliferation and Disarmament (Canberra: International Commission on Nuclear Non-proliferation and Disarmament, 2009), p. 194.
- <sup>8</sup> Payne and Schlesinger, *Minimum Deterrence: Examining the Evidence*, op. cit., pp. 13-14.
- <sup>9</sup> James Cartwright, et al., *Global Zero U.S. Nuclear Policy Commission Report: Modernizing U.S. Nuclear Strategy, Force Structure and Posture* (Washington, D.C.: Global Zero, May 2012), pp. 1-2, 6; Tom Nichols, "The Coming War with... the Soviet Union?" *The National Interest*, August 26, 2013, available at <http://nationalinterest.org/commentary/the-coming-nuclear-war-withthe-soviet-union-8945>.
- <sup>10</sup> James Acton, *Deterrence During Disarmament* (Abington, UK: Routledge, 2011), p. 22.
- <sup>11</sup> Quoted in, Bill Gertz, "Pentagon concerned by China's New High-Speed Missile," *Washington Free Beacon*, January 28, 2014, available at <http://freebeacon.com/pentagon-concerned-by-chinas-new-high-speed-missile/>.
- <sup>12</sup> Department of Defense, *Quadrennial Defense Review* (Washington, D.C.: Department of Defense, March 2014), p. 61, available at [http://www.defense.gov/pubs/2014\\_Quadrennial\\_Defense\\_Review.pdf](http://www.defense.gov/pubs/2014_Quadrennial_Defense_Review.pdf).
- <sup>13</sup> President Barack Obama, "Remarks by the President in Address to European Youth, Palais des Beaux Arts, Brussels, Belgium," (Washington, D.C.: Office of the White House Press Secretary, March 26, 2014), available at <http://www.whitehouse.gov/the-press-office/2014/03/26/remarks-president-address-european-youth>.
- <sup>14</sup> Quoted in, "Israeli Official: Iran to Have 50-100 Nuclear Warheads by 2024," *Washington Free Beacon*, June 9, 2014, available at <http://freebeacon.com/national-security/israeli-official-iran-to-have-50-100-nuclear-warheads-by-2024/>.
- <sup>15</sup> See, Chung-in Moon, Ildo Hwang, "Identity, Supreme Dignity, and North Korea's External Behavior: A Cultural/Ideational Perspective," *Korea Observer*, Vol. 45, No. 1 (Spring 2014), pp. 1-37.
- <sup>16</sup> *Ibid.*, pp. 4-5.
- <sup>17</sup> Richard Danzig, *Driving in the Dark: Ten Propositions About Prediction and National Security*, (Washington, D.C.: Center for a New American Security, October 2011), p. 14.
- <sup>18</sup> Defense Science Board, *Capability Surprise Volume I: Main Report*, op. cit., p. 1.
- <sup>19</sup> Thomas Schelling, "Foreword," in Elbridge A. Colby and Michael S. Gerson, eds., *Strategic Stability: Contending Interpretations* (Carlisle Barracks, PA: U.S. Army War College, Strategic Studies Institute, 2013), pp. vii-viii. Similarly, in early 2014, the Defense Science Board rightly reported in this regard that the "nuclear future" is "unlike the past" because: "Too many factors have changed, and are changing from our historic basis and experience developed throughout the Cold War...The actual or threatened acquisition of nuclear weapons by more actors—with

a range of motivations, capabilities, and approaches—is emerging in numbers not seen since the early days of the Cold War. Many of these actors are hostile to the U.S. and its allies, and of greater worry, they do not appear to be bound by established norms nor are they deterred by traditional means.” See, Department of Defense, Office of the Under Secretary for Acquisition, Technology and Logistics, Defense Science Board, *Task Force Report: Assessment of Monitoring and Verification Technologies* (Washington, D.C.: Defense Science Board, January 2014), p. 1, available at <http://www.acq.osd.mil/dsb/reports/NuclearMonitoringAndVerificationTechnologies.pdf>.

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<sup>127</sup> Office of the Deputy Assistant to the Secretary of Defense for Nuclear Matters, *Nuclear Matters: A Practical Guide* (Washington, D.C.: Office of the Deputy Assistant to the Secretary of Defense for Nuclear Matters, 2008), p. 39.

<sup>128</sup> Michael A. Miller, *U.S. Air Force Bomber Sustainment and Modernization: Background and Issues for Congress*, R43049 (Washington, D.C.: Congressional Research Service, April 23, 2013), p. 31.

<sup>129</sup> Creedon, “Prepared Statement before the Strategic Forces Subcommittee of the House Armed Services Committee,” op. cit., pp. 2-3.

<sup>130</sup> The “dual criteria” are associated with the strategist Albert Wohlstetter. See Robert Zarate, “Albert and Roberta Wohlstetter on Nuclear-Age Strategy,” in Robert Zarate and Henry Sokolski, eds., *Nuclear Heuristics: Selected Writings of Albert and Roberta Wohlstetter* (Carlisle, PA: U.S. Army War College Strategic Studies Institute, January 2009), p. 54.

- <sup>131</sup> *The Air Force Handbook 2007* (Washington, D.C.: Department of the Air Force, 2007), p. 36.
- <sup>132</sup> See the discussion of various definitions of “resilience” in L. Carlson, et al., *Resilience: Theory and Applications*, ANL/DIS-12-1 (Argonne, IL: Argonne National Laboratory, January 2012).
- <sup>133</sup> Mark B. Schneider and Peter Huessy, *Russian Deployment of Missile Defenses Hidden in Plain Sight* (New York: Gatestone Institute, February 18, 2013), available at <http://www.gatestoneinstitute.org/3590/russia-missile-defense>.
- <sup>134</sup> Passive defenses, however, can reduce effective damage inflicted by all nuclear force elements. These defenses include concealment, hardening, redundancy, dispersal, mobility, and other measures to protect likely targets of U.S. attack.
- <sup>135</sup> U.S. Air Force, “LGM-30G Minuteman III,” fact sheet, July 26, 2010, available at <http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104466/lgm-30g-minuteman-iii.aspx>.
- <sup>136</sup> Vice Adm. William Burke, USN, Deputy Chief of Naval Operations for Warfare Systems, “Navy Perspectives on Trident Strategic Modernization,” remarks at the AFA-NDIA-ROA Capitol Hill Breakfast Forum, April 4, 2013, National Security Reports transcript; Franklin C. Miller, *The Need for a Strong U.S. Nuclear Deterrent In the 21<sup>st</sup> Century*, White Paper (Washington, D.C.: Submarine Industrial Base Council, 2012), p. 8; and Rear Adm. Terry Benedict, USN, director, Strategic Systems Program, “The Trident and Its Contribution to Deterrence,” remarks at the AFA-NDIA-ROA Capitol Hill Breakfast Forum, July 20, 2012, National Security Reports transcript.
- <sup>137</sup> Dick Cheney, *Department of Defense Annual Report to the President and the Congress* (Washington, D.C.: GPO, February 1992), p. 59; and Department of Defense, *Nuclear Posture Review Report*, op. cit., p. 25.
- <sup>138</sup> *NATO’s Nuclear Forces in the New Security Environment*, fact sheet (Brussels: NATO, October 22, 2009), pp. 3,4, available at [http://www.nato.int/nato\\_static/assets/pdf/pdf\\_topics/20091022\\_Nuclear\\_Forces\\_in\\_the\\_New\\_Security\\_Environment-eng.pdf](http://www.nato.int/nato_static/assets/pdf/pdf_topics/20091022_Nuclear_Forces_in_the_New_Security_Environment-eng.pdf).
- <sup>139</sup> National Nuclear Security Administration, Department of Energy, *FY 2014 Stockpile Stewardship and Management Plan* (Washington, D.C.: National Nuclear Security Administration/Department of Energy, June 2013), p. 2-2.
- <sup>140</sup> *Ibid.*, pp. 2-16—2-20, 8-11—8-18; Government Accountability Office, *ICBM Modernization: Approaches to Basing Options and Interoperable Warhead Designs Need Better Planning Synchronization*, GAO-12-831 (Washington, D.C.: Government Accountability Office, September 2013); Creedon, “Prepared Statement before the Strategic Forces Subcommittee of the House Armed Services Committee,” op. cit.; and Mike Janes, “LRSO: Sandia Plays Key Role in Long-Range Stand-Off Warhead,” *Sandia Lab News*, Vol. 65, No. 15 (August 23, 2013), pp. 1,3.
- <sup>141</sup> On the hedge included in the nuclear weapons stockpile, see Department of Defense, *Nuclear Posture Review Report*, op. cit., pp. 22, 38; and Department of Defense, *Report on Nuclear Employment Strategy of the United States Specified in Section 491 of 10 U.S.C.*, op. cit., pp. 6-7.
- <sup>142</sup> Henry M. Narducci, *Strategic Air Command and the Alert Program: A Brief History* (Offutt Air Force Base, NE: Office of the Historian, Headquarters Strategic Air Command, April 1, 1988).
- <sup>143</sup> Theodore C. Sorenson, *Kennedy* (New York: Harper & Row, 1965), p. 705.
- <sup>144</sup> Robert S. Norris, “The Cuban Missile Crisis: A Nuclear Order of Battle, October/November 1962,” presentation at the Woodrow Wilson Center, October 24, 2012.
- <sup>145</sup> Henry Kissinger, *Years of Upheaval* (Boston: Little, Brown & Co., 1982), p. 591; Barry M. Blechman and Douglas M. Hart, “The Political Utility of Nuclear Weapons: The 1973 Middle East Crisis,” *International Security*, Vol. 7, No. 1 (Summer 1982), pp. 132-156; and Douglas M. Hart, “Soviet Approaches to Crisis Management: The Military Dimension,” *Survival*, Vol. 26, No. 5 (September/October 1984), pp. 214-223.
- <sup>146</sup> Department of Defense, *Nuclear Posture Review Report*, op. cit., p. 22.
- <sup>147</sup> See, for example, Nikolai Sokov, “The Russian Nuclear Arms Control Agenda After SORT,” *Arms Control Today*, Vol. 33, No. 3 (April 2003), p. 7; Sergei Ryabkov, Russian deputy foreign minister, “US-Russian Nuclear Disarmament: Current Record and Possible First Steps, talk delivered at the Simons Symposium on European Security and Nuclear Disarmament,” Berlin, July 1, 2011, available at [http://www.pugwash.org/reports/pic/59/59\\_documents/PLEN.Ryabkov.pdf](http://www.pugwash.org/reports/pic/59/59_documents/PLEN.Ryabkov.pdf); and Vladimir Kozin, “The ‘New’ U.S. Nuclear Strategy and Its Implications for Russia,” *International Affairs* (Moscow), Vol. 59, No. 6 (2013), pp. 24-25. The Senate Foreign Relations Committee report on the New START Treaty states that “Russian commentary during the negotiation of the treaty suggests that Russia is very sensitive to U.S. upload capabilities, and it would be

reasonable to assume that such capabilities would figure in the Russian cost-benefit analysis of any proposed serious violation of the treaty.” *Treaty with Russia on Measures for Further Reduction and Limitation of Strategic Offensive Arms (The New START Treaty)*, Executive Report 111-6, 111<sup>th</sup> Cong., 2<sup>nd</sup> Sess. (Washington, D.C.: GPO, October 1, 2010), p. 24.

<sup>148</sup> Senate Foreign Relations Committee, *Treaty with Russia on Measures for Further Reduction and Limitation of Strategic Offensive Arms*, Executive Report 111-6, op. cit., pp. 24, 28, 29-30.

<sup>149</sup> For discussion of suspected Russian violations of the INF Treaty, see Mark B. Schneider, *Reports of Russian Violations of the INF Treaty*, National Institute Information Series No. 340 (Fairfax, VA: National Institute for Public Policy, June 2012); and Keith B. Payne and Mark B. Schneider, “The Nuclear Treaty Russia Won’t Stop Violating,” op. cit.

<sup>150</sup> See the prescient discussion by Walter B. Slocombe in, “The Future of U.S. Nuclear Weapons in a Restructured World,” in Patrick Garrity and Steven Maaranen, eds., *Nuclear Weapons in the Changing World* (New York: Plenum Press, 1992), pp. 58-59.

<sup>151</sup> William J. Perry, *Department of Defense Annual Report to the President and the Congress* (Washington, D.C.: GPO, February 1995), pp. 10, 85-87. See also Deutch, in *Briefing on Results of the Nuclear Posture Review*, op. cit., pp. 12, 14; Adm. William Owens, vice chairman, Joint Chiefs of Staff, in the previous source, pp. 37, 57-58 (written response for the record); and Deutch, in House Foreign Affairs Committee, *U.S. Nuclear Policy*, Hearing, 103<sup>rd</sup> Cong., 2<sup>nd</sup> Sess. (Washington, D.C.: GPO, 1995), pp. 33-34, 59, 75, 77.

<sup>152</sup> “Russia is not...an enemy”: Douglas J. Feith, Under Secretary of Defense for Policy, “Prepared Statement in Senate Armed Services Committee,” *Department of Defense Authorization for Appropriations for Fiscal Year 2003, Part 1*, S. Hrg. 107-696, Pt. 1, 107<sup>th</sup> Cong., 2<sup>nd</sup> Sess. (Washington, D.C.: GPO, 2003), p. 326; “re-emergence of a hostile peer competitor”: Donald H. Rumsfeld, *Department of Defense Annual Report to the President and the Congress* (Washington, D.C.: GPO, 2002), pp. 89, 90. For more on the upload hedge (also known as the “responsive capability” during the Bush Administration), see Feith, *Department of Defense Authorization for Appropriations for Fiscal Year 2003, Part 1*, pp. 326-329 (prepared statement), 346, 380-381 (written response for the record).

<sup>153</sup> “a change in the international landscape...alter the U.S. calculus”: Department of Defense, *Report on Nuclear Employment Strategy of the United States Specified in Section 491 of 10 U.S.C.*, op. cit., p. 6; “geopolitical surprise”: Department of Defense, *Nuclear Posture Review Report*, op. cit., pp. 25, 30, 38, 39. For more on the hedge, see *Report on Nuclear Employment Strategy of the United States Specified in Section 491 of 10 U.S.C.*, pp. 6-8; and *Nuclear Posture Review Report*, pp. 22, 40, 41.

<sup>154</sup> Bodman and Gates, “National Security and Nuclear Weapons in the 21<sup>st</sup> Century,” op. cit., p. 2 (emphasis in original).

<sup>155</sup> *Nuclear Matters Handbook—Expanded Edition*, op. cit., pp. 36, 38; and *Report on Nuclear Employment Strategy of the United States Specified in Section 491 of 10 U.S.C.*, op. cit., p. 7.

<sup>156</sup> Gen. John A. Gordon, USAF (ret.), administrator, National Nuclear Security Administration, written response for the record, in Senate Armed Services Committee, *Department of Defense Authorization for Appropriations for Fiscal Year 2003, Part 1*, S. Hrg. 107-696, Pt. 1, 107<sup>th</sup> Cong., 2<sup>nd</sup> Sess. (Washington, D.C.: GPO, 2003), p. 378.

<sup>157</sup> Department of Defense, *Nuclear Posture Review Report*, op. cit., p. 25.

<sup>158</sup> Department of Defense, “Increasing Transparency in the U.S. Nuclear Weapons Stockpile,” Fact Sheet, May 3, 2010; and James Miller, Under Secretary of Defense for Policy, “Nuclear Deterrence: New Guidance and Constant Commitment,” remarks at the AFA-NDIA-ROA Capitol Hill Breakfast Forum, July 17, 2013, National Security Reports transcript.

<sup>159</sup> Bureau of Arms Control, Verification and Compliance, Department of State, “New START Treaty Aggregate Numbers of Strategic Offensive Arms,” Fact Sheet, January 1, 2014.

<sup>160</sup> *Nuclear Matters Handbook—Expanded Edition*, op. cit., pp., 38-39.

<sup>161</sup> Maj. Gen. Roger Burg, Director of Strategic Security, Office of the Deputy Chief of Staff for Operations, Plans, and Requirements, Headquarters U.S. Air Force, “Prepared Statement in Senate Armed Services Committee,” *Department of Defense Authorization for Appropriations for Fiscal Year 2008, Part 7*, S. Hrg. 110-201, Pt. 7 (Washington, D.C.: GPO, 2008), p. 56.

<sup>162</sup> Government Accountability Office, *ICBM Modernization: Approaches to Basing Options and Interoperable Warhead Designs Need Better Planning Synchronization*, op. cit., pp. 7, 18; and Department of Defense, *Nuclear Posture Review Report*, op. cit., pp. 22, 25.

<sup>163</sup> Adm. Michael Mullen, USN, Chairman, Joint Chiefs of Staff (“the United States will retain the ability to ‘upload’ a significant number of nuclear warheads as a hedge”) and Robert Gates, Secretary of Defense (“upload capability will be more than sufficient under New START”), written responses for the record, Senate Foreign Relations Committee, *The New START Treaty (Treaty Doc. 111-5)*, S. Hrg. 111-738, 111<sup>th</sup> Cong., 2<sup>nd</sup> Sess. (Washington, D.C.: GPO, 2010), p. 111.

<sup>164</sup> Norman Polmar and Robert S. Norris, *The U.S. Nuclear Arsenal: A History of Weapons and Delivery Systems Since 1945* (Annapolis, MD: Naval Institute Press, 2009), pp. 62, 65-66, 69, 173.

<sup>165</sup> *Sandia Annual Report—2006* (Albuquerque, NM: Sandia National Laboratories, 2006), p. 8; and Bill Murphy, “W76-1 Life Extension Program Milestone a Labs-Wide Accomplishment,” *Sandia Lab News*, Vol. 61, No. 23 (December 4, 2009), p. 4.

<sup>166</sup> Rear Adm. G.P. Nanos, USN, “Strategic Systems Update,” *Submarine Review* (April 1997), p. 13. See also Robert S. Norris and Hans M. Kristensen, “U.S. Nuclear Forces, 2010,” *Bulletin of the Atomic Scientists*, Vol. 66, No. 3 (May-June 2010), p. 65.

<sup>167</sup> See the information provided in Amy F. Woolf, *The New START Treaty: Central Limits and Key Provisions*, R41219 (Washington, D.C.: Congressional Research Service, January 8, 2014), pp. 6-9; and Woolf, *U.S. Strategic Nuclear Forces: Background, Developments, and Issues*, op. cit., pp. 9-11, 17, 19-20, 25-27.

<sup>168</sup> *Defense Imperatives for the New Administration* (Washington, D.C.: Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, August 2008), pp. 13-14.

<sup>169</sup> *Nuclear Matters Handbook—Expanded Edition*, op. cit., pp., 38-39.

<sup>170</sup> For an overview of the modernization program, see John R. Harvey, Principal Deputy Assistant Secretary of Defense for Nuclear, Chemical, and Biological Programs, “Prepared Statement in House Armed Services Committee,” *Fiscal Year 2014 Budget Request for Atomic Energy Defense Activities and Nuclear Forces Programs*, H.A.S.C. 113-45 (Washington, D.C.: GPO, 2013), pp. 96-103.

<sup>171</sup> General Kevin Chilton, Commander, U.S. Strategic Command, *Hearing of the Senate Foreign Relations Committee; Subject: The New START (Strategic Arms Control and National Security) Treaty: Views From the Pentagon*, op. cit., pp. 18-19.

<sup>172</sup> Congressional Budget Office, *Projected Costs of U.S. Nuclear Forces, 2014-2023*, op. cit.

<sup>173</sup> ADM Jonathan W. Greenert, U.S. Navy, “Payloads over Platforms: Charting a New Course,” *U.S. Naval Institute Proceedings*, Vol. 138/7/1,313, July 2012.

<sup>174</sup> Hon. Madelyn R. Creedon, Assistant Secretary of Defense for Global Strategic Affairs, “Prepared Statement before the House Armed Services Committee,” 113<sup>th</sup> Cong., 1<sup>st</sup> Sess., October 29, 2013, p. 4.

<sup>175</sup> Ibid.

<sup>176</sup> Stephen Young, “Performance Drives the B61 Bomb Update,” Union of Concerned Scientists, October 29, 2013, available at <http://allthingsnuclear.org/performance-drives-the-b61/>.

<sup>177</sup> Hon. Madelyn R. Creedon, “Prepared Statement before the House Armed Services Committee,” op. cit., p. 3.

<sup>178</sup> Office of the Deputy Assistant to the Secretary of Defense for Nuclear Matters, *Nuclear Matters: A Practical Guide*, op. cit., p. 39.

<sup>179</sup> New START Treaty, Article IV, paragraphs 10 and 11.

<sup>180</sup> New START Treaty Protocol, Part IV: Notifications, Section 111: Notifications Concerning Movement of Strategic Offensive Arms, Paragraphs 3-6.

<sup>181</sup> William J. Perry and James Schlesinger, *America’s Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington, D.C.: United States Institute of Peace Press, 2009) p. 36.

<sup>182</sup> Hans M. Kristensen, Robert S. Norris, and Ivan Oelrich, *From Counterforce to Minimal Deterrence: A New Nuclear Policy on the Path Toward Eliminating Nuclear Weapons* (Washington, D.C.: Federation of American Scientists and the Natural Resources Defense Council, Occasional Paper No. 7, April 2009), pp. 21-22.

<sup>183</sup> North Atlantic Treaty Organization, *Strategic Concept for the Defence and Security of the Members of the North Atlantic Treaty Organization*, Adopted by the Heads of State and Government at the NATO Summit in Lisbon, 19-20 November 2010, p. 15.

<sup>184</sup> Department of Defense, *Nuclear Posture Review*, op. cit., pp. viii, ix, 16.

<sup>185</sup> General C. R. Kehler, Commander, United States Strategic Command, "Statement before the Senate Committee on Armed Services," 113<sup>th</sup> Cong., 2<sup>nd</sup> Sess., March 12, 2013, p. 14, available at: <http://www.armed-services.senate.gov/statemnt/2013/03%20March/Kehler%2003-12-13.pdf>.

<sup>186</sup> Keith Payne, Thomas Scheber, Mark Schneider, David Trachtenberg, and Kurt Guthe, *Conventional Prompt Global Strike: A Fresh Perspective* (Fairfax, VA: National Institute Press, 2012), p. 18.

<sup>187</sup> Bill Gertz, "Inside the Ring: Pentagon Goes Hypersonic with Long-range Rapid Attack Weapon," *The Washington Times*, March 19, 2014.

<sup>188</sup> Payne and Schlesinger, *Minimum Deterrence: Examining the Evidence*, op. cit., pp. 39-44.

<sup>189</sup> To comply with the New START Treaty, the U.S. will eliminate four SLBM launchers on each SSBN. For a force of twelve deployable SSBNs, this represents a capacity reduction of 384 warheads. In addition, assuming 50 Minuteman III ICBM launchers are eliminated, warhead capacity would be reduced an additional 150. The total capacity reduction for SLBMs plus ICBMs equals 534. In addition, the inventory of nuclear-capable B-52H bombers would be cut from 76 to 44. The 32 B-52s eliminated from the nuclear force could carry B61 gravity bombs as well as ALCM cruise missiles. The cumulative reduction in capacity would total well over 600.

<sup>190</sup> The Replacement SSBNs will have only 16 SLBM launch tubes. For a force of twelve SSBNs, this would be 48 fewer deployable SLBMs than for the New-START-compliant force and a decrease in warhead capacity of 384. When added to the capacity reduction of about 600 for New START, the cumulative reduction is approximately 1,000.

<sup>191</sup> Department of Defense Press Release, "DoD Announces Strategic Force Structure," DoD Press Release No. NR-170-14, April 8, 2014.

<sup>192</sup> Maj. Gen. Garrett Harencak, USAF, assistant chief of staff for strategic deterrence and nuclear integration, testimony before the strategic forces subcommittee of the Senate Armed Services Committee, March 5, 2014, video available at [http://www.armed-services.senate.gov/hearings/nuclear-forces-and-policies\\_03/05/2014](http://www.armed-services.senate.gov/hearings/nuclear-forces-and-policies_03/05/2014).

<sup>193</sup> Jerry A. Krill and J. Paul Reason, Co-chairs, Committee on Capability Surprise on U.S. Naval Forces, *Responding to Capability Surprise: A Strategy for U.S. Naval Forces, Report of the Committee on Capability Surprise on U.S. Naval Forces* (Washington, D.C.: The National Academy Press, 2013), pp. 3, 72-73.

<sup>194</sup> Department of Defense, *Nuclear Posture Review Report*, op. cit., p. 39.

<sup>195</sup> For example, see remarks by then Secretary of Energy Steven Chu in, "Defense Department Special Briefing: New Nuclear Posture Review, Speakers: Robert Gates, Secretary, U.S. Department of Defense, ADM. Michael Mullen, Chairman, Joint Chiefs of Staff, Hillary Clinton, Secretary, U.S. Department of State, Steven Chu, Secretary, U.S. Department of Energy," Washington, D.C., April 6, 2010. transcript by Federal News Service, pp. 5-6. See also, *Fiscal Year 2014 Stockpile Stewardship and Management Plan: Report to Congress* (Washington, D.C.: Department of Energy, June 2013), pp. 1-2.

<sup>196</sup> "Department of Defense Special Briefing: New Nuclear Posture Review, Speakers: Jim Miller, Principal Deputy Undersecretary for Policy, Gen. James Cartwright, Vice Chairman, Joint Chiefs of Staff, Thomas D'Agostino, Administrator, National Nuclear Security Administration, and Ellen Tauscher, Undersecretary of State for Arms Control and International Security," April 6, 2010, transcript by Federal News Service, Washington, D.C., p. 9.

<sup>197</sup> For example, see Hans M. Kristensen, "Capabilities of the B61-12 Nuclear Bomb Increase Further," FAS Strategic Security Blog, posted October 30, 2013, available at: <http://blogs.fas.org/security/2013/10/b61-12hearing/>.

<sup>198</sup> U.S. Department of Energy, *Fiscal Year 2014 Stockpile Stewardship and Management Plan Report to Congress*, op. cit., pp. 1-2 and 2-22.

<sup>199</sup> Brent Scowcroft, John Deutch, and R. James Woolsey, "A Small, Survivable, Mobile ICBM," *The Washington Post*, December 26, 1986, p. A23.

<sup>200</sup> Statements by John Kerry and Robert Gates in, *Treaty With Russia On Measures For Further Reduction And Limitation Of Strategic Offensive Arms (The New START Treaty)*, op. cit., pp. 24, 29-30.

<sup>201</sup> Mark B. Schneider, "Russian Violations of its Arms Control Obligations," op. cit., pp. 34-36.

<sup>202</sup> Quoted in Elaine Grossman, "U.S. Nuclear Commander Warns Against Rushing Further Arms Cuts," *National Journal*, September 14, 2012, available at <http://www.nti.org/gsn/article/us-nuclear-commander-warns-against-rushing-further-arms-cuts/>.

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<sup>203</sup> U.S. Congress, Office of Technology Assessment, *MX Missile Basing* (Washington, D.C.: GPO, September 1981), p. 264.

<sup>204</sup> See the discussion in, Payne and Schlesinger, *Minimum Deterrence: Examining the Evidence*, op. cit., pp. 57-64.

<sup>205</sup> See, The National Institute for Defense Studies, *East Asian Strategic Review 2010* (Tokyo, Japan: The Japan Times, Ltd., 2010), pp. 33-34, available at <http://www.nids.go.jp/english/publication/east-asian/e2010.html>; and, David Santoro and Brad Glosserman, *Building Toward Trilateral Cooperation on Extended Deterrence in Northeast Asia: The First US-ROK-Japan Extended Deterrence Trilateral Dialogue* (Washington, D.C.: Center for Strategic and International Studies, September 2013), pp. 2, 12-13, available at [http://csis.org/files/publication/issuesinsights\\_vol13no14.pdf](http://csis.org/files/publication/issuesinsights_vol13no14.pdf); and, Tae-Woo Kim, "ROK-U.S. Defense Cooperation against the North Korean Nuclear Threat: Strengthening Extended Deterrence," in Jung-Ho Bae and Abraham Denmark, *The U.S.-ROK Alliance in the 21<sup>st</sup> Century* (Seoul: Korean Institute for National Unification, December 2009), pp. 206-208; and Nurşin Ateşoğlu Güney, "Turkish Nuclear Security after Iranian Nuclearization," *Contemporary Security Policy*, Vol. 33, No. 3 (December 2012), p. 526.



