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Safe, Secure and Effective Nuclear Operations in the Nuclear Zero Era

by

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Abstract

Nuclear weapons have provided the foundation for international diplomacy and strategic stability for over six decades now. Their often misunderstood mission and strategic value rests in the ability to prevent, not win, major wars. This ability to deter is produced through understood capability and believable will, and ultimately rests on nuclear credibility. However, the central dilemma surrounding these weapons has always been that they provide America with both security and her only existential threat. For this reason many have tried, and thus far failed, to rid the world of nuclear weapons. The latest abolition movement, championed by former high-ranking government officials and prominent business leaders, gained momentum when President Obama declared his nuclear agenda during a 2009 speech in Prague. But his vision for a world free of nuclear weapons also came with a promise to ensure America's nuclear credibility well into the future. Often labeled a no-fail mission, producing deterrence is demanding, disciplined work with inherent risk. The addition of abolition rhetoric adds unnecessary risk in the form of mission relevance and the erosion of expertise and much needed resources for sustainment and modernization. Without significant change in the geopolitical landscape, nuclear weapons will remain a relevant portion of America's long-term national security strategy. Therefore, the burdens and responsibilities of maintaining an effective nuclear deterrent force are paramount to ensure credibility for America and her allies. Bottom line: nuclear weapons and nuclear deterrence are still relevant today and for the foreseeable future. Therefore, to maintian international strategic stability we must embrace the necessity of nuclear deterrence, develop strategic policy that supports deterrence as an essential element and adequately resource the enterprise.

Chapter 1

Introduction

We are reducing our nuclear arsenal and reliance on nuclear weapons, while ensuring the reliability and effectiveness of our deterrent.

--2010 National Security Strategy[1]

The nuclear weapon abolitionist movement has received renewed interest in recent years. "For the first time since the demise of General and Complete Disarmament (GCD) in the 1960s, there is a serious discussion of the possibility of utterly removing nuclear weapons from the planet earth."[2] Far from a novel concept, the idea of ridding the world of nuclear weapons started almost simultaneous with their invention, but the movement does seem to have more weight and energy today than in recent years. The movement gained fuel when four former high-ranking US officials drafted a plan to free the world of nuclear weapons. The well-known Wall Street Journal article called nuclear deterrence "increasingly hazardous and decreasingly effective."[3] In their update one year later, Mr. Kissinger, Mr. Schultz, Mr. Perry and Mr. Nunn discussed the steps necessary to realize this vision and listed several current and former world leaders who support the effort.[4] But there is no question, the spark igniting the recent firestorm of interest came when President Barack Obama gave his April 5, 2009 speech in the Czech Republic. The President set the stage by saying, "The existence of thousands of nuclear weapons is the most dangerous legacy of the Cold War" and that "generations lived with the knowledge that their world could be erased in a single flash of light."[5] He then provided his explicit commitment to this vision, in what has become one of the most often quoted portions of his speech: "So today, I state clearly and with conviction America's commitment to seek the peace

and security of a world without nuclear weapons."[6] Since then, numerous articles, studies and reports have been written detailing the inherent dangers of nuclear weapons, questioning their relevance in today's world and giving opinions on the steps necessary to set the world on a path toward their removal.

However, within the same speech and shortly after issuing his "clearly stated commitment," the President made another promise. This one—directed to America, to her allies, and to any potential adversary sought to ensure "as long as these weapons exist, the United States will maintain a safe, secure and effective arsenal to deter any adversary, and guarantee that defense to our allies."[7]

The United States has a vast nuclear enterprise charged with the special trust and responsibility of ensuring the safety, security and effectiveness of the arsenal President Obama referred to in his Prague address. A major portion of that enterprise and responsibility resides with the United States Air Force. With its nuclear capable bombers and Intercontinental Ballistic Missiles, the Air Force is home to two-thirds of the United States' nuclear triad. Air Force Global Strike Command (AFGSC) is the organization responsible for operating, maintaining and securing both of these weapon systems. Established as one remedy to the Air Force's need to reinvigorate the enterprise after two embarrassing incidents and the predictable studies, panels and commissions that followed, the command derived its mission statement directly from President Obama's speech:

> Develop and provide combat-ready forces for nuclear deterrence and global strike operation ... Safe … Secure … Effective … to support the President of the United States and combatant commanders.[8]

The role these personnel play in safely securing and maintaining nuclear weapons, as well as effectively operating the systems responsible for their launch upon Presidential order is tough, demanding work. These are serious professionals, dealing with the world's most serious

weapons in often harsh surroundings with natural risk. To do so in the face of a renewed abolitionist movement fostering an uncertain future only adds to that risk. Therefore, studying the intersection between the President's order to his nuclear personnel and his vision of a safer world is the objective of this effort. Identifying potential risks to the safe, secure and effective mandate posed by the global zero movement is the focus of this paper.

In order to understand the importance of these risks, a foundation for their significance must first be established. To that effort, this paper begins with a discussion of deterrence, focusing on the contributions of nuclear weapons and their relevance to future United States deterrence objectives. Defined as the product of a nation's capability and will, deterrence—specifically nuclear deterrence—has been regarded as the foundation of our national security for several decades and this paper provides the rationale for why this fact should remain true well into the future. Next, this paper identifies potential risks to the capability portion of the deterrence equation, arguing that continued nuclear reductions combined with abolition rhetoric have negative consequences to nuclear personnel, processes and resources. These consequences in no way suggest we should abandon the President's goal of a safer world, but rather advocate the long-term necessity of nuclear deterrence and therefore the sustainment of deterrent forces and their support infrastructure. Finally, this paper provides suggestions to mitigate the risks identified; ultimately advocating the need for senior officials to recognize the fallacy of abolition and re-enforce the importance of nuclear deterrence. This recognition will provide the foundation necessary for future nuclear reductions while also ensuring our national security requirements are satisfied. Safeguarding the US, assuring our allies and complicating the decision calculus of our enemies has been the role of our nuclear deterrent force for over 60 years now. Striking a balance between the vision of a world free of nuclear weapons with the necessity of a deterrent force follows both the strategy and the warning resident in the two quotes

above. It charts a course toward reduced nuclear danger while maintaining the safety and security provided by credible nuclear deterrent forces.

Assumptions

In order to complete this effort during such a period of change, assumptions are required. First, the President's nuclear zero vision, as well as current US nuclear policy and strategy will not change. Second, the current economic crisis and subsequent defense budgets will not render the US nuclear arsenal unsupportable. Third, no major reductions or proliferation of world-wide nuclear weapon capability significantly altering either the pro or con side of the nuclear debate. And finally, no breakthrough, technological or otherwise, rendering nuclear weapons obsolete or significantly decreasing their destructive capability.

Limitations

This effort admittedly fails to adequately articulate the nuclear disarmament position; a result of intent, not oversight. The goal is to present current, operational risks to the nuclear enterprise. The author's purpose for the chapter on deterrence and nuclear weapons then is to provide a foundation for the relevance of those risks, not a full discussion of the nuclear zero debate. Much has been studied, researched and written on both sides of the nuclear-free agenda. It is not the author's intent to add to this discourse, but rather identify potential risks to the US nuclear arsenal associated with this vision.

Notes

[1] Executive Office of the President, National Security Strategy (Washington D.C.: The White House, , May 2010), 4. Available on line at: http://www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf
[2] Thomas C. Schelling, "A World Without Nuclear Weapons?" *Daedalus,* Vol. 138, No. 4 (Fall 2009): 124-129.
[3] George P. Schultz, William J. Perry, Henry A. Kissinger and Sam Nunn, "A World Free of Nuclear Weapons," *The Wall Street Journal*, 4 January 2007.
[4] George P. Schultz, William J. Perry, Henry A. Kissinger and Sam Nunn, "Toward A Nuclear-Free World," *The Wall Street Journal*, 15 January 2008.

Notes

[5] Barack Obama, "Remarks by President Barack Obama," (address, Hradcany Square, Prague, Chech Republic, 5 April 2009). Available on-line at: http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered/
[6] Ibid.
[7] Ibid.
[8] See Air Force Global Strike Command Mission, Available on-line at: http://www.afgsc.af.mil/main/welcome.asp (accessed 7 February 2012).

Chapter 2

Deterrence, Nuclear Weapons and Global Zero

> *As long as nuclear weapons exist, the United States must sustain a safe, secure, and effective nuclear arsenal—to maintain strategic stability with other major nuclear powers, deter potential adversaries, and reassure our allies and partners of our security commitments to them.*
>
> -- Secretary Of Defense Robert M. Gates[1]

In 1939, Albert Einstein drafted a letter to President Franklin Roosevelt detailing a scientific breakthrough making the "set up of a nuclear chain reaction in a large mass of uranium … almost certain."[2] He went on to discuss possible uses of this new phenomenon, to include construction of new "extremely powerful bombs."[3] Similar scientific work in England, the threat of work in Germany, combined with the United States' entry into World War II after the attacks on Pearl Harbor, led to an "all-out" nuclear research effort.[4] The U.S. Manhattan Project rose from this tense international environment, ultimately producing atomic weapons. Shortly thereafter, President Harry Truman authorized their use against Japan to bring the fighting in World War II to a controversial early end.

The development and eventual use of these weapons in the 1930s and 1940s laid the foundation of deterrence—specifically nuclear deterrence—and began the still on-going debates over their existence. Deterrence is unique in its "debatable" qualities. No other national strategy or international relations theory is tied so closely to a single weapon system; and no other

weapon system has been the subject of such passionate study, from both Hawks and Doves alike—and rightfully so.

A major driving factor for these debates is the delicate balance between morality and security. The very weapon capable of providing safety and security to America and her allies, is in fact the only one capable of destroying her as well. "U.S. nuclear strategy begins with the central dilemma that nuclear weapons are both the greatest potential threat to our way of life and important guarantors of U.S. security."[5] The immense destructive power resident in what Bernard Brodie called the "absolute weapon" provides the capability necessary to produce deterrence. But if actually deployed, the effects are devastating. In 1939, Einstein warned President Roosevelt of this possibility; today, Graham Allison explains the reality:

> Imagine the consequences of a 10-kiloton weapon exploding in San Francisco, Houston, Chicago, Los Angeles, Charlotte, or any other city Americans call home. From the epicenter of the blast to a distance of approximately one-third mile, every structure will be destroyed and no one would be left alive. A second circle of destruction extending three-quarters of a mile from ground zero would leave buildings looking like the Federal Office Building in Oklahoma City. A third circle reaching out 1 mile would be ravaged by fires and radiation. [6]

"Nuclear weapons are special weapons and not just more powerful versions of high-explosive munitions"[7] and have provided a backdrop for international relations and diplomacy for over six decades.

Deterrence Defined

Considered by many the cornerstone of American national security, deterrence "is ultimately about decisively influencing decision making."[8] Joint Publication 1-02, the Department of Defense dictionary, defines deterrence as "the prevention from action by fear of the consequences … a state of mind brought about by the existence of a credible threat of

unacceptable counteraction."[9] Often described as a cost/benefit analysis, Air Force doctrine says, "Their leadership should believe the cost of aggression against the US, its interests, or its allies will be so high as to outweigh any possible gain."[10] Conducted in the cognitive domain of the players involved, deterrence entails coercion through influencing perceptions, most often through threat of violence. Thomas Schelling described the process this way:

> The only purpose, except sport or revenge, must be to influence somebody's behavior, to coerce his decision or choice. To be coercive, violence has to be anticipated. And it has to be avoidable through accommodation. The power to hurt is bargaining power. To exploit it is diplomacy—vicious diplomacy, but diplomacy.[11]

Deterrence proves successful when fear of consequences outweighs expected benefits, forcing the adversary to ultimately decide against their contemplated course of action.

In order to achieve the desired outcome and positively alter the decision calculus of a potential adversary, the deterrent must be credible. Credibility (therefore deterrence) is achieved through convincing capability and courageous will.[12] An outcome produced through multiplication not addition, relies on both sides of the equation. If either side falls, the entire equation reduces to zero and deterrence fails.[13] A 2009 bipartisan commission report mandated by Congress states:

> "Whether potential adversaries are deterred (and U.S. allies are assured) is a function of their understanding of U.S. capabilities and intentions. Those capabilities must be sufficiently visible and sufficiently impressive. But deterrence is more than a summary calculation of cumulative target kill probabilities. And it is not simply a function of technical characteristics of the nuclear force. It derives also from perceptions of U.S. intent."[14]

The success of America's deterrent resides in visibly maintaining capabilities, mustering the will to use them when necessary, and ensuring allies and enemies alike clearly understand both.

Although deterrence certainly relies in part on nuclear weapons, inducing pause and influencing the decision cycle of others is not accomplished with nuclear weapons alone. It takes

the combined use of all elements of national power[15] and strength to accomplish these goals. The traditional DIME (Diplomacy, Information, Military, and Economic) model is useful here to identify and understand options available to national leaders. Through targeted diplomatic, information and economic measures, the US can and does achieve deterrent objectives. And even within the military context, nuclear weapons are not the sole deterrent; overwhelming conventional capabilities of the US military prove an effective deterrent as well. But without question, while "nuclear forces are not the only factor in the deterrence equation, our nuclear capability underpins all other elements of deterrence."[16]

Nuclear Deterrence and the Unique Role of Nuclear Weapons

A particular subset of deterrence is nuclear deterrence. Since invention and demonstration of their power, nuclear weapons have supplied the ultimate "anticipation of violence" for the "diplomacy" Thomas Schelling described. The immense destructive capability of these weapons, coupled with their speed to target,[17] forced revolutionary change in military affairs and international relations. Given today's environment with several nuclear capable states, these weapons create the dilemma introduced previously—serving as both a provider of security and an existential threat. If deterrence relies on a credible promise of counteraction, nuclear deterrence then expands to a guarantee of destruction. "State survival can only be secured through the credible threat of an equal reprisal that assures the destruction of an attacker."[18]

Like all other military weapons in the US arsenal, nuclear weapons provide the Commander-in-Chief with options for use as necessary to defend American freedoms and interests. However, nuclear weapons are "special weapons" with the distinct ability to produce

both military and political aims. The 1940s rush to obtain the atomic bomb, admittedly, was military in nature. Seeking advantage through adding weapons to your arsenal before your enemy can do the same is classic strategy. But once obtained and subsequently used to help end the brutal fighting in World War II, the dual military and political nature of these weapons began to materialize. Strategists were forced to take note, study and learn how to best utilize these weapons. Ideas, concepts and theories like extended nuclear deterrence (providing nuclear support to friends and allies), crisis stability, escalation control, arms control, and many others started to emerge as outcomes produced by nuclear weapons. But since that first (and only) wartime use, the primary role of nuclear weapons has always been to prevent, not win wars.

This tradition of "non-use" in order to achieve political goals extends back to Strategic Air Command (SAC) and remains true today. In 1960 General Thomas Power, then SAC Commander, wrote, "Contrary to widespread public opinion, the primary mission of the Strategic Air Command is not one of 'massive retaliation.' SAC's primary job is its peacetime mission of deterrence—to help maintain an honorable peace by discouraging aggression."[19] Today's Air Force nuclear doctrine echoes the same goal. "The day-to-day purpose of nuclear weapons is to deter; to create desired political effects without actually employing nuclear weapon kinetic effects."[20] The preventive nature, the assurance guarantee and the non-use concepts surrounding nuclear weapons compare nicely to the analogy of insurance.[21] Once again, General Power articulated this point well:

> We find ourselves in a position similar to that of a man who wants to take out insurance to protect himself against any possible judgment in a civil suit arising from an automobile accident during the coming year. If he were to know the exact amount for which he will be sued throughout the next twelve months, he would be foolish to insure himself for more than that. But he does not know and, therefore, the amount of insurance he will take out becomes entirely a matter of judgment and "assessment of the threat." This is the reason why different people carry different amounts of liability insurance. Some have more to protect than

> others or place a greater value on what they want to protect. Some are more cautious and pessimistic; others do not care to spend money for insurance and carry little or, perhaps, no insurance at all. It is their choice.[22]

From the very beginning of deterrence strategy, nuclear weapons have served as the definitive insurance policy for America and her allies.

The Challenge of Deterrence

Determining how much insurance to purchase is a difficult task however, and a function of risk management. The same is true for deterrence. Continuing the informative discussion by General Power, he went on to say: "Similarly, the American people must decide what they want to protect, how much it is worth to them, and what kind of protection they desire in order to insure the nation against a threat whose future magnitude and nature are unpredictable."[23] Colin Gray added to the debate through a parallel discussion on redundancy by comparing the design of the US strategic arsenal to that of an elevator:

> An elevator accident could be so catastrophic for those involved that backup systems to backup systems are provided for safety. No elevator designer is permitted to ask of safety engineering, "how little is enough?" Statistically improbable sequences of events do occur. The designer of strategic forces knows that the potential failure of one element of the triad needs to be insured against the existence of complimentary retaliatory forces in the other triad legs.[24]

Answering tough questions like "how much is enough" is a classical challenge of nuclear deterrence and the difficulty lies in the ability (or inability) to prove its effectiveness. As previously noted, the deterrent battle is waged in the cognitive domain, rooted in the mind and perceptions of those involved. In short, "deterrence is in the eye of the beholder."[25] Keith Payne, professor and head of the Graduate Department of Defense and Strategic Studies at Missouri State University and a member of the congressional commission on US strategic

posture, discussed this issue and how it relates to nuclear deterrence and the adequacy of our force. According to Payne:

> At the risk of shattering widespread illusions, it is important to understand an inconvenient truth: there is no basis for confident, definitive answers to any of these fundamental questions. All attempts to answer these questions involve considerable speculation. And no answer, however insightful for the moment, can be considered pertinent across time and place.
>
> Why? Because deterrence is not a physical science; it is an arcane psychological art involving a shifting mosaic of adversary decision makers, circumstances, uncertainty, and error. There is considerable inherent uncertainty and unavoidable ambiguity in the functioning of deterrence, because predicting foreign decision making—particularly under stressful conditions—is an inherently uncertain business. As the Obama administration's director of central intelligence [now Secretary of Defense] Leon Panetta recently observed, "Our biggest problem is always how do we get into the head of somebody … Those are the kinds of things that are obviously very tough for intelligence to predict."[26]

He also noted, "James Clapper, the director of national intelligence, similarly observed, "We are not clairvoyant."[27]

Like those forbidden dinner topics of politics and religion, "winning" either the pro or con side of the deterrence debate proves difficult. If fully understanding the culture, thoughts and traditions of your enemy in order to influence decision making is difficult; then providing proof of said influence after-the-fact is almost impossible. This uncertainty, coupled with (1) the changing post-Cold War international security environment and (2) the realities of today's economic crisis, provide added fuel for those that question the relative importance of deterrence and nuclear weapons. In 2008, the Schlesinger Task Force on Department of Defense Nuclear Weapons Management forewarned of this possibility by saying, "the most difficult challenge in maintaining a credible nuclear posture to deter WMD attacks upon the United States and its allies will be in persuading this nation of the abiding requirement for nuclear forces."[28] A similar declaration was made in the Report of the Defense Science Board (DSB) Task Force on

Nuclear Capabilities in 2006 when it stated, "For the fifty years of the Cold War, there was a viable national consensus for the need of nuclear weapons on the role these weapons played in the security of the United States and its allies. Fifteen years after the end of the Cold War, this consensus no longer exists."[29] In the face of such challenges, and fully grasping the abiding necessity of nuclear deterrence, both the Schlesinger and Defense Science Board reports recommended nuclear weapons continue their deterrent role well into the future. They also encouraged senior leaders to support and broadly articulate this affirmation as well.

Nuclear Weapon Elimination—Replace Rhetoric with Reality

The sincere desire to rid the world of nuclear dangers is far from new. The very scientists that unlocked the process to produce a nuclear yield later joined forces against its use as a weapon;[30] every U.S. President since Truman's decision to employ atomic weapons on Japan has discussed the inherent dangers and publically supported their eventual elimination; international treaties have been negotiated and signed targeting their removal. Paul Doty described a few of these early efforts.

> The vision of a nuclear-free world caught hold at the governmental level more than 40 years ago, most notably through the 1968 Non-Proliferation Treaty (NPT), which required that "[e]ach of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament." Eighteen years later, in 1986, the Reykjavik Summit gave further hope for government action toward total nuclear disarmament, even hope for a new treaty. At the Summit, Gorbachev suddenly proposed the elimination of all nuclear weapons if space-based defenses would be abandoned as well; Reagan, however, could not agree to this condition, and hopes for a new treaty failed.[31]

All of these earlier efforts, to include the "Easter marches of the 1950s and 1960s or the nuclear freeze movement of the 1980s"[32] met the same fate as the Reykjavik Summit and failed at their

ultimate goal of nuclear abolition. However, "this time around the policy elites themselves are leading the charge...with a *Who's Who* list of supporters to include President Barack Obama [who] aligned himself with the cause, declaring global disarmament a top priority."[33] Adding to this mix of high-level support, the US arsenal currently sits at its lowest level since the Truman administration,[34] requires substantial investment to counter an aging infrastructure and faces constant scrutiny regarding relevance in today's security environment. This uncertain environment caused Adam Lowther, a defense analyst at the Air Force Research Institute to conclude, "A generation after the fall of the Berlin Wall and the collapse of the Soviet Union, the United States stands at a crossroad. One path leads to a reinvigoration of the nuclear enterprise, while the other promises an end to nuclear weapons."[35]

Nuclear disarmament and abolition advocates list numerous motivations to support their cause. Chief among them, the basic assertion they are inhumane; simply unjust and unnecessary weapons that should never be used in anger again—although some, having personally faced the horrors and inhumane conditions of combat arrive at a different conclusion regarding the morality of nuclear weapons.[36] But there is no doubt the arguments in defense of, and against, nuclear deterrence are exceptionally complex. Both have well-researched, well-documented, and well-known books, papers and studies to support their position. As detailed in the introduction, the intent of this paper is not to retrace those arguments in full. But a discussion of a few of today's more pressing questions is appropriate; questions concerning nuclear weapons' contribution to the interwoven dangers of nuclear proliferation and nuclear terrorism and the relevance of post-Cold War nuclear deterrence are germane. Questions T.V. Paul outlined in the introduction of *Complex Deterrence: Strategy in the Global Age*;

> Deterrence, the leading theoretical and policy framework during the cold war, has come under criticism. Some believe that in the absence of a major great-power

> rivalry, deterrence has lost much of its value, and others contend that it has little utility in dealing with "rogue" states or cataclysmic terrorist groups.[37]

A popular abolition argument today involves the role of nuclear weapons in deterring our most pressing security threats; the deeply connected issues of nuclear proliferation and terrorism. Many believe "the September 11 attacks seemed to sound a death knell for deterrence."[38] Nuclear proliferation and nuclear terrorism are real threats as indicated by their prominent inclusion as the top priority in both the U.S. National Security Strategy[39] and Nuclear Posture Review.[40] President Obama called this "the most immediate and extreme threat to global security."[41] Matt Bunn, Associate Professor of Public Policy at Harvard's Kennedy School of Government and the Co-Principal Investigator for The Belfer Center's Project on Managing the Atom, documented several facts relating to the threat of nuclear terrorism:

- Al Qaeda is seeking nuclear weapons and has repeatedly attempted to acquire the materials and expertise needed to make them
- Numerous studies by the U.S. and other governments have concluded that it is plausible that a sophisticated terrorist group could make a crude nuclear bomb if it got enough of the needed nuclear materials
- There have been over 18 documented cases of theft or loss of plutonium or highly enriched uranium (HEU), the essential ingredients of nuclear weapons
- The immense length of national borders, the huge scale of legitimate traffic, the myriad potential pathways across these borders, and the small size and weak radiation signal of the materials needed to make a nuclear bomb make nuclear smuggling extraordinarily difficult to stop[42]

The threat posed by proliferation of nuclear materials to a determined terrorist organization is legitimate and requires unprecedented effort and international cooperation to counter. However, throwing stones at the nuclear arsenal alone for not "deterring" such attacks is simply opportunistic rhetoric. You could in fact, make the same argument for any U.S. weapon system

and/or national security policy. Lieutenant Colonel Andrew Kovich makes this clear in his research paper, *Maintaining Deterrence and Nuclear Weapons*:

> The idea that nuclear weapons failed to deter al Qaeda or other would-be nuclear terrorists oversimplifies the US deterrent posture writ large. However, that same argument could be made for any major weapon system. Nuclear weapons are certainly not the right tool to counter all forms of aggression against the US, but nuclear capability deters the most egregious threats to national survival. Should there be a call for cancellation of air superiority fighters simply because there has not been an air-to-air threat in over a decade of US military operations? To do so would be extremely negligent and represents a sort of constraint on US freedom of action that only benefits an adversary.[43]

Terrorism definitely represents a security concern today and for the foreseeable future. Nuclear terrorism adds significant complexity and urgency to the equation. Much debate surrounds the inability to deter terrorism, but placing that solely at the feet of the nuclear enterprise is playing careless and casual with U.S. national security. While nuclear weapons are "not suited for every 21st century challenge," they do "remain an essential element in modern strategy."[44]

Nuclear abolition advocates also debate the current relevance of deterrence. With the collapse of the Soviet Union, the bi-polar nuclear stand-off between the two major superpowers disappeared, clearing the way for weapons reductions and the decline of deterrence as a foundational element of international security. Unfortunately, this vision has not played out in reality. The 2006 DSB report discussed today's complex international security landscape and its effects on nuclear deterrence.

> Contrary of expectation, as the Cold War wound down, nuclear issues have become more, not less, complex as the nation moved from the dangerous, but slowly evolving, set of challenges characterizing the Cold War to the more complex, rapidly changing, and still dangerous, challenges in this century.[45]

The 2010 National Security Strategy, as well as the 2010 Quadrennial Defense and Nuclear Posture Reviews echo the same—today's multi-polar international security environment provides increased challenges compared to those of the Cold War era. [46] [47] [48]

The specific complexity with regard to deterrence stems from recent worldwide nuclear activity. The arsenals of the accepted "nuclear haves" of Russia and China are of obvious concern, but the actions of North Korea and Iran add tremendous complexity to an already difficult international nuclear landscape. Russia continues to modernize their arsenal and has an increasing reliance on nuclear weapons in its security policy, in large part due to their decreasing conventional capabilities.[49] This, coupled with their large non-strategic nuclear stockpile creates difficulty when trying to establish common ground regarding further reductions and eventual disarmament.[50]

China also continues to modernize its nuclear forces. Advances in nuclear-capable ballistic missile technologies complement their formidable anti-access/area denial capability, ensuring China is not simply an Asia-Pacific regional power, but a strategic global power as well. According to a joint Department of Defense and Department of Energy report on nuclear weapons in the 21st Century,

> China's long-term, comprehensive transformation of its military forces is improving its capabilities for force projection and anti-access/area denial operations. China's near-term focus on preparing for contingencies in the Taiwan Strait, including the possibility of U.S. intervention, is an important driver of its modernization.
>
> China has had a fully functional and operating nuclear weapons infrastructure for over thirty years and is the only major nuclear power that is expanding the size of its nuclear arsenal. It is qualitatively and quantitatively modernizing its nuclear forces…[51]

China has long maintained their arsenal is for self-defense only, adopting no-first-use as their nuclear doctrine.[52] But the secrecy surrounding their nuclear program produces an unsettling uncertainty regarding their true capabilities,[53] causing problems when determining US force structure needs.

North Korea and Iran continue to resist international pressure in search of their own nuclear capability. The joint Departments of Defense and Energy report also point out that "The illicit pursuit of nuclear weapon programs by North Korea and Iran jeopardizes the global nonproliferation regime and threatens regional stability."[54] A recent International Atomic Energy Agency (IAEA) report on Iran listed "serious concerns regarding possible military dimensions to Iran's nuclear programme" and that it "continues to carry out uranium enrichment activities."[55] These summary findings intensified the already tense Iranian nuclear dilemma and sparked numerous reports, articles and opinions on the issue.[56] William Tobey, a former U.S. National Nuclear Security Administration official and National Security Council member stated, "International efforts to prevent Tehran from drawing closer to a nuclear weapons capability are failing. Iran has shortened considerably the distance it must travel to construct a nuclear weapon, and the pace of its program is accelerating."[57] The recent activity caused Graham Allison, author of *Essence of a Decision: Explaining the Cuban Missile Crisis*, to question whether Iran could be President Obama's version of the 1960s tense U.S. and Soviet standoff.[58] While that is truly a possibility, it is absolutely certain their defiant nuclear stance creates international instability.[59]

Likewise, North Korea continues their march toward a reliable nuclear weapon and nuclear weapons delivery capability. Despite international condemnation, they conducted a nuclear weapon test in October 2006. They also continue testing long-range missile technology,

including the latest attempt on April 12, 2012, under the guise of a space launch program. Labeled a space launch due to claims the rocket's intention was to carry a satellite in celebration of Kim Il Sung's 100th birthday, skeptics believe North Korea's true intentions were to test long-range missile capability.[60] Characterized as a "failure"[61] because the rocket did not perform as expected, the test still demonstrates continued resolve on behalf of North Korean leadership. Long-range rocket capability is not easy to master as the US discovered with many "failures" in the 1950s and 1960s. But with complete dedication to the effort, lessons learned from each launch attempt and political backing for the program, the capability was eventually proven, then perfected. With sustained dedication to test despite international pressure, the same resolve surrounds the North Korean missile program. This same commitment extends to their nuclear fuel production program as well, where new discoveries raised more questions regarding their current capability and nuclear intentions.[62] Recent reports also indicate another nuclear test is planned for the immediate future. This commitment and history of testing, combined with recent activity, heighten concerns about North Korea's nuclear intentions and continues to threaten regional stability. "While North Korean nuclear weapon production is not likely to produce a regional nuclear chain reaction, the development[s] could exacerbate the security dilemma among the region's major powers and thereby destabilize regional international relations,"[63] which obviously has negative consequences for U.S. national security.

So, Russia and China are modernizing, Iran and North Korea are working toward nuclear capability and remain a constant threat to share/sell their nuclear technology and expertise. Other countries known, or expected to have nuclear capability—Britain, France, India, Pakistan and Israel—continue to rely on their nuclear arsenal (or the assumed threat of a nuclear arsenal)

for deterrence and national security. What impact does this international nuclear activity have on the US?

In 2008, Congress commissioned a "bipartisan, independent, forward-looking assessment of America's strategic posture."[64] The bipartisan Commission admittedly struggled to gain consensus on their recommendations and conclusions, but did agree "as long as other nations have nuclear weapons, the U.S. must continue to safeguard its security by maintaining an appropriately effective nuclear deterrent force."[65] Actions otherwise create an unstable nuclear landscape and undermine US national security. Questioning the "relevancy" of our nuclear arsenal then seems inconsistent with the reality that as long as other nations possess a nuclear arsenal, the US must maintain a capable arsenal of their own. With no evidence of nuclear elimination on the foreseeable horizon, the Global Zero rhetoric should be replaced with realism. US policy makers should embrace the long-term necessity (or if not, then the current and near-term reality) of nuclear weapons. Otherwise, lack of commitment to the nuclear enterprise could result in unacceptable risk to the "safe, secure and effective" mandate that President Obama directed, and that the American people deserve.

Notes

[1] United States Department of Defense, Nuclear Posture Review Report (Washington D.C.: April 2010), i.

[2] Albert Einstein to President Franklin D. Roosevelt, letter, 2 August 1939.

[3] Ibid.

[4] Department of Defense, *Nuclear Matters: A Practical Guide* (Washington D.C.: Office of the Deputy Assistant Secretary of Defense [Nuclear Matters], 2008), 2.

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

[6] Graham Allison, *Nuclear Terrorism: The Ultimate Preventable Catastrophe* (New York: Henry Holt and Company, 2004), 4.

[7] William J. Perry, James R. Schlesinger, et. al. *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington DC: United States Institute of Peace Press, 2009), 20.

[8] General Kevin C. Chilton, "Waging Deterrence in the Twenty-first Century," *Strategic Studies Quarterly*, 3, no. 1 (Spring 2009), 33.

[9] United States Department of Defense, Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, (Washington D.C.: Pentagon, 8 November 2010 (amended through 31 January 2011)), 107.

[10] Air Force Doctrine Document 3-72, *Nuclear Operations*, 7 May 2009, 2.

[11] Thomas Schelling. *Arms and Influence* (New Haven and London: Yale University Press, 1966), 2.

[12] General Russell E. Dougherty, "Leadership During the Cold War: A Four-Star General's Perspective," in Peter B. Land and Ronald E. Marcello, *Warriors and Scholars: A Modern War Reader* (Denton, TX: University of North Texas Press, 2005) 116. Gen Dougherty recounts a lecture he received while at National War College, from West Point Professor George A. "Abe" Lincoln. Professor Lincoln said, "Capability

Notes

times Will equals Deterrence…and that it should be thought of as a product not a sum…for if either factor was zero, the deterrent was sure to be zero."

[13] Ibid.

[14] William J. Perry, James R. Schlesinger, et. al. *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington DC: United States Institute of Peace Press, 2009), 22.

[15] Department of Defense, United States Quadrennial Defense Review Report (Washington D.C: February 2010), 14. Available on-line at: http://www.defense.gov/qdr/

[16] Air Force Doctrine Document 3-72, *Nuclear Operations*, 7 May 2009, 2.

[17] Thomas C. Schilling, *Arms and Influence* (New Haven and London: Yale University Press, 1966), 18-24.

[18] Lt Col David M. Franklin, "Miscalculated Ambiguity: The Effects of US Nuclear Declaratory Policy on Deterrence and Nonproliferation," (Master's thesis, Maxwell AFB, AL: Air University, School of Advanced Air and Space Studies, June 2010), 12.

[19] General Thomas S. Power, "Strategic Air Command," *Air Force Magazine*, Vol 43, No 9,(September 1960).

[20] Air Force Doctrine Document 3-72, *Nuclear Operations*, 7 May 2009, 9.

[21] Lieutenant Colonel Andrew Kovich, explains this concept very well throughout his paper, "Maintaining Deterrence and Nuclear Weapons: The Triad and Reducing Nuclear Dangers" (Research report, Maxwell AFB, AL: May 2010), 25.

[22] Ibid, 25, 26

[23] Ibid, 25, 26

[24] Barry R. Schneider, Colin S. Gray, Keith B. Payne, *Missiles for the Nineties, ICBMs and Strategic Policy (Boulder, Colorado:* Westview Press, 1984), 8.

[25] William J. Perry, James R. Schlesinger, et. al. *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington DC: United States Institute of Peace Press, 2009), 22.

[26] Keith Payne, "Maintaining Flexible and Resilient Capabilities for Nuclear Deterrence," *Strategic Studies Quarterly,5*, no. 2 (Summer 2011), 14.

[27] Ibid.

[28] James R. Schlesinger, et al, Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase II: Review of the DoD Nuclear Mission (December 2008), 11.

[29] Department of Defense, Report of the Defense Science Board Task Force on Nuclear Capabilities (Washington D.C.: Office of the Undersecretary of Defense [Acquisition, Technology and Logistics], 2006), 2.

[30] For a historical discussion of nuclear weapon elimination see for instance, John Holdren, "Getting to Zero: Is Pursuing a Nuclear-Weapon-Free World Too Difficult? Too Dangerous? Too Distracting?" (Discussion Paper 98-24, Cambridge, MA: Harvard Belfer Center for Science and International Affairs, April 1998).

[31] Paul Doty, "The Minimum Deterrent & Beyond," *Daedalus*, Vol. 138, No. 4, (Fall 2009), 130-139.

[32] Josef Joffe and James W. Davis, "Less Than Zero," *Foreign Affairs* (January/February 2011).

[33] Ibid

[34] David M. Kunsman and Douglas B. Lawson, "A Primer on U.S. Strategic Nuclear Policy" (Albuquerque, NM: Department of Energy, Sandia National Laboratories, January 2001).

[35] Adam Lowther, "Challenging Nuclear Abolition" (Research Paper 2009-4, Maxwell AFB, AL: Air University, Air Force Research Institute, August 2009).

[36] See for instance, Paul Fussell's discussion in, *Thank God for the Atom Bomb and Other Essays*, Summit Books, 1988, where he argues Truman's decision to use the atomic bomb was the more humane choice when considering both the number of lives lost per day in the war, plus the expected losses if an invasion of Japan were orderd (including his own)

[37] T.V. Paul, "Complex Deterrence: An Introduction," chapter in *Complex Deterrence: Strategy in a Global Age*, edited by T.V. Paul, Patrick Morgan and James Wirtz (Chicago and London: University of Chicago Press, 2009), 1.

[38] Jeffery Knopf, "Three Items in One: Deterrence as a Concept, Research Program, and Political Issue," in *Complex Deterrence: Strategy in the Global Age* (Chicago and London: University of Chicago Press, 2009), 53.

[39] Executive Office of the President, National Security Strategy (Washington D.C.: The White House, May 2010),4.

[40] United States Department of Defense, Nuclear Posture Review Report (Washington D.C.: April 2010), iii.

[41] Barack Obama, "Remarks by President Barack Obama," (address, Hradcany Square, Prague, Chech Republic, 5 April 2009). Available on-line at: http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered/

[42] Matthew Bunn, *Securing the Bomb 2010: Securing All Nuclear Materials in Four Years* (Washington D.C.: Nuclear Threat Initiative and Belfer Center Project on Managing the Atom, Harvard University, April 2010), v.

[43] Lieutenant Colonel Andrew Kovich, "Maintaining Deterrence and Nuclear Weapons: The Triad and Reducing Nuclear Dangers" (Research Report, Maxwell AFB, AL, May 2010), 13.

[44] Department of Energy and Department of Defense, "National Security and Nuclear Weapons in the 21st Century" (Washington D.C.: September 2008), 3. Available on-line at: http://www.defense.gov/news/nuclearweaponspolicy.pdf

[45] Department of Defense, Report of the Defense Science Board Task Force on Nuclear Capabilities (Washington D.C.: Office of the Undersecretary of Defense [Acquisition, Technology and Logistics], 2006), 2.

[46] Executive Office of the President, National Security Strategy (Washington D.C.: The White House, , May 2010), 7

[47] United States Department of Defense, Quadrennial Defense Review Report (Washington D.C. February 2010), 5. Available on-line at: http://www.defense.gov/qdr/

[48] United States Department of Defense, Nuclear Posture Review Report (Washington D.C.: April 2010),3.

[49] Nuclear Weapons in 21st Century U.S. National Security, Report by a Joint Working Group of AAAS, the American Physical Society and the Center for Strategic and International Studies (December 2008), 6.

[50] Simon Saradzhyan, *Russia's Non-strategic Nuclear Weapons in Their Current Configuration and Posture: A Strategic Asset or Liability?* (Cambridge, MA: The Belfer Center, Harvard University, January 2010),2.

Notes

[51] Department of Energy and Department of Defense, "National Security and Nuclear Weapons in the 21st Century" (Washington D.C.: September 2008), 6.

[52] Hui Zhang,"China and Nuclear Disarmament," chapter in *Reducing and Eliminating Nuclear Weapons: Country Perspectives on the Challenges to Nuclear Disarmament*, (Princeton, NJ: Princeton University, May 2010), 10-15.

[53] See, for instance, Hui Zhang's op-ed "The Defensive Nature of China's Underground Great Wall" in the *Bulletin of the Atomic Scientists*, January 16, 2012 where he responds to a study by Georgetown University's Phillip Karber who claimed a vast network of tunnels in China could hide up to 3,000 nuclear weapons.

[54] Department of Energy and Department of Defense, "National Security and Nuclear Weapons in the 21st Century" (Washington D.C.: September 2008), 5.

[55] International Atomic Energy Agency, Director General's Report on Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran (24 February 2012), summary findings 51 & 52. http://www.iaea.org/Publications/Documents/Board/2012/gov2012-9.pdf

[56] See, for instance Harvard's Belfer Center website for a culmination of many expert opinions and analysis on Iran. http://belfercenter.ksg.harvard.edu/ (Accessed March 2010).

[57] William Tobey, "The Latest on Iran's Nuclear Program," *Foreign Policy*, 27 February 2012.

[58] Graham Allison, "Will Iran Be Obama's Cuban Missile Crisis," Op-Ed, *Washington Post*, 8 March 2012.

[59] A few of the many concerns of a nuclear Iran, which leads to international instability include: the threat to Israel, possible proliferation in the region, and more bold/aggressive/hostile behavior from Iran and its allies. One discussion on these issues can be found at Shlomo Brom, Shai Feldman and Shimon Stein, "A Real Debate About Iran," *Foreign Policy*, January 30, 2012. Many other articles on the Iran issue can be found on the Belfer Center for Science and International Affairs website, http://belfercenter.ksg.harvard.edu/.

[60] Alyssa Newcomb, Luis Martinez and Martha Raddatz, "North Korean Rocket Launch Fails: US Official," ABC News, 12 April 2012. http://abcnews.go.com/International/north-korea-launches-test-rocket/story?id=16125951

[61] Ibid

[62] See Dr. Siegfried Hecker's trip report to North Korea's Yongbyon Nuclear Complex, Center for International Security and Cooperation, Stanford University, 20 November 2010.

[63] John Park and Dong Sun Lee, "North Korea: Existential Deterrence and Diplomatic Leverage," chapter in *The Long Shadow: Nuclear Weapons and Security in 21st Century Asia* edited by Muthiah Alagappa (Stanford, CA: Stanford University Press, 2008), 267-295.

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

[65] Ibid, ix.

Chapter 3

Safe, Secure and Effective: What are the Risks?

I have heard it said, 'We don't manage risk in the nuclear business, we eliminate it.' I guarantee this person is not walking in my shoes.

--Major General C. Donald Alston, Commander, 20th Air Force[1]

The nuclear enterprise is often characterized as a "no-fail" operation. Senior officials visiting nuclear personnel or talking about the profession habitually mention themes like "there's no room for error" or "perfection is the standard." This idealistic, naive narrative most often comes from those "outside-the-ropes" of the daily nuclear mission. Their language is one part motivational tactic and one part strategic hope—their motivation directed to the personnel entrusted with properly caring for the world's most powerful weapons; their hope focused inward to help alleviate any lingering doubt that these weapons are safe, secure and effective arms only employed upon proper authorization from the President of the United States. Misguided attempts at motivation and hope, however, do not provide the foundation necessary to ensure an effective nuclear arsenal.

As impractical as these labels may be, they are an accepted reality for today's nuclear personnel for two reasons: past performance and future expectations. The hard work, attention-to-detail perfection of their nuclear predecessors produced an extraordinary safety record throughout the lifespan of these weapons. High expectations of the American people demands a continued excellence from current and future nuclear stewards as well. But as clearly stated

above, those granted the special trust and responsibilities of nuclear surety fully understand success is a matter of risk management, not risk aversion or elimination. And that success, is ultimately grounded in providing two guarantees. Major General Tim McMahon, a former Twentieth Air Force Commander, describes the essential elements of nuclear surety and positive control when he said,

- First: we guarantee the President of the United States that if he directs that we strike and produce a nuclear yield, then we will do so precisely as directed;
- Second: we guarantee the people of the United States that absent that order, the weapons in our custody are safe; they are secure; and, they are reliable.
- If we cannot deliver on the first guarantee, then the force is politically and militarily irrelevant. If we cannot deliver on the second guarantee, then the existence of the force and the weapons themselves are intolerable.[2]

General Alston understands and acknowledges the risk encountered daily by nuclear professionals under his command. But unfortunately, it is not just management of those understood and accepted enterprise risks General Alston refers to that jeopardizes the guarantees General McMahon describes. Today's abolition debate drives an uncertain future for nuclear weapons and provides a unique challenge for leadership within the nuclear arena.

Risk Defined: Will vs. Capability

Before discussing risks, revisiting the deterrence equation is helpful. Deterrence, as defined in the previous chapter is the *product* of a nation's credible will multiplied by its capabilities. To produce nuclear deterrence then, a nation must possess both a capable nuclear force and convincing political will to utilize that force when necessary. If either falters, the equation is driven to zero, credibility is lost, and deterrence fails.

Nuclear Will: A President's Choice

Nuclear weapons are often described as the "President's weapons." Unique from others in the US military arsenal, the President is the sole release authority for nuclear weapons.[3] This authority cannot and is not delegated to US military commanders or other high-ranking political figures. Nuclear execution orders flow directly from the President to military launch controllers and all such orders are methodically verified and authenticated to safeguard this fact. The United States is, of course, a democracy, so Presidential decisions are heavily influenced by the American voting public. But determining the actual use of nuclear weapons, under what one can assume would be dire, time-critical circumstances is a decision only the President can make. Ultimate will of use then remains a Presidential responsibility. As such, it proves difficult, if not impossible to measure when considering the "health" of the deterrence equation.

Nuclear Capability

The President has an equally important, although shared responsibility in maintaining US deterrence capability. The entire nuclear enterprise—the President, Congress, leadership in both the Departments of Defense and Energy, down through the military pilots and launch commanders—retains accountability for producing credible nuclear capability on behalf of America and her allies. The risks discussed in this chapter focus on the capability portion of the deterrence equation.

Relevance as Risk

The most significant risk to the nuclear enterprise and deterrence remains mission relevance. Without public and political support, the nation's nuclear capabilities atrophy. Risk to the success of an already difficult mission increases when nuclear personnel face questions regarding the relative importance of deterrence. The Air Force, for instance, recently dealt with

such negative results of mission attrition after the historic dismissal of their highest ranking civilian and military leaders; the Secretary (SECAF) and Chief of Staff (CSAF).[4] The firings followed completion of an investigation into the second of two embarrassing Air Force incidents. First, in August of 2007 an Air Force bomber flew with live nuclear warheads from Minot Air Force Base in North Dakota to Barksdale Air Force Base in Louisiana without anyone knowing. Next, in March of 2008 the Air Force discovered a prior shipment of parts was mistakenly sent to Taiwan. The Secretary of Defense responded by saying:

> In summary, I believe these actions are required because, first, the focus of the Air Force leadership has drifted with respect to perhaps its most sensitive mission. Second, performance standards in that sensitive area were allowed to degrade. Third, only after two internationally sensitive incidents did Air Force leadership apply increased attention to the problem. And fourth, even then, action to ensure a thorough investigation of what went wrong was not initiated by the Air Force leadership but required my intervention.[5]

Secretary Gates subsequently removed the SECAF and CSAF, directed investigative studies into Air Force and DoD management of the nuclear enterprise and helped establish a path toward reinvigoration of the nuclear enterprise. The underlying themes that began to surface from those studies were not a surprise to nuclear personnel. "Erosion of nuclear-related expertise" and "diminished sense of mission importance, discipline and excellence"[6] were examples cited as not just the cause of these incidents, but problems found within the overall Air Force management of the nuclear mission.

The sine wave of nuclear support that peaked during the Cold War years had started its decline after the Soviet Union fell in the early 1990s, then hit bottom as the new century began. Several studies prior to these incidents described this culture of declining nuclear support.

- Joint Advisory Committee Report on the Nuclear Readiness of the Department of Defense, 1995

  - There is reason for concern about the long-term quantity and quality of nuclear weapon expertise within the DoD
  - DoD does not have the structure in place and the expertise…to be a smart customer of the DOE supplier of nuclear warheads and support

- Defense Science Board Task Force on Nuclear Deterrence, 1998
  - It is imperative that the general decline in the value accorded nuclear expertise be reversed now
  - Some policy declarations/documents have minimum emphasis on nuclear deterrence

- Defense Science Board Task Force on Nuclear Capabilities, 2006
  - Since the end of the Cold War, DoD senior-level attention to nuclear weapons management has been minimal at best
  - Nuclear-dedicated organizations were disestablished, vitiated, or tasked with additional missions that, in various degrees, submerge the nuclear weapons activities[7]

Lack of support from the highest levels began to erode the self-disciplined culture required to successfully execute the mission and ultimately produce credible nuclear deterrence. The Air Force responded by making the nuclear enterprise its highest priority; established a nuclear directorate on the Headquarters staff in the Pentagon; created a new Major Command charged with oversight of all Air Force nuclear weapon systems and their support infrastructure; and consolidated nuclear weapon life-cycle management under one authority.[8] With these and other much needed changes, effective Air Force leadership and support of the nuclear mission returned. But Air Force personnel are simply stewards of the President's weapons and America's deterrence. Without support from both, the nuclear resurgence cannot and will not last. As the 2008 Schlesinger Task Force noted:

> The most difficult challenge in maintaining a credible nuclear posture to deter WMD attacks upon the United States and its allies will be in persuading this nation of the abiding requirement for nuclear forces. Such leadership must come from the top. Deterrence has worked because the U.S. Government and its allies have supported it with resources and leadership. Deterrence must continue to have such support, including the visible public commitment of the President, the White House, and the Department of Defense.[9]

The continued de-emphasis of deterrence and debate over the future existence of nuclear weapons diminishes the ability to successfully produce credible deterrent capability. This diminished capacity could very well lead to more serious incidents in the future. Recognizing the long-term relevance of deterrence allows for a reversal of this trend and provides the foundation for mission essential support. Recruiting and retaining qualified personnel and obtaining adequate resources are the life-blood of any successful organization; the same proves true for America's nuclear enterprise as well.

Nuclear Personnel

Abolition rhetoric and de-emphasizing deterrence has a negative effect on daily mission performance, as well as attracting and maintaining expertise. This adds unnecessary risk to the safety, security and effectiveness of the nuclear arsenal. Qualified nuclear personnel are required to ensure a credible capability in order to produce deterrence. This fact rings true for any successful organization, military or otherwise. But when you consider the gravity of failure and the difficult nature of the profession, the relevance of maintaining nuclear expertise becomes obvious. The consequences of failure within the nuclear enterprise concerns both domestic safety and national security. This dual role or responsibility was described in Scott Sagan's book, *The Limits of Safety:*

> Still, at a fundamental level, it is important to recognize that the military commands controlling U.S. nuclear weapons have been asked to do the impossible. Peter Feaver has used the phrase, the "always/never dilemma" to describe the twin requirements placed on U.S. military commands. Political authorities have demanded, for the sake of deterrence, that the organizations *always* be able and willing to destroy an enormous variety of targets inside the Soviet Union, at a moments notice, under every conceivable circumstance. They have demanded that military commanders *always* be able to execute such attacks at any time of the day, 365 days a year. They have demanded that our nuclear forces *always* be effective, regardless of whether the U.S. struck first or was

> retaliating after having suffered a catastrophic nuclear attack. And, finally, they demanded that the military, while doing all this, *never* have a serious nuclear weapon accident, *never* have an accidental detonation, and *never* permit the unauthorized use of a weapon to occur.[10] [emphasis in original]

The necessity of trained, experienced personnel to perform this crucial mission may be obvious, but not unique to the nuclear enterprise. Speaking in terms of the US military, conventional weapons obviously require the same. Multi-billion dollar aircraft, satellites or ships are not simply toys for the incompetent; they are instruments of national power and strength and require selectively trained personnel to operate, maintain and secure them. However, no conventional weapon carries the same emotional, physical and/or political effects as nuclear weapons. Even what might be considered an insignificant procedural error elsewhere, can carry severe consequences in the context of dealing with nuclear weapons. A small mistake with exceedingly high consequences occurred in 1980 at a Titan II missile silo in Arkansas:

> During routine maintenance in a Titan II silo, an Air Force repairman dropped a heavy wrench socket, which rolled off a work platform and fell toward the bottom of the silo. The socket bounced and struck the missile, causing a leak from the pressurized fuel tank. The missile complex and the surrounding area were evacuated and a team of specialists was called in from Little Rock Air Force Base, the missile's main support base. About 8 1/2 hours after the initial puncture, fuel vapors within the silo ignited and exploded. The explosion fatally injured one member of the team. Twenty-one other USAF personnel were injured. The missile's reentry vehicle, which contained a nuclear warhead, was recovered intact. There was no radioactive contamination.[11]

A momentary loss of self-discipline was the cause of this terrible accident. Attention to detail, strict adherence to established procedures, and checklist discipline are all hallmarks of nuclear duty and required for both nuclear safety and operations. General Curtis LeMay, the most influential of the former Strategic Air Command (SAC) commanders and truly the “father” of nuclear safety and operational standards in the Air Force, fully embraced the deterrence mission. He understood the costs of failure were too high to pay and established the tradition of

disciplined effort and tough nuclear standards during his command. "To ensure nothing ever went wrong, SAC wrote manuals for every job, demanded strict adherence to checklists, and drilled aircrews in a rugged routine of training and alerts that created a body of 'perfect specialists' who were consumed with executing their mission flawlessly."[12] Even momentary lapses of concentration and judgment are not tolerable when dealing with nuclear weapons. Deterrence only works when a believable, credible capability exists. With repeated personnel failures, the capability erodes and deterrence fails. General LeMay, who understood this fact as well, stated:

> Everything we do must be real, consequential, and meaningful, and it must be recognized as such by the Soviet Union. No bluff, no smoke and mirrors, just raw and recognizable capability to exact unacceptable punishment, and with the unquestioned ability of our forces to employ it effectively under all circumstances.[13]

His creed was: "a force that cannot fight and win will not deter."[14] "Every single procedure and requirement for employing those weapons—from communicating the national command authorities' orders to launch, to the actual delivery, penetration, and impact on designated targets—had to be seen to be believable, robust, and reliable."[15] The same holds true today. For effective deterrence, potential adversaries must remain convinced in the abilities and capabilities of our nuclear personnel.

In addition to the already difficult daily task of maintaining high nuclear safety and operational standards, continued talk of a world free of nuclear weapons and their reduced national security role make it increasingly difficult to attract, develop and retain qualified personnel. A recent report out of Air University, analyzing the Minot to Barksdale and Taiwan nuclear incidents was released. After studying both incidents, their most significant finding was: "…the foremost issue is declining technical competence (expertise) in the Air Force ranks."[16]

Their recommendations for improvement included four main areas: expertise, leadership, management, and culture. Each area centrally affected by the ability (or inability) to recruit, train and maintain qualified personnel.

This report comes on the heels of several others with similar arguments. The 2008 Defense Science Board Report on Nuclear Deterrence Skills stated:

> In the absence of a strong national commitment to sustaining the nuclear security enterprise and visible leadership starting at the senior levels, it is difficult to keep the rigor and focus needed at all levels to meet the demanding proficiency standards that are indispensable for nuclear deterrence activities. It also is difficult, absent such a strong national commitment, to retain the best of the younger workforce. Words are not enough. There must be evidence of commitment that manifests itself in both strong leadership and real, meaningful work.[17]

The report also described nuclear expertise as uniquely demanding, not something acquired overnight or on the fly, and that the team was concerned about the future of America's nuclear deterrence expertise. More troubling though, they "did not find adequate planning to deal with the problem."[18]

Likewise, a key finding of the Phase I Schlesinger Task Force followed this same thought. It recommended "The Air Force review its deployment, assignment and promotion policies to ensure that it develops personnel and future leaders who are nuclear qualified and that nuclear-focused careers provide opportunities for professional development and promotion to senior ranks."[19] In Phase II, the report documented this lack of development and expertise went well beyond the Air Force and into higher levels of government:

> The Task Force found a distressing degree of inattention to the role of nuclear weapons in deterrence among many senior DoD military and civilian leaders. Many lack the foundation of experience for understanding nuclear deterrence, its psychological content, its political nature, and its military role—which is to avoid the use of nuclear weapons. A lack of education on nuclear deterrence has contributed to this problem. This shortfall of experience and understanding will become even more acute among senior leaders in the future.[20]

This lack of purposefully cultivated talent and expertise is not isolated to the military ranks and civilian policy-makers, the National Nuclear Security Administration's (NNSA) national laboratories are hit just as hard. Secretary Gates summarized the deteriorating effects in a 2008 speech:

> No one has designed a new nuclear weapon in the United States since the 1980s, and no one has built a new one since the early 1990s. The U.S. is experiencing a serious brain drain in the loss of veteran nuclear weapons designers and technicians. Since the mid-1990s, the National Nuclear Security Administration has lost more than a quarter of its workforce. Half of our nuclear lab scientists are over 50 years old–and many of those under 50 have had limited or no involvement in the design and development of a nuclear weapon. By some estimates, within the next several years, three quarters of the workforce in nuclear engineering and at the national laboratories will reach retirement age.[21]

This erosion of nuclear expertise coupled with the threat of future nuclear reductions sparked a study by the Henry L. Stimson Center released in 2009 concerning the nuclear laboratories Secretary Gates referred to in his speech. The purpose of the report was to assess:

> … the potential application of the immense scientific and engineering talent housed at the NNSA national security Laboratories to meeting current and future national security challenges beyond their core nuclear weapons mission.[22]

In other words, to maintain their personnel and funding, they felt it necessary to explore other national security problems to which they could apply their extensive science and technology expertise. The mere fact our national nuclear laboratories were searching for ways to maintain their support by solving other "urgent national security problems"[23] is very telling of the situation. An excerpt from the executive summary explains exactly why they felt this search for other work was necessary:

> On the campaign trail, President Obama embraced the vision of a nuclear free world, but he made clear that until the time such a world was possible, the US would maintain a "robust deterrent." Resolving the inherent tension in these divergent goals is no easy task. The backbone of our deterrent is the scientific base at our nuclear weapons Laboratories. In order to recruit, train, and retain

> young, talented scientists, our political leaders must articulate a vision for the Laboratories that translates into meaningful work – a mission that young scientists can embrace and to which they will dedicate their professional lives. Simultaneously, the work to achieve this vision should not undercut US nonproliferation goals.[24]

This continued lack of commitment and inattention to the lasting role of nuclear deterrence will continue to erode US nuclear expertise. While the threat has changed from a bi-polar stand-off with the Soviet Union to a multi-polar international nuclear environment, the threat still exists and most likely will for a very long time. As determined by every major study and governmental document produced on the subject, deterrence remains viable, required and a foundational part of US national security. Acknowledgment and recognition of the necessity of deterrence and the myth of abolition will allow decision makers to take appropriate steps to preserve the capability. The ability to recruit, develop and retain nuclear expertise provides one part of America's nuclear capability; adequate resources provide the other.

Nuclear Resources

Qualified, trained personnel clearly form the foundation required to produce credible nuclear capability. But without adequate resources, those dedicated professionals lack the necessary tools to perform their mission effectively, morale suffers and credible capability is lost. Those resources come in the form of program dollars. The most crucial and most obvious show of support from political and military leaders for any military program is the DoD budget. Gordon Adams, professor of international affairs at American University and Henry L. Stimson Center Distinguished Fellow and Cindy Williams, MIT research scientist and former Assistant Director of the Congressional Budget Office noted this by saying:

> National Security budgets are the most dependable reflection of US security policy. Seeing things through the lens of the budget can help decision-makers and

> ordinary citizens discern the genuine priorities of national leaders from the oftentimes illusory ones portrayed in rhetoric."[25]

Support for Air Force nuclear resources begins with submission of budget priorities to the Secretary of Defense. The Secretary of Defense reviews the service's proposal, makes desired changes and forwards for Presidential then Congressional coordination and approval. Secretary of Defense Robert McNamara developed this resource allocation process to help solidify civilian control of the military.[26] It's no surprise then that defense priorities are political priorities, enabling national leaders to implement security policy through the budget process.

The nation faces tough financial choices regarding the current nuclear weapons program. Our national security documents and most, if not all, of our senior leaders consistently extol the virtues and relevance of nuclear deterrence now, and for as long as nuclear weapons exist. Just as the quote above describes, tests of this support will soon materialize. Much of today's nuclear triad, is old, deteriorating and in need of modernization. General Robert Kehler, Commander of United States Strategic Command, described the overall modernization challenge when addressing the House Armed Service Subcommittee on Strategic Forces:

> Specifically, funding is vital for the sustainment and modernization of delivery systems (development of OHIO-class SSBN replacement and requirements scoping for both the next generation bomber and follow-on ICBM), weapon life extensions (W76-1, B61, W78), infrastructure recapitalization (Uranium Processing Facility, Chemistry and Metallurgy Research Replacement-Nuclear Facility), crucial naval reactor design activities for the OHIO-class SSBN replacement, and C3 assets, including the USSTRATCOM Headquarters command and control complex.[27]

This need for modernization will force investment choices in the midst of a struggling economy, conflicts in the Middle East and conventional weapon recapitalization after multiple, lengthy engagements overseas. General Kehler echoed the same view:

> The U.S. nuclear enterprise faces a substantive, multi-decade recapitalization challenge at the very time we simultaneously face stark fiscal realities that

> demand difficult choices and the most careful and effective stewardship of taxpayer dollars."[28]

These choices will largely discern reality from rhetoric as national security programs compete for resources throughout this budget cycle. The services and political decision-makers are currently dealing with this issue as budget submissions and Congressional testimony on the Fiscal Year 2013 (FY13) budget are underway. With a lot of political gamesmanship and finger pointing thus far—much of it dealing with nuclear modernization, Presidential promises kept (or not) for securing New START votes, and future nuclear force-structure decisions—the road to effective deterrence will continue to be a challenge. Although it is too early to determine impacts to the force since the decisions are not final, one factor always rings true with Congressional deliberations: lack of bipartisan support guarantees suboptimal results. Nuclear deterrence and modernization stirs emotions on both sides of the political aisle, but as current debates indicate, deterrence clearly lacks bipartisan support.

A few items on the delivery system issues General Kehler addressed are resident in the FY13 Presidential request to Congress. First, the request included a two-year delay for the Ohio-Class Nuclear Ballistic Missile Submarine (SSBN) replacement, projecting its availability in 2013.[29] This adjustment forces the Navy into a temporary reduction to ten (possibly nine) available nuclear submarines in the 2030s,"[30] absent any further funding delays or acquisition issues. Second, the next generation nuclear bomber faces similar financial decisions, "with questions still remaining about whether the new bomber will be nuclear certified at the outset."[31] Finally, a one-year Analysis of Alternatives (AoA) for the follow-on ICBM, expected now to last until 2030, was funded and scheduled to begin in 2013.[32] Given the history and pace of DoD acquisitions, this AoA timeline provides very little room for maneuver. In Senate testimony, General Kehler indicated any operational risk induced by these, or any other 2013 budget

decision is "manageable" for now. But he is concerned about the future, because the "Secretaries of Energy and Defense have said that we do not have the complete plan in place for what happens beyond 2013."[33]

Unfortunately for nuclear modernization advocates, these issues represent only the tip of the proverbial iceberg. They embody only a few of the many issues resident in the delivery systems alone, with attention required elsewhere as well. For example, the NNSA—the governmental agency responsible for the management and security of the nation's nuclear weapons and nuclear nonproliferation programs—requires increased resources for an aging infrastructure and nuclear weapons life extension programs (the same weapon life extension and infrastructure concerns General Kehler discussed). Secretary Gates explained the urgency related to the weapons program:

> Let me first say very clearly that our weapons are safe, reliable, and secure. The problem is the long-term prognosis–which I would characterize as bleak … To be blunt, there is absolutely no way we can maintain a credible deterrent and reduce the number of weapons in our stockpile without either resorting to testing our stockpile or pursuing a modernization program.[34]

With the lack of support for future nuclear testing, the U.S. is left with modernization as the only viable choice. Comparing the U.S. to other nuclear states, the Secretary added, "Currently, the United States is the only declared nuclear power that is neither modernizing its nuclear arsenal nor has the capability to produce a new nuclear warhead."[35] It was problems such as these (and to be fair, many other DoD issues as well) that led Admiral Michael Mullen, the recently retired Chairman of the Joint Chiefs of Staff to say, the "single, biggest threat to national security is our debt."[36] The Chairman understood shrinking budgets are a reality given the country's economic crisis, forcing decisions on what to keep and what to cut. This resource-constrained environment

makes increased needs, like modernization of the nuclear enterprise, more difficult to defend without significant high-level, bipartisan support.

This exact scenario played out in the 1990s as nuclear assets became bill payers for other programs. Constricting budgets, the fall of the Soviet Union and the rise of conventional conflicts caused a shift in defense spending to the detriment of nuclear weapons and their aging support infrastructure. After SAC closed its doors in 1992, resource advocacy for Air Force nuclear bombers went to Air Combat Command and ICBMs to Air Force Space Command.[37] With a tendency toward tactical air platforms and skyrocketing costs of space systems, it became increasingly difficult for nuclear programs to compete for funding priorities.[38] Phase II of the Schlesinger Report solidified this fact: "The Task Force found that over the past 15 years the military services have shed nuclear assets—or attempted to do so—in order to use the resources elsewhere."[39] This 1990s restructure of funding as a result of shifting priorities directly led to the acknowledged and dangerous decline within the nuclear enterprise we are still trying to reverse today. The nuclear modernization choices made now similarly define America's future nuclear deterrent capability.

On affordability, we must consider that today's nuclear arsenal was born during similar economic decision-making and has always provided this nation an exceptional return on her investment. The post-World War II era military drawdown resulted in policy-makers searching for options. The idea of favoring nuclear weapons over more costly conventional ones after a frustrating, prolonged Korean War experience was solidified by President Dwight Eisenhower's New Look or Massive Retaliation policy:[40]

> The United States would no longer constrain itself to meet Communist military probes with local conventional counterforce, as it had in Korea. Instead, it would depend primarily upon a great capacity to retaliate instantly and massively against major Communist powers responsible.[41]

They favored a smaller, pre-World War II military infrastructure and understood competing with the Soviet Union in a conventional arms race was not in our best interest. They chose national security through nuclear strength, resulting in deterrence as the prominent security strategy. Largely criticized for lack of flexibility, the policy was later adjusted to add gradual response options.[42] A result of this policy, still true today, was that nuclear weapons provide national security with "more bang for the buck."[43] Ultimately, the decision to forgo a conventional arms race with the Soviet Union and opt for nuclear strength kept America safe while protecting national treasure.

A similar plan or national strategy is required today. Otherwise, the competing financial interests and economic crisis will drive national security. We will be left with the force we can afford instead of the force we require. Of course, many have observed this as reality anyway. John Lewis Gaddis studied several previous national security policies and concluded, "The perception of means available, then, appears to be the single most determinant of national strategy."[44] Again, Gordon Adams and Cindy Williams would certainly understand this conclusion, as they point out that "without resources, national security policy is largely rhetoric."[45] By allowing finances to drive strategy though, we add risk and ignore the warnings of one of our most respected Founding Fathers, Benjamin Franklin who stated:

> *Let us, therefore, beware of being lulled in to a dangerous security, and of being enervated and impoverished by luxury;* of being weakened by internal contentions and divisions; of being shamefully extravagant in contracting private debts, while we are backward in discharging honorably those of the public; of neglect in military exercises and discipline, and in providing stores of arms and munitions of war, to be ready on occasion; for all these are circumstances that give confidence to enemies, and diffidence to friends; *and the expenses required to prevent a war, are much lighter than those that will, if not prevented, be absolutely necessary to maintain it.*[46] [emphasis added]

The nuclear enterprise is a profession with inherent risk. Nuclear personnel work with extreme weapons, often in extreme conditions, with no tolerance for deviation from accepted procedures. Today's abolition movement questions the future relevance of this mission. This adds additional risk in the form of depleted expertise and resources, erodes nuclear capability, and undermines the overall production of US nuclear deterrence. International strategic stability deteriorates, threatening the overarching goal and tradition of nuclear non-use, placing America and her allies at unacceptable risk to their one and only existential threat.

Notes

[1] Major General C. Donald Alston, Commander, Twentieth Air Force, Twentieth Air Force Vector: The State of the Force and Priorities to Enhance our Culture of Critical Self-Assessment, 31 January 2012

[2] Major General (Ret) Timothy McMahon, former Commander, Twentieth Air Force, in Major General C. Donald Alston, Commander, Twentieth Air Force, Twentieth Air Force Vector: The State of the Force and Priorities to Enhance our Culture of Critical Self-Assessment, 31 January 2012

[3] Air Force Doctrine Document 3-72, *Nuclear Operations*, 7 May 2009, 11.

[4] Robert M. Gates, Secretary of Defense, transcript of "DoD News Briefing with Secretary Gates from the Pentagon, " 5 June 2008.

[5] Ibid

[6] Major General C. Donald Alston, et. al., Air Force Nuclear Task Force, "Reinvigorating the Air Force Nuclear Enterprise," 28 October 2008.

[7] Information compiled by and presented at, Nuclear Management Fundamentals Course (Kirtland AFB, NM: Air Force Material Command, Air Force Nuclear Weapons Center), Day 1 introduction brief, slide 24.

[8] Michael Donley, Secretary of the Air Force, "The Nuclear Enterprise," (address, National Defense University's Congressional Breakfast, Washington, D.C., June 23, 2010).

[9] James R. Schlesinger, et al, Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase II: Review of the DoD Nuclear Mission (December 2008), 11.

[10] Scott D. Sagan, *The Limits of Safety*, (Princeton, NJ: Princeton University Press, 1993),278-79.

[11] U.S. Senate, *Narrative Summaries of Accidents Involving U.S. Nuclear Weapons, 1950-1980, Energy and Water Development Appropriations Act*, Congressional Record for the 102nd Congress (1991-1992), 3 August 1992.

[12] Mike Worden, *Rise of the Fighter Generals: The Problem with Air Force Leadership, 1945-1982* (Maxwell AFB, AL: Air University Press, March 1998), 61.

[13] General Curtis LeMay, *Mission with LeMay* (Garden City, NY: Doubleday, 1965)

[14] General Russell E. Dougherty, "Leadership During the Cold War: A Four-Star General's Perspective," in Peter B. Land and Ronald E. Marcello, *Warriors and Scholars: A Modern War Reader* (Denton, TX: University of North Texas Press, 2005),110.

[15] Ibid, 119

[16] Michelle Spencer, Aadina Ludin, Heather Nelson, "The United States Air Force Minot and Taiwan Nuclear Weapons-Related Incidents: An Assessment" (research report, Maxwell AFB, AL: Air University, April 2011), 25.

[17] Department of Defense, Report of the Defense Science Board Task Force on Nuclear Deterrence Skills (Washington D.C.: Office of the Undersecretary of Defense [Acquisition, Technology and Logistics], May 2008), vii.

[18] Ibid, v.

[19] James R. Schlesinger, et al, Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase I: The Air Force's Nuclear Mission (September 2008), 4.

[20] James R. Schlesinger, et al, Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase II: Review of the DoD Nuclear Mission (December 2008), iv.

[21] Robert M. Gates, Secretary of Defense, (address, Carnegie Endowment for International Peace, Washington, D.C., Tuesday, October 28, 2008)

[22] Task Force on Leveraging the Scientific and Technological Capabilities of the NNSA National Laboratories for 21st Century National Security, "Leveraging Science for Security: A Strategy for the Nuclear Weapons Laboratories in the 21st Century" (Washington D.C.: The Henry L. Stimson Center, March 2009), 58.

[23] Ibid, 58

[24] Ibid, 2-3

Notes

[25] Gordan Adams and Cindy Williams, *Buying National Security: How America Plans and Pays for its Global Role and Safety at Home*, (New York, NY: Routledge, 2010), 1.

[26] Ibid, 93.

[27] General C. Robert Kehler, Commander, United States Strategic Command (address, The House Committee on Armed Services, Subcommittee on Strategic Forces, Washington, D.C., 2 November 2011).

[28] Ibid.

[29] Leon Panetta, Secretary of Defense (address, U.S. Senate Committee on Armed Services, Washington, D.C., 14 February 2012).

[30] U.S. Senate, Hearing to Receive Testimony on the Department of Navy in Review of the Defense Authorization Request for Fiscal Year 2013 and the Future Years Defense Program (Washington D.C., 15 March 2012). During the hearing, the Chief of Naval Operations Admiral Greenert was asked about the delay by Senator Reed. His response: "Today, Senator, we have 14 *Ohio*-class submarines. Two are in overhaul, so that leaves us with 12 really operational. With that, there are ten or nine available at any given time for Strategic Command. We feel due to this delay we will ride a period where we'll have 10 operational, sometimes 9. So we'll have a similar risk there. We have to watch it very closely because at that time frame in that future—I'm talking about the late 20s and the 30s—we'll have older *Ohio*s. So we'll have to watch it very carefully. But right now we think that we can mitigate that risk."

[31] Senator Jon Kyl, "The Failed Promises of Nuclear and Missile Defense Modernization" (address, Congressional Breakfast Series on Nuclear Deterrence and Missile Defense, Washington D.C., 17 April 2012).

[32] Madelyn Creedon, Assistant Secretary of Defense for Global Strategic Affairs and Andrew Weber, Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs (joint statement, The Senate Committee on Armed Services, Subcommittee on Strategic Forces, Washington D.C., 28 March 2012).

[33] General C. Robert Kehler, Commander, United States Strategic Command (address, The Senate Committee on Armed Services, Washington, D.C., 27 March 2012).

[34] Robert M. Gates, Secretary of Defense, (address, Carnegie Endowment for International Peace, Washington, D.C., Tuesday, October 28, 2008).

[35] Ibid.

[36] Michael J. Carden, Army Sgt. 1st Class, "National Debt Poses Security Threat, Mullen Says," American Forces Press Service, 27 August 2010. Available on-line at: http://www.defense.gov/news/newsarticle.aspx?id=60621 (accessed 23 April 2012).

[37] The ICBM mission first transferred along with the nuclear bombers to Air Combat Command, but was subsequently transferred to Air Force Space Command in July of 1993. http://www.nationalmuseum.af.mil/shared/media/document/AFD-090731-063.pdf (accessed 15 March 2012)

[38] This statement based on the authors experience as a budget programmer in Air Force Space Command from 2006–2009. During this time, as the command responsible for ICBMs, we compiled information and answered questions regarding the decline in nuclear funding.

[39]James R. Schlesinger, et al, Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase II: Review of the DoD Nuclear Mission (December 2008), 25

[40] David M. Kunsman and Douglas B. Lawson, "A Primer on U.S. Strategic Nuclear Policy" (Albuquerque, NM: Department of Energy, Sandia National Laboratories, January 2001), 33

[41] John D. Skelton, Colonel, U.S. Army, "The Triad—A Relook: Should the United States Retain its Land Based ICBM Force?" (monograph, Fort Leavenworth, KS: U.S. Army Command and General Staff College, School of Advanced Military Studies, 10 February 1992), 22.

[42] Ibid, 23-24.

[43] Ibid, 23. As referenced in Colonel Skelton's paper, the term was used during the New Look era; but could be used to explain today's financial situation as well. As with all governmental spending, it is somewhat difficult to determine exact expenditures as represented by the highly publicized exchange between Congressmen Mike Turner and Ed Harkey after a report by the Ploughshares estimated nuclear costs at $50B per year. Congressman Markey used this number to request $20B per year cut from the program. Congressman Turner disputed the claims, saying, "The correct figure is approximately $21.4 billion per year, or $214 billion over the next ten years. Indeed, the $214 billion figure is the Obama Administration's own estimate." Either way, with an over $500B base DoD budget, this would equate to less that 1 in 10 or less than 1 in 20 (depending on which estimate you believe) going toward deterrence. That's for everything—weapons, weapons laboratories, delivery systems (operations and maintenance), research and development, etc., the entire program.

[44] John Lewis Gaddis, *Strategies of Containment* (New York: Oxford University Press, 1982), 355.

[45] Gordan Adams and Cindy Williams, *Buying National Security: How America Plans and Pays for its Global Role and Safety at Home*, (New York, NY: Routledge, 2010)), 221.

[46] Benjamin Franklin, to Charles Thomson, letter, 13 May 1784.

Chapter 4

Conclusion

Mr. Speaker, wars are not caused by the build-up of weapons. They are caused when an aggressor believes he can achieve his objectives at an acceptable price. No-one understood the importance of deterrence more clearly than Winston Churchill, when in his last speech to you he said: "Be careful above all things not to let go of the atomic weapon until you are sure and more than sure that other means of preserving peace are in your hands!"

--Margaret Thatcher[1]

What seems to work best in world affairs, historian Donald Kagan wrote in his book On the Origins of War, "Is the possession by those states who wish to preserve the peace of the preponderant power and of the will to accept the burdens and responsibilities required to achieve that purpose." Now, if we accept that nuclear weapons are still relevant – and indeed, necessary – then we also have to accept certain responsibilities.

--Secretary of Defense Robert Gates[2]

President Obama took office in January 2009 and he inherited a nuclear arsenal at its lowest levels since the Truman administration. The neglected and aging nuclear enterprise was struggling after years of inattention and required resources for modernization in the midst of two wars and a growing financial crisis. At the same time, nuclear proliferation and terrorism were quickly becoming the most dangerous threat to U.S. sovereignty. After taking office and delivering on promises from his successful Presidential campaign, the Obama administration established a vision to reduce nuclear dangers and eventually eliminate nuclear weapons;

negotiated and signed a treaty to bring nuclear force numbers lower; and reduced the role of nuclear weapons in US national security.

Many have called for nuclear weapon abolition in the past. But for several reasons, this latest appeal seized the emotions of abolition advocates like few before. Possibly because force structure numbers of the two major nuclear powers are at all-time lows. Maybe this vision, set forth by this President, at this precise moment in history seemed more credible than past attempts. Or perhaps the threat of nuclear terrorism compelled these leaders to act. But whatever the reason, many experts like Graham Allison were forced to "pause, to reflect, and to begin to reexamine questions they thought had been answered in the 1980s" or "… revisit issues once thought settled."[3] However, since those initial steps in the early days of this administration, momentum has slowed and reality returned.[4] Russia and China continue to modernize their nuclear force. North Korea and Iran remain committed to obtaining nuclear capability. And domestically, lack of bipartisan Congressional support threatens any further nuclear reductions.

Even without those significant challenges, evidence proving that the world is safer without nuclear weapons remains elusive. One could imagine a utopian society, safe from the dangers of nuclear weapons—lacking initial discovery. But now, after invention and use, their existence cannot simply disappear. Many issues challenge this concept of a safer world without nuclear weapons, but one stands out … trust. President Regan liked the term "Trust but Verify," and often used it when describing US relations with the Soviet Union. The very same verification of trust between nations would severely complicate a post invention, nuclear-free world. George Quester described such an environment as a "prisoner's dilemma"[5] and compared it to the original World War II "race" to obtain nuclear weapons. The US obviously won that

race, owned a nuclear monopoly, and subsequently chose to use its new invention on Hiroshima. Thomas Schelling offered his thoughts on this dilemma as well:

> Except for some "rogue" threats, there is little that could disturb the quiet nuclear relations among the recognized nuclear nations. This nuclear quiet should not be traded away for a world in which a brief race to reacquire nuclear weapons could become every former nuclear state's overriding preoccupation.[6]

Nuclear weapons exist and the knowledge to build them will not disappear; there's no real evidence today's world is actually safer without them; they continue to play a relevant role within the complex international security landscape; and the initial domestic momentum toward abolition slowed. Safe conclusion: the existence of nuclear weapons is a reality we must learn to live with responsibly.

Solidify the Role of Nuclear Weapons

The first, and most critical, step in accepting our nuclear responsibilities is to embrace their necessity. In reality, many noted "the New START treaty reduced nuclear weapons only very modestly, and … the Nuclear Posture Review changed US reliance on nuclear weapons only modestly"[7] as well; forcing conclusions that little actually shifted in US nuclear polity from the previous administration.[8] But words have meaning and unintended consequences. Terms like "reducing the role" and "for as long as nuclear weapons exist" stir negative emotions regarding mission relevance and continuity within the very personnel entrusted with their safety, security and effectiveness. When backed by the Commander-in-Chief, the person sitting atop the nuclear enterprise pyramid, they carry even more weight. Embracing the necessity of nuclear weapons and solidifying their national security role reverses this trend and facilitates production of credible nuclear deterrence for America and her allies.

Develop Strategic Policy

With relevance solidified, the next step is strategic policy. A policy simply based on reducing strategic stockpiles or total elimination altogether is flawed. It adds unnecessary risk to operations within the nuclear enterprise today and threatens international stability in the future. In responding to speculation that the Obama administration was considering a nuclear policy based on reduced force structure, Mr. Kissinger and Mr. Scowcroft asserted:

> Before momentum builds on that basis, we feel obliged to stress our conviction that the goal of future negotiations should be strategic stability and that lower numbers of weapons should be a consequence of strategic analysis, not an abstract preconceived determination.[9]

Whether determining strategic policy based on preconceived notions of warhead totals—by financial constraints or any other limiting factor—puts the cart well in front of the horse. Policy drives force structure, not the reverse. Otherwise, you undermine the abiding requirement and risk diminished returns on investment; in this case, US nuclear deterrence and international strategic stability. US policy-makers must first struggle through the difficult work of determining our nuclear strategy, before committing to requirements. Informed debate on questions like the following must be answered prior to determining force structure: Will we continue to rely on calculated ambiguity? What conditions are necessary to shift toward a policy of no first use? Will we continue to underwrite extended deterrence? To whom and at what cost? A policy aimed at force reductions, absent informed debate and conclusions regarding the fundamental purpose of said policy, lacks credibility. Without credibility, deterrence fails. Mr. Kissinger and Mr. Scowcroft went on to say, "regardless of one's vision of the ultimate future of nuclear weapons, the overarching goal of contemporary US nuclear policy must be to ensure that

nuclear weapons are never used."[10] Failure to adequately address and develop US nuclear policy adds risk to this overarching goal.

Resource the Enterprise

With questions regarding necessity answered and a policy developed, adequate support easily follows. By all accounts, future reductions to the US and Russian arsenals are inevitable, and quite frankly, necessary to support the global vision of reducing nuclear dangers. The challenge is continuing to produce credible nuclear deterrence while simultaneously trimming force structure. Since the fall of the Berlin Wall, US and Russian authorities are intimately familiar with the well-traveled road of nuclear reductions. This increasingly served as the answer to nuclear policy questions over the last two decades. But as we go lower, the dynamics of deterrence change significantly and—"less is not just less, less is different."[11]

Major General Chambers, the Air Force general responsible to the SECAF and CSAF for nuclear deterrence operations, discussed this challenge explaining "reductions in warheads and platforms aren't just adaptations to a new environment; reductions will actually change the environment and the deterrence decision calculus."[12] In order to maintain "strategic stability" as we go lower in numbers, operational capabilities become increasingly important. Much of the focus regarding these capabilities has been directed toward maintaining the Triad, and rightfully so. The nuclear triad provides stability and remains flexible to all adversarial threat scenarios. But the triad only works if properly resourced and adequately maintained. Personnel and funding represent the eternal heartbeat of the strategic nuclear triad. Regardless of future force structure decisions, modernizing an aging infrastructure and cultivating nuclear expertise remain the most essential strategic requirements.

In *The Tipping Point*, Malcom Gladwell eloquently describes how seemingly small events lead to social epidemics. An exploding fashion trend, decreasing crime rates, rise of literacy through television all began small, reached a "Tipping Point," then grew exponentially.[13] After the celebrated Wall Street Journal article "A World Free of Nuclear Weapons" the authors, each of course a former high-ranking US statesmen, created and released the similarly titled *Nuclear Tipping Point* documentary.[14] In it, they discuss nuclear dangers and the steps necessary to rid the world of nuclear weapons, in hopes the same exponential growth occurs for their vision. However, such a tipping point works with equal impact in reverse. US nuclear personnel are still working to reinvigorate an enterprise and correct the trends established after years of neglect and decline caused nuclear capability to tip in the wrong direction. Lack of resources, failure to develop requisite expertise, and lack of mission focus contributed to two nuclear incidents, a historic dismissal of Air Force senior leadership and unprecedented poor organizational performance. Decisions regarding the nuclear enterprise today determine which way the trend tips in the future, ultimately affecting nuclear capability and therefore the ability to produce credible nuclear deterrence for the United States and its allies.

Notes

[1] Margaret Thatcher (address, Joint Houses of Congress, Capitol Hill, Washington DC, 20 February 1985). Available on-line at: http://www.margaretthatcher.org/document/105968.

[2] Robert M. Gates, Secretary of Defense, (address, Carnegie Endowment for International Peace, Washington, D.C., Tuesday, October 28, 2008)

[3] Graham Allison, "Thinking about Zero: Could Elimination of Nuclear Weapons Make the World Safe for a Rogue Non-Nuclear Superpower? Foreword to Simon Saradzhyan, "Russia's Support for Zero: Tactical Move or Long-Term Commitment?" (paper, Belfer Center for Science and International Affairs, Harvard Kennedy School, 11 September 2009), 2.

[4] Steven E. Miller, "Nuclear Weapons 2011: Momentum Slows, Reality Returns," *Bulletin of the Atomic Scientists* 68, no. 1 (January/February 2012), 20-28.

[5] George Quester, "The Last Time We Were at Global Zero," *Naval War College Review*, vol 64, no 3 (Summer 2011), 131.

[6] Thomas Schelling, "A World Without Nuclear Weapons?" *Daedalu*, vol 138, no. 4 (20 September 2009), 124-129.

[7] Matthew Bunn, "Reducing nuclear dangers (Review of *How the End Begins: The Road to a Nuclear World War III* by Ron Rosenbaum), *Issues in Science and Technology* (Winter 2012). Available on-line at: http://www.issues.org/28.2/br_bunn.html (accessed 22 April 2012).

[8] Eben Harrell, "Obama's Nuclear Strategy: What's Different?" *Time U.S.*, 7 April 2010. Available on-line at: http://www.time.com/time/nation/article/0,8599,1978348,00.html. (accessed 21 April 2012).

Notes

[9] Henry A. Kissinger and Brent Scowcroft, "Nuclear weapon reductions must be part of strategic analysis," *Washington Post*, Opinions page, 22 April 2012. Available on-line at: http://www.washingtonpost.com/opinions/nuclear-weapon-reductions-must-be-part-of-strategic-analysis/2012/04/22/gIQAKG4iaT_story.html. (accessed 23 April 2012).

[10] Ibid

[11] Major General William A. Chambers, Assistant Chief of Staff for Strategic Deterrence and Nuclear Integration, (address, National Defense University Foundation, Congressional Breakfast Seminar, Washington, D.C.). Transcript of speech received through Headquarters AF/A10 secure website. (Accessed 22 April 2012)

[12] Ibid

[13] Malcom Gladwell, *The Tipping Point* (New York, NY: Back Bay Books: Little, Brown and Company, 2000).

[14] Information regarding the Nuclear Security Project and the Nuclear Tipping Point documentary can be found on their website, http://www.nuclearsecurityproject.org/. (accessed 20 April 2012).

Bibliography

Adams, Gordan and Cindy Williams. *Buying National Security: How America Plans and Pays for its Global Role and Safety at Home.* New York, NY: Routledge, 2010.

Air Force Doctrine Document 3-72. *Nuclear Operations.* 7 May 2009.

Allison, Graham. *Nuclear Terrorism: The Ultimate Preventable Catastrophe.* New York: Henry Holt and Company, 2004.

Allison, Graham. "Thinking about Zero: Could Elimination of Nuclear Weapons Make the World Safe for a Rogue Non-Nuclear Superpower? Foreword to Simon Saradzhyan, "Russia's Support for Zero: Tactical Move or Long-Term Commitment?" Paper, Belfer Center for Science and International Affairs, Harvard Kennedy School, 11 September 2009.

Allison, Graham. "Will Iran Be Obama's Cuban Missile Crisis." Op-Ed, *Washington Post*, 8 March 2012.

Alston, Major General C. Donald, et. al. Air Force Nuclear Task Force. "Reinvigorating the Air Force Nuclear Enterprise." 28 October 2008.

Alston, Major General C. Donald. Commander, Twentieth Air Force, Twentieth Air Force Vector: The State of the Force and Priorities to Enhance our Culture of Critical Self-Assessment, 31 January 2012.

Brom, Shlomo, Shai Feldman, and Shimon Stein. "A Real Debate About Iran." *Foreign Policy*, January 30, 2012.

Bunn, Matthew. "Reducing Nuclear Dangers." Book Review of *How the End Begins: The Road to a Nuclear World War III* by Ron Rosenbaum. *Issues in Science and Technology*, Winter 2012.

Bunn, Matthew. *Securing the Bomb 2010: Securing All Nuclear Materials in Four Years.* Washington D.C.: Nuclear Threat Initiative and Belfer Center Project on Managing the Atom, Harvard University, April 2010.

Carden, Michael J., Army Sgt. 1st Class. "National Debt Poses Security Threat, Mullen Says." American Forces Press Service, 27 August 2010. http://www.defense.gov/news/newsarticle.aspx?id=60621 (accessed 23 April 2012).

Chambers, Major General William A., Assistant Chief of Staff for Strategic Deterrence and Nuclear Integration. Address, National Defense University Foundation, Congressional

Breakfast Seminar, Washington, D.C. Transcript of speech received through Headquarters AF/A10 secure website. (Accessed 22 April 2012)

Chilton, General Kevin C. "Waging Deterrence in the Twenty-first Century." *Strategic Studies Quarterly*, 3, no. 1 (Spring 2009).

Creedon, Madelyn, Assistant Secretary of Defense for Global Strategic Affairs and Andrew Weber, Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs. Joint statement, The Senate Committee on Armed Services, Subcommittee on Strategic Forces, Washington D.C., 28 March 2012.

Department of Defense. Joint Publication 1-02. *Department of Defense Dictionary of Military and Associated Terms*. Washington D.C.: Pentagon, 8 November 2010 (amended through 31 January 2011).

Department of Defense. *Nuclear Matters: A Practical Guide*. Washington D.C.: Office of the Deputy Assistant Secretary of Defense [Nuclear Matters], 2008.

Department of Defense. Nuclear Posture Review Report. Washington D.C.: April 2010.

Department of Defense. Report of the Defense Science Board Task Force on Nuclear Capabilities. Washington D.C.: Office of the Undersecretary of Defense [Acquisition, Technology and Logistics], 2006.

Department of Defense. Report of the Defense Science Board Task Force on Nuclear Deterrence Skills. Washington D.C.: Office of the Undersecretary of Defense [Acquisition, Technology and Logistics], May 2008.

Department of Defense. United States Quadrennial Defense Review Report. Washington D.C: February 2010.

Department of Energy and Department of Defense. "National Security and Nuclear Weapons in the 21st Century." Washington D.C.: September 2008. http://www.defense.gov/news/nuclearweaponspolicy.pdf

Donley, Michael. Secretary of the Air Force. "The Nuclear Enterprise." Address, National Defense University's Congressional Breakfast, Washington, D.C., June 23, 2010.

Doty, Paul. "The Minimum Deterrent & Beyond." *Daedalus*, Vol. 138, No. 4, (Fall 2009).

Dougherty, General Russell E. "Leadership During the Cold War: A Four-Star General's Perspective." In Peter B. Land and Ronald E. Marcello, *Warriors and Scholars: A Modern War Reader*. Denton, TX: University of North Texas Press, 2005.

Einstein, Albert. To President Franklin D. Roosevelt. Letter, 2 August 1939.

Executive Office of the President. National Security Strategy. Washington D.C.: The White House, , May 2010. http://www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf

Franklin, Lt Col David M. "Miscalculated Ambiguity: The Effects of US Nuclear Declaratory Policy on Deterrence and Nonproliferation." Master's thesis, Maxwell AFB, AL: Air University, School of Advanced Air and Space Studies, June 2010.

Fussell, Paul. *Thank God for the Atom Bomb and Other Essays. New York, NY:* Summit Books, 1988.

Gaddis, John Lewis. *Strategies of Containment: A Critical Appraisal of Postwar American National Security Policy.* New York: Oxford University Press, 1982.

Gates, Robert M. Secretary of Defense. Address, Carnegie Endowment for International Peace, Washington, D.C., Tuesday, October 28, 2008.

Gates, Robert M. Secretary of Defense. Transcript of "DoD News Briefing with Secretary Gates from the Pentagon." 5 June 2008.

Gladwell, Malcom. *The Tipping Point.* New York, NY: Back Bay Books: Little, Brown and Company, 2000.

Harrell, Eben. "Obama's Nuclear Strategy: What's Different?" *Time U.S.*, 7 April 2010. http://www.time.com/time/nation/article/0,8599,1978348,00.html. (accessed 21 April 2012).

Hecker, Dr. Siegfried. Trip Report to North Korea's Yongbyon Nuclear Complex. Center for International Security and Cooperation, Stanford University, 20 November 2010.

Holdren, John. "Getting to Zero: Is Pursuing a Nuclear-Weapon-Free World Too Difficult? Too Dangerous? Too Distracting?" Discussion Paper 98-24, Cambridge, MA: Harvard Belfer Center for Science and International Affairs, April 1998.

International Atomic Energy Agency. Director General's Report on Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran. 24 February 2012. http://www.iaea.org/Publications/Documents/Board/2012/gov2012-9.pdf

Joffe, Josef and James W. Davis. "Less Than Zero." *Foreign Affairs*. January/February 2011.

Kehler, General C. Robert. Commander, United States Strategic Command. Address, The House Committee on Armed Services, Subcommittee on Strategic Forces, Washington, D.C., 2 November 2011.

Kehler, General C. Robert. Commander, United States Strategic Command. Address, The Senate Committee on Armed Services, Washington, D.C., 27 March 2012.

Kissinger, Henry A. and Brent Scowcroft. "Nuclear Weapon Reductions Must Be Part of Strategic Analysis." *Washington Post*, Opinions page, 22 April 2012. http://www.washingtonpost.com/opinions/nuclear-weapon-reductions-must-be-part-of-strategic-analysis/2012/04/22/gIQAKG4iaT_story.html. (accessed 23 April 2012).

Knoph, Jeffery. "Three Items in One: Deterrence as a Concept, Research Program, and Political Issue." In *Complex Deterrence: Strategy in the Global Age*. Chicago and London: University of Chicago Press, 2009.

Kovich, Lt Col Andrew. "Maintaining Deterrence and Nuclear Weapons: The Triad and Reducing Nuclear Dangers." Research report, Maxwell AFB, AL: May 2010.

Kunsman, David M. and Douglas B. Lawson. "A Primer on U.S. Strategic Nuclear Policy." Albuquerque, NM: Department of Energy, Sandia National Laboratories, January 2001.

Kyl, Senator Jon. "The Failed Promises of Nuclear and Missile Defense Modernization." Address, Congressional Breakfast Series on Nuclear Deterrence and Missile Defense, Washington D.C., 17 April 2012.

LeMay, General Curtis. *Mission with LeMay*. Garden City, NY: Doubleday, 1965.

Lowther, Adam. "Challenging Nuclear Abolition." Research Paper 2009-4, Maxwell AFB, AL: Air University, Air Force Research Institute, August 2009.

McMahon, Major General Timothy. former Commander, Twentieth Air Force. In Major General C. Donald Alston. Commander, Twentieth Air Force. Twentieth Air Force Vector: The State of the Force and Priorities to Enhance our Culture of Critical Self-Assessment. 31 January 2012.

Miller, Steven E. "Nuclear Weapons 2011: Momentum Slows, Reality Returns." *Bulletin of the Atomic Scientists* 68, no. 1. January/February 2012.

Newcomb, Alyssa, Luis Martinez and Martha Raddatz. "North Korean Rocket Launch Fails: US Official." ABC News. 12 April 2012. http://abcnews.go.com/International/north-korea-launches-test-rocket/story?id=16125951

Nuclear Weapons in 21st Century U.S. National Security. Report by a Joint Working Group of AAAS, the American Physical Society and the Center for Strategic and International Studies. December 2008.

Obama, Barack. "Remarks by President Barack Obama." Address, Hradcany Square, Prague,

Chech Republic, 5 April 2009. http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered/

Panetta, Leon. Secretary of Defense. Address, U.S. Senate Committee on Armed Services, Washington, D.C., 14 February 2012.

Park, John and Dong Sun Lee. "North Korea: Existential Deterrence and Diplomatic Leverage." Chapter in *The Long Shadow: Nuclear Weapons and Security in 21st Century Asia*. Edited by Muthiah Alagappa. Stanford, CA: Stanford University Press, 2008.

Paul, T.V. "Complex Deterrence: An Introduction." Chapter in *Complex Deterrence: Strategy in a Global Age.* Edited by T.V. Paul, Patrick Morgan and James Wirtz. Chicago and London: University of Chicago Press, 2009.

Payne, Keith. "Maintaining Flexible and Resilient Capabilities for Nuclear Deterrence." *Strategic Studies Quarterly,5*, no. 2, Summer 2011.

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

Power, General Thomas S. "Strategic Air Command." *Air Force Magazine*, Vol 43, No 9, September 1960.

Quester, George. "The Last Time We Were at Global Zero." *Naval War College Review*, vol 64, no 3, Summer 2011.

Sagan, Scott D. *The Limits of Safety*. Princeton, NJ: Princeton University Press, 1993.

Saradzhyan, Simon. *Russia's Non-strategic Nuclear Weapons in Their Current Configuration and Posture: A Strategic Asset or Liability?* Cambridge, MA: The Belfer Center, Harvard University, January 2010.

Schelling, Thomas C. "A World Without Nuclear Weapons?" *Daedalus*, Vol. 138, No. 4, Fall 2009.

Schelling, Thomas. *Arms and Influence*. New Haven & London: Yale University Press, 1966.

Schlesinger, James R., et al. Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase I: The Air Force's Nuclear Mission. September 2008.

Schlesinger, James R. et al. Secretary of Defense Task Force on DoD Nuclear Weapons Management, Phase II: Review of the DoD Nuclear Mission. December 2008.

Schneider, Barry R., Colin S. Gray, Keith B. Payne. *Missiles for the Nineties, ICBMs and Strategic Policy. Boulder, Colorado:* Westview Press, 1984.

Schultz, George P., William J. Perry, Henry A. Kissinger, and Sam Nunn. “A World Free of Nuclear Weapons.” *The Wall Street Journal*, 4 January 2007.

Schultz, George P., William J. Perry, Henry A. Kissinger, Sam Nunn. “Toward A Nuclear-Free World.” *The Wall Street Journal*, 15 January 2008.

Skelton, John D. Colonel, U.S. Army. “The Triad—A Relook: Should the United States Retain its Land Based ICBM Force?” Monograph, Fort Leavenworth, KS: U.S. Army Command and General Staff College, School of Advanced Military Studies, 10 February 1992.

Spencer, Michelle, Aadina Ludin, Heather Nelson. “The United States Air Force Minot and Taiwan Nuclear Weapons-Related Incidents: An Assessment.” Research report, Maxwell AFB, AL: Air University, April 2011.

Task Force on Leveraging the Scientific and Technological Capabilities of the NNSA National Laboratories for 21st Century National Security. “Leveraging Science for Security: A Strategy for the Nuclear Weapons Laboratories in the 21st Century.” Washington D.C.: The Henry L. Stimson Center, March 2009.

Thatcher, Margaret. Address, Joint Houses of Congress, Capitol Hill, Washington DC, 20 February 1985. http://www.margaretthatcher.org/document/105968.

Tobey, William. “The Latest on Iran’s Nuclear Program.” *Foreign Policy*, 27 February 2012.

U.S. Senate. Hearing to Receive Testimony on the Department of Navy in Review of the Defense Authorization Request for Fiscal Year 2013 and the Future Years Defense Program. Washington D.C., 15 March 2012.

U.S. Senate. *Narrative Summaries of Accidents Involving U.S. Nuclear Weapons, 1950-1980, Energy and Water Development Appropriations Act.* Congressional Record for the 102nd Congress (1991-1992), 3 August 1992.

Worden, Mike. *Rise of the Fighter Generals: The Problem with Air Force Leadership, 1945-1982.* Maxwell AFB, AL: Air University Press, March 1998.

Zhang, Hui. "China and Nuclear Disarmament." Chapter in *Reducing and Eliminating Nuclear Weapons: Country Perspectives on the Challenges to Nuclear Disarmament.* Princeton, NJ: Princeton University, May 2010.

Zhang, Hui. op-ed, "The Defensive Nature of China's Underground Great Wall." In the *Bulletin of the Atomic Scientists*, January 16, 2012.