

USAWC STRATEGY RESEARCH PROJECT

THE FUTURE OF U.S. NUCLEAR FORCES: BOOM OR BUST?

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ABSTRACT

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In its December 2001 Nuclear Posture Review, the Bush administration described its plan for transforming the roles and structure of U.S. nuclear forces to meet the realities of the 21st century. The updated posture laid out plans to reduce U.S. reliance on nuclear weapons by building up conventional strike capabilities, missile defenses, and a more responsive and robust defense infrastructure. To be effective, however, this new posture highlighted several key areas that need to be addressed. These include, reviewing the need for nuclear weapons, the affect of personnel retirement on the arsenal, NATO and treaty obligations, the role of missile defense, and the current state of the supporting infrastructure. Recommendations are provided to overcome challenges identified within the current force structure to ensure the United States' nuclear weapons complex and forces remain current, effective, credible, safe, and secure.

THE FUTURE OF U.S. NUCLEAR FORCES: BOOM OR BUST?

Hardly a day goes by without some print, television, or radio outlet reporting on the threat of weapons of mass destruction, or WMD. In the mid-1960s, at the height of the Cold War, the United States' nuclear stockpile boasted an estimated 32,000 warheads. Today, 15 years after the end of the Cold War, there are still nearly 10,000 nuclear warheads in the U.S. arsenal.¹ In the mid-1980s, the five nuclear powers (United States, Russia, Britain, France, and China) possessed nearly 70,000 nuclear weapons, widely dispersed in the Soviet Union, Eastern and Western Europe, and Asia, as well as on and beneath the high seas. Current levels are estimated to be near 36,000 warheads.²

Shortly after September 11, 2001, President Bush, in a joint White House press conference with Russian President Vladimir Putin, reiterated that both countries are "working hard to put the threats of the 20th century behind us once and for all." Towards that end, President Bush, in what would later be codified in and referred to as the Moscow Treaty, announced that the U.S. was going to unilaterally reduce operationally deployed warheads to a level of between 1,700 and 2,200 by 31 December 2012, a level deemed still adequate to meet America's security needs.³

In its December 2001 Nuclear Posture Review (NPR), the Bush administration described its plan for transforming the roles and structure of U.S. nuclear forces. The updated posture laid out plans to reduce U.S. reliance on nuclear weapons by building up conventional strike capabilities, missile defenses, and a more responsive and robust defense infrastructure.⁴ Further, in May 2004, President Bush announced steps to further reduce America's nuclear stockpile, both deployed and non-deployed, to numbers almost one-half of 2001 levels. This would be the lowest level since the Eisenhower administration—a "factor of four reduction from the end of the Cold War."⁵ This raises some concerns, though. Is it enough to simply reduce the number of warheads, or are there other elements of our nuclear force that need to be looked at as well?

To continue providing a credible and effective deterrent capability against the growing threat of WMD, this new force posture requires the reader to ponder and answer several key questions. These include, what is the role of U.S. nuclear weapons; what is the affect of personnel retirement on the U.S. nuclear arsenal; can the U.S. meet North Atlantic Treaty Organization (NATO) nuclear mission needs from the continental U.S. (CONUS); what is the nexus between missile defense and nuclear posture; does limited missile defense affect the ability of the U.S. and Russia to meet their Non-Proliferation Treaty (NPT) Article VI obligations;

what is the appropriate division of labor between agencies responsible for maintaining U.S. nuclear forces; and, finally, has America's nuclear infrastructure been properly maintained?⁶ An understanding of the role of U.S. nuclear weapons will help put these questions, on future nuclear policy, into perspective.

Role of U.S. Nuclear Weapons

For more than a half century, U.S. nuclear deterrence strategy protected America against an expanding and domineering Soviet Union. The United States' nuclear weapons provided an effective counterbalance to the Soviet's vastly superior numbers of conventional forces compared with much fewer numbers of U.S. and NATO forces. Although the strategy behind using U.S. nuclear forces had shifted over the years from massive retaliation, to flexible response, then mutually assured destruction, the intent remained the same, to provide an "unblinking deterrent" against the threat of a formidable foe.⁷ Up until the fall of the Berlin Wall in 1989, and the subsequent collapse of what President Reagan dubbed the "Evil Empire," America's war planners had really only one opponent to plan against. Since then, however, that planning effort has become exponentially more complicated.

The demise of the Soviet Union as a super power at the end of 1991 left Russia with more than 16,600 strategic warheads; Ukraine with 1,568; Kazakhstan with 1,360; and Belarus with 54. One nuclear state had now become many.⁸ In 1992, the former Soviet Republics of Belarus, Ukraine, and Kazakhstan signed treaty protocols to return to Russia the dozens of nuclear warheads and launchers that had been deployed on their soil. Although reports indicate that all warheads had been returned to Russia by November 1996,⁹ there are still fears that, more than a decade later, absolute Russian control over much of their nuclear material may be in question. This is due to the dozens of nuclear weapon bases and facilities, thousands of weapons, and hundreds of metric tons of fissile material on Russian soil, not to mention the thousands of nuclear scientists and technicians with access to nuclear materials and know-how that still live in Russia.¹⁰ Even with U.S. and international assistance, this presents a huge oversight problem and one which causes current world leaders much concern. The possible proliferation of loosely guarded nuclear materials and aid from sympathetic weapons designers could provide non-state actors the ability to manufacture and use WMD.

But possessing nuclear weapons alone is not enough to deter the WMD threat. Over the first 50 years of their existence, the U.S. developed nuclear weapons and launch systems that were referred to as the Nuclear Triad based on their means of delivery, that is, air (bombers), sea (submarine-launched ballistic missiles (SLBM)), and land (intercontinental ballistic missiles

(ICBM)). To meet the emerging realities of today's global environment, a new mix of nuclear, non-nuclear, and defensive capabilities is required for the "diverse set of potential adversaries and unexpected threats the United States may confront in the coming decades."¹¹ The 2001 NPR introduced a New Triad in which the offensive systems just described, to include non-nuclear capabilities, make up just one leg of the New Triad. The other legs consist of active and passive defenses, and a responsive defense infrastructure, respectively. The main strategy behind the first Triad was to provide a credible deterrence, and should that deterrence fail, deliver sufficient forces to swiftly end aggression on terms favorable to the U.S. or its allies. The New Triad supports the U.S. defense policy's four goals—assure, dissuade, deter, and defeat.¹²

These goals allow strategic leaders more options in dealing with potential adversaries. United States' friends and allies can be assured that, by maintaining nuclear forces, the U.S. can respond to any nuclear threat. Enemy forces are dissuaded from attacking the U.S. or its allies by the presence of U.S. forces that are numerically superior, technologically more advanced, and highly reliable. U.S. nuclear forces provide deterrence against potential enemies by offering the President flexible response options that place enemy centers of gravity at risk. Lastly, U.S. nuclear forces put overwhelming destructive power in the hands of the President to defeat any enemy.¹³ Possessing the requisite weapons and facilities for deterrence is one thing, having sufficient personnel trained to operate and sustain the weapons complex is quite another.

Affect of Personnel Retirement on U.S. Arsenal

In 1999, the Commission on Maintaining United States Nuclear Weapons Expertise submitted its final report to Congress and the secretary of Energy. Charged with developing a plan to recruit and retain personnel with scientific, engineering, and technical backgrounds to oversee the Department of Energy's nuclear program, the Commission identified twelve recommendations to overcome the challenges inherent in an aging workforce and to ensure a safe and reliable nuclear weapons stockpile for the future.¹⁴ Why the concern today, though, about an aging workforce?

It is no secret that as a population ages, it brings with it the demand for a country to adjust economically and educationally to meet new expectations. There is a greater cost in providing medical benefits which drains resources from other areas of national interest, such as maintaining a robust defense force. As people retire, there needs to be someone "in the pipeline" to replace them.

The Commission found three factors especially noteworthy resulting from changes since the Cold War's end. First, the U.S. ended underground nuclear testing and the vast majority of engineers and scientists that conducted underground testing have long since retired creating a vacuum of expertise or "corporate knowledge" necessary to replace them. This has forced safety and reliability of weapons stockpiles to be determined by expert judgment through modeling and simulation rather than analysis of actual explosive testing. The second is the move away from a large production complex making new weapons for the stockpile. Design flaws identified before the Cold War's end were corrected during subsequent production runs. Now, with a significantly smaller production complex, there is much greater reliance on human judgment to anticipate and detect deficiencies, as well as propose effective corrective action plans. The final factor is the aging weapons stockpile itself. With an average stockpile age approaching a quarter-century and no plans in the works for developing new weapons, it is critical that the U.S. maintain human capital that has a "PhD-level" understanding of the science behind nuclear materials and systems.¹⁵

To overcome these shortfalls, and ensure sufficient talent for the future, the Commission highlighted the need for the National Nuclear Security Agency (NNSA) to continue strict oversight of the Stockpile Stewardship Program (SSP). The SSP was developed to ensure a credible U.S. nuclear deterrent without full-scale nuclear testing, and to recruit and retain competent scientists, physicists, engineers, craftsmen, managers, manufacturers, operators, and security and support staff. NNSA will also have to offer incentives to compete with other industries and even other countries for this limited pool of high quality talent.¹⁶ Even with a stable work force, can the U.S. meet the nuclear security needs of its NATO allies from CONUS bases and, thereby, minimize the amount of nuclear materiel overseas available for proliferation?

Meeting NATO Needs from CONUS

According to the NATO Strategic Plan, "the fundamental purpose of the nuclear forces of the Allies is political: to preserve peace and prevent coercion and any kind of war."¹⁷ These Allied forces consist of those of the United States, the United Kingdom, and France, each of which have their own deterrent role. Due to the improving security environment in Europe, since 1991, and NATO's ability to defuse crises through diplomacy and other means, Allies have been able to greatly reduce their European-based theater-level nuclear forces. Though no longer targeting other countries, NATO continues to maintain a minimum number of nuclear forces to meet security needs, including dual-capable aircraft (able to drop either conventional

or nuclear bombs) and a limited number of United Kingdom Trident warheads, which provide an essential tie to strategic nuclear forces, thus reinforcing the transatlantic U.S. and European link.¹⁸

The Natural Resources Defense Council (NRDC), in a 2005 report, claims the United States has 480 nuclear weapons deployed at eight bases in six European countries (United Kingdom, Netherlands, Belgium, Germany, Italy, and Turkey). One could argue that the main threat for which these weapons were deployed (defense from attack by the Soviet Union) has ended and these weapons, still at 1993 levels, can be removed. Some argue a second justification for their deployment, protection against proliferation of WMD, though valid, could be better achieved by conventional means or nuclear forces based outside Europe.¹⁹

The NRDC report also highlighted the advantages of a nuclear-free Europe. One would be eliminating the need for non-nuclear NATO countries to maintain the capability to carry nuclear weapons on some of their Air Force aircraft, thus minimizing questions about non-compliance with the Non-Proliferation Treaty—a potential stumbling block in deterring Iran and North Korea from developing weapons of their own. Another advantage would be the freeing up of resources that the U.S. and NATO Air Forces could then use for non-nuclear missions and other security priorities. Nuclear storage and maintenance facilities in the region could be used for other purposes. Security and command and control systems and personnel could also be redirected. Finally, removing NATO's nuclear weapons could allow the U.S. and Europe to leverage other countries in the Middle East to support a “nuclear weapons free zone,” thus further enhancing NATO's security.²⁰

According to Matthew Martin, program officer in Policy Analysis and Dialogue at the Stanley Foundation, several other benefits can be realized by eliminating nuclear weapons from Europe. These include realigning U.S. nuclear forces to match other nuclear powers—keeping sovereign weapons on sovereign soil. The U.S. is the only country that bases nuclear weapons on foreign territory. Other benefits include the improvement of relations among NATO and non-NATO countries by responding to the will of their people uncomfortable with the current posture (one survey indicates three-fourths of Germans disapprove of the presence of nuclear weapons in their country); further reductions of Russian non-nuclear forces could be accelerated and our relationship with that country improved; nuclear basing in Europe makes broader negotiations on non-proliferation matters (i.e., Iran) more difficult; and forward-based nuclear weapons have little or no strategic value in the current political environment.²¹

To meet NATO needs from abroad, the U.S. has an abundant number of weapons from which to choose including the means to deliver those weapons, including the SLBMs, ICBMs,

and bombers mentioned earlier in this paper. Naturally, removing nuclear weapons from Europe will place an increased demand on the accuracy and timeliness of actionable intelligence to provide indications and warnings of the impending need for nuclear retaliation.

Up to this point, this paper has focused primarily on the first leg of the New Triad, offensive systems. What role does missile defense play in national deterrence?

Nexus between Missile Defense and Nuclear Posture

The purpose behind the United States' missile defense program is to deploy an effective National Missile Defense system capable of defending United States territory, to include allies and friends, against limited ballistic missile attack (whether accidental, unauthorized, or deliberate).²² The challenge, though, is that the U.S. could not get there from here without first withdrawing from its obligations under the Anti-Ballistic Missile (ABM) Treaty co-signed with the Soviet Union in 1972.

The ABM Treaty was signed and ratified at the height of the Cold War when both countries had thousands of nuclear warheads pointed at each other and peace was assured under the premise of mutual assured destruction (MAD). The ABM treaty was so restrictive (no system capable of providing national-level defense could be developed) that the Soviets could only deploy a missile defense system around Moscow and the U.S. was limited to a site in North Dakota. Today's security environment is completely different, however. The Soviet Union is no more, Russia is a U.S. partner in many security and non-security related ventures, and new threats now face both countries.²³ Since withdrawal from the ABM Treaty, the U.S. is now able to deploy a system designed not to just protect North Dakota from ballistic missile attack, but the entire U.S. and its friends and allies, as well.

While the end of the Cold War reduced the likelihood of a nuclear conflict between the U.S. and Russia, the threat from ballistic missiles has continued to grow due to the availability of WMD technology to countries hostile to the U.S. and its allies. What, exactly, is this threat?

As of 2000, more than 25 countries have developed or acquired ballistic missile systems. Such systems have been used in several regional conflicts, including the Iran-Iraq War, the Afghan Civil War, the war in Yemen, the 1991 Persian Gulf conflict, and the 1999-2000 Russian military action in Chechnya. Ballistic missiles fall into one of several categories based on their maximum range. These are short-range ballistic missiles (SRBM) (<1,000 km (621 mi); medium-range ballistic missiles (MRBM) (1,000-3,000 km (621-1,864 mi); intermediate-range ballistic missiles (IRBM) (3,000-5,500 km (1,864 - 3,418 mi); intercontinental ballistic missiles

(ICBM) (>5,500 km (3,418 mi); submarine-launched ballistic missiles (SLBM) (any ballistic missile launched from a submarine, regardless of maximum range).²⁴

The most proliferated ballistic missile, by far, has been the Russian SS-1c Mod 1 SRBM, also called the SCUD B. It has even been modified by other countries, such as Iraq and North Korea, to nearly double its maximum range. Medium-range ballistic missiles, as well as IRBMs, have been developed by China, North Korea, Iran, India, and Pakistan, and can carry either conventional or nonconventional (i.e. chemical, biological, radiological, nuclear, or high-yield explosive (CBRNE)) payloads. India and Pakistan, and to a lesser degree of certainty, North Korea, have already tested nuclear weapons. China has ICBMs capable of reaching the U.S., and North Korea and Iran, both with foreign assistance, continue to develop such systems for themselves.²⁵

It is quite evident that there is, and will continue to be, a credible threat to the U.S. and its allies and friends. What, then, is the link between missile defense and the U.S. nuclear posture? On December 17, 2002, President Bush announced his intent to field a missile defense capability to counter what he described as the gravest threat to U.S. citizens, “the catastrophic harm that may result from hostile states or terrorist groups armed with weapons of mass destruction and the means to deliver them.”²⁶

Along with this effort, the U.S. has taken steps to develop positive relationships with Russia, still the leading threat for ICBM attack, by associating in counterterrorism activities and in other areas of mutual interest. Additionally, to entice U.S. friends and allies to take an active role in their defense and possibly eliminate their need to stockpile nuclear weapons, President Bush directed that the missile defense program be structured in a way that would encourage participation by these nations. One example would be for the United Kingdom and Denmark to upgrade early-warning radars on their territory that would feed data into the United States’ missile defense command and control network.²⁷

In 2005, to domestically counter the threats from small, rogue nations like North Korea and Iran, the U.S. deployed an initial ballistic missile defense system consisting of multiple, layered defenses. Short-, and intermediate-range ballistic missile threats are defended against by Patriot and Aegis missile systems, while ground-based interceptors deployed at two locations, Fort Greely, Alaska, and Vandenberg AFB in California, are designed to provide initial defense against IRBMs and ICBMs. Future phases of this ballistic missile defense system call for expanded protection through air-, land-, sea-, and space-based components.²⁸

Bottom line, if the U.S. can field a credible missile defense system that involves the active participation of our friends and allies (which gives them a certain level of “ownership” in the

process), we can lobby these other countries to reduce or eliminate their nuclear systems in exchange for the U.S. continuing to provide a nuclear protective umbrella (possibly at lower force levels than present) as a “hedge against future contingencies.”²⁹ Furthering the partnerships between the U.S. and Russia as described above, and continuing cooperation with China economically on a global scale and with North Korea regionally, lessens the likelihood of armed conflict and allows nuclear related topics to be dealt with collegially.³⁰

The U.S. had to withdraw from the ABM Treaty in order to deploy its missile defense system. How does such a system impact other treaty obligations?

Missile Defense Impact on Non-Proliferation Treaty Obligations

The intent of The Treaty on the Non-Proliferation of Nuclear Weapons (NPT) is “to prevent the spread of nuclear weapons and weapons technology, to promote co-operation in the peaceful uses of nuclear energy and to further the goal of achieving nuclear disarmament and general and complete disarmament.”³¹ As of April 2005, 189 states and parties have signed or acceded to the treaty making it the most widely adhered to of any arms control agreement.³²

One of the provisions of the treaty, Article VI, deals directly with the issue of missile defense. This Article states, in effect, that the nuclear weapons states (U.S., Russia, China, France, and U.K.) will pursue negotiations in good faith on effective measures relating to ending the nuclear arms race as soon as possible and to nuclear disarmament under strict and effective international control.³³ How does this impact the deployment of a ballistic missile defense system (BMDS)? By employing a robust and effective BMDS, a nation effectually negates the need for other countries to have nuclear weapons since they would be, in theory, ineffective against the defended country. This directly meets the intent of NPT Article VI, stopping the nuclear arms race and beginning disarmament.

The Bush administration further states that nonproliferation, deterrence, and missile defense complement each other in the United States’ overall defense strategy. Weapons of mass destruction and missile proliferation are the driving forces behind this strategy. As these threats are reduced, so is the sheer size of the threat that must be dealt with by missile defenses. Rogue states such as Iran, Iraq, and North Korea are less likely to invest in missiles if they believe they will be ineffective. Finally, a robust BMDS strengthens deterrence and keeps rogue states from blackmailing the United States, its friends or allies by threatening missile attack.³⁴ As further evidence of its excellent record in NPT compliance, the U.S. reported to the 2005 NPT Review Conference that, by 2012, levels of deployed strategic nuclear

warheads will have dropped 80% from 1991 levels (from 10,000 to 1,700-2,200)³⁵ and non-strategic nuclear weapons have been reduced 90% (from 4,000 to 480).³⁶

John Bolton, prior to becoming U.S. ambassador to the U.N., was undersecretary of state for Arms Control and International Security. In this role, Ambassador Bolton echoed President Bush's stance on BMDS by stating such a system is important "not simply to prevent the catastrophe" of a nuclear attack on the United States or its allies, but to convince the potential possessors of ballistic missiles "not even to think about" developing them. As further assurance of U.S. intent to meet Article VI obligations, Bolton went on to say that as technology for BMDS matures, the U.S. will share it with friends and allies through NATO and other alliances.³⁷

This paper has, thus far, described offensive and defensive components of the U.S. nuclear weapons complex. What agencies are responsible for operating and maintaining this huge complex?

Agencies Responsible for Maintaining U.S. Nuclear Forces

Identifying all of the agencies involved with, or responsible for, maintaining U.S. nuclear forces can be a daunting task. Determining the appropriate division of labor between them can be even more so. The nation's nuclear stockpile, both deployed and in storage, can be looked at as falling under three broad categories—research and development, requirements and employment, and inspections and oversight. Each of these includes a number of different agencies and literally thousands of people, and is worth looking into in more detail to appreciate the scope of America's nuclear enterprise.

The Departments of Defense (DoD) and Energy (DOE) share joint responsibility for nuclear weapons activities, under a 1983 Memorandum of Understanding between the two organizations. The National Nuclear Security Agency (NNSA), as part of DOE, oversees the Stockpile Stewardship Program (SSP) ensuring a credible U.S. nuclear deterrent absent the ability to conduct full-scale nuclear testing. This is accomplished through surveillance, assessment, maintenance, refurbishment, manufacture, and nuclear weapons dismantlement, as well as research and development and certification efforts.³⁸ The nuclear weapons complex is comprised of eight government-owned, contractor-operated facilities:

- Los Alamos National Laboratory (LANL), New Mexico, run by University of California; nuclear R&D, design, safety, and certification
- Lawrence Livermore National Laboratory (LLNL), California, run by University of California; nuclear R&D, design, safety, and certification

- Sandia National Laboratory (SNL), New Mexico, run by Sandia Corporation; non-nuclear R&D, nuclear testing, design, safety, and certification
- Nevada Test Site (NTS), Nevada, run by Bechtel Corporation; experimentation, training, and testing
- Kansas City Plant (KCP), Missouri, run by Honeywell Federal Manufacturing & Technologies; non-nuclear production, testing, and repair
- Pantex Plant, Texas, run by BWXT Pantex, LLC; assemble, test, maintain, and dismantle warheads
- Oak Ridge Y-12 Facility (Y-12), Tennessee, run by BWXT Y-12, LLC; production support for weapons labs, weapons materials storage, and manufacturing technology
- Savannah River National Laboratory (SRNL), South Carolina, run by Westinghouse Savannah River Company, LLC; process, handle, and store tritium and plutonium from warheads

The total workforce employed by these facilities equals roughly 47,000 personnel (as of October 1998). Approximately one-third of these, or 17,000, directly support weapons programs.³⁹

Nuclear weapon requirements and employment fall to DoD under the purview of the Office of the Deputy Assistant to the Secretary of Defense for Nuclear Matters, as well as the Armed Services, and is based on national security needs as outlined by the President. America's nuclear arsenal consists of gravity bombs deliverable by U.S. and Allied Air Forces; Tomahawk Land Attack Cruise Missiles/Nuclear (TLAM/N) deliverable by attack submarines; Air-Launched Cruise Missiles (ALCMs) deliverable by long-range bombers; and SLBMs and ICBMs.⁴⁰ The Navy and Air Force service chiefs ensure appropriate forces are organized, trained, and equipped to perform their assigned nuclear missions. The U.S. Army currently has no assigned nuclear mission.

The Commander, U.S. Strategic Command, in Omaha, Nebraska, exercises overall command and control, planning, and execution responsibility for America's nuclear forces. Some of this may be further delegated to a geographic commander in theater if the situation warrants. Ultimate authority for use of nuclear weapons, however, rests with the President and Secretary of Defense.⁴¹

Inspection and oversight of America's nuclear forces falls primarily to Congress, DOE (through NNSA mentioned above), and from an international perspective, the International Atomic Energy Agency (IAEA). Congress established the Nuclear Weapons Council (NWC) in 1986 to facilitate cooperation and coordination between DoD and DOE/NNSA as they fulfill their

responsibilities for U.S. nuclear weapons stockpile management. The NWC, as an oversight and reporting body, is accountable to both the Legislative and Executive branches of government. The NWC also reports annually to the President as to the safety and reliability of the U.S. nuclear weapon program. Because of the technical nature of the involved programs and the vastness and diversity of the complexes, NWC is staffed by a cross section of disciplines from throughout the community.⁴²

Despite the efforts of the Nuclear Weapons Council, Congress itself has been seen as being lackadaisical in taking their oversight responsibilities seriously. Stephen Schwartz of the Carnegie Endowment, in a recent report on the history of congressional nuclear weapon oversight, stated that Congress has historically shown little interest in its role except where budgets or constituent needs are concerned. He sees this as unfortunate since the U.S. has invested more than \$7.5 Trillion (adjusted for 2005 dollars) in its nuclear weapons program, making it third in U.S. investment only behind all other U.S. defense expenditures and Social Security.

One reason for this is the way in which oversight is handled. Prior to 1977, one group, the Joint Committee on Atomic Energy, had oversight. Since 1977, this responsibility has been farmed out to more than 30 committees and sub-committees. In the past 60 years, Schwartz claims, Congress has only terminated one nuclear weapon program, the Safeguard ABM system in 1975. Proposed remedies for this laxness include returning oversight of all nuclear weapons programs to one committee, requiring a combined DoD/DOE nuclear weapons budget, and expanding the Congressional Research Service.⁴³

The IAEA, an independent organization of the United Nations, stood up in 1957 as the international inspection agency for nuclear matters. The Agency, with a staff of 2,200 from more than 90 countries, has three goals—promoting safeguards and verification, promoting safety and security, and promoting science and technology. Under the first goal, the IAEA verifies that safeguarded nuclear material and activities are not being used for military purposes. They also act as the inspection arm of the UN Security Council (UNSC) and play a pivotal role in enforcing the conditions of the Nuclear Non-Proliferation Treaty. The second goal, promoting safety and security, calls for them to help countries upgrade nuclear safety and security, and prepare for and respond to emergencies. Finally, by promoting science and technology, the IAEA helps developing countries find peaceful applications of nuclear science and technology to meet critical needs. The IAEA reports annually to the UN General Assembly and, as required, to the UNSC.⁴⁴ Other agencies also have a role in the safety of nuclear materials and facilities.

The U.S. Nuclear Regulatory Commission (NRC) was formed in 1975 to regulate the nation's civilian use of nuclear materials to ensure public health and safety, promote defense and security, and protect the environment. The 3,000 person NRC has three main areas of concern, nuclear reactors, nuclear materials, and nuclear waste.⁴⁵

The Defense Nuclear Facilities Safety Board (DNFSB) was established by Congress in 1988 as an independent federal agency within the Executive Branch to provide safety oversight of the nuclear weapons complex operated by the Department of Energy and "to ensure adequate protection of public health and safety" at DOE's defense nuclear facilities.⁴⁶ This 100-person agency looks at four areas of the nuclear weapons complex; nuclear weapon operations, nuclear material processing and stabilization, nuclear facilities design and infrastructure, and nuclear safety programs and analysis. As an example of its findings, in its 2006 report to Congress, DNFSB identified the risks associated with a conscious effort by DOE senior management to lessen federal oversight. These risks were due to the emphasis of productivity over safety, loss of technical competence among DOE upper management, insufficient safety research, and inadequate central safety oversight. In their findings, they also identified a four-year corrective program to reverse this trend.⁴⁷

All of these agencies have a tremendous responsibility in ensuring the effectiveness of this Nation's nuclear weapons complex. How well have they done?

Maintenance of the Nuclear Infrastructure

Has America's nuclear infrastructure been properly maintained? Several experts agree that the answer is "No!" More than 15 years ago, DOE identified improvements that needed to be made for the nation to maintain and modernize its nuclear weapons complex. However, with the demise of the Cold War in 1991, these improvements never came to fruition.⁴⁸ In 1999, DoD's Office of the Director, Program Analysis and Evaluation (OSD/PA&E), estimated it would take \$450M annually for 17 years to refurbish the nation's nuclear weapons production complex. At the same time, the Commission on Maintaining United States Nuclear Weapons Expertise reported there was no comprehensive plan to address required space reductions or modernizing facilities, nor address current and future maintenance requirements.⁴⁹ President Bush's 2001 Nuclear Posture Review reiterated the fact that a robust and properly maintained weapons complex was directly tied to achieving a credible deterrent posture and a responsive defense infrastructure to "increase confidence in the deployed forces, eliminate unneeded weapons, and mitigate the risks of technological surprise."⁵⁰

Based on this, in its November 2004 Strategic Plan, NNSA highlighted the concern it had with deteriorating facilities and the corrective steps it was taking to enhance the safety, security, and reliability of America's nuclear weapons stockpile. As part of this ten-year turnaround plan, it would first reduce the amount of deferred maintenance, estimated to be \$1.2 Billion. Nearly half of the facilities are 50 years old and need to be either repaired or replaced. A second goal was to reduce the NNSA complex footprint, currently 38 million square feet at ten sites, by three million square feet. This would help eliminate unneeded floor space, and allow for more efficient operations at a lower life-cycle cost. Finally, NNSA would ensure facilities and infrastructure deemed "mission essential" complied fully with industry standards and regulations.⁵¹

Nearly two years later, NNSA is well on its way to achieving the goals outlined above. An independent review by the White House Office of Management and Budget (OMB), in August 2006, confirmed this by stating that despite it being in place only a short time, the revitalized infrastructure maintenance program has been "moderately effective" in stabilizing deferred maintenance and should meet industry standards by 2009 (though this original estimate has slipped to 2011).⁵² Furthermore, NNSA has developed a robust Facilities and Infrastructure Recapitalization Program (FIRP) to oversee its modernization efforts, and received praise from a Senate committee for its work. In another report to Congress, OMB concluded that maintaining the current FIRP structure would "ensure a high probability of success in fulfilling the direction of the Nuclear Posture Review."⁵³

Conclusions and Recommendations

In late 2001, Presidents Bush and Putin acknowledged the threat that weapons of mass destruction posed not only to their countries, but to the world at large, and took steps to further reduce their respective nuclear stockpiles. But the reduction of warheads alone is not enough, the entire supporting infrastructure, as well as enabling organizations, have a significant role also.

As this paper has shown, maintaining a credible and effective deterrence against the use of WMD involves many components. The role of nuclear weapons, for instance, has not changed significantly since their inception near the end of World War II. A sufficient variety of weapons, along with their associated delivery platforms, is essential in keeping enemy forces at risk. To say what level is actually enough is debatable, however, once this decision is made, strong national leadership is required to ensure the reliability of this nation's nuclear weapons. There must continue to be ongoing dialogue between the world's nuclear weapons states as to

future levels necessary for effectiveness considering advances in technology and the impact of global WMD proliferation.

With respect to an aging workforce and its impact on the U.S. nuclear weapons complex, this is a matter that needs to be watched closely and addressed promptly. The government should immediately provide incentives for students to pursue advanced degrees and strongly encourage internships with industry. This will have the dual positive impact of combining education with experience to keep the U.S. nuclear weapons complex and related fields second to none. We see everyday the impact that technology and automation have on job opportunities. If the U.S. does not reverse the downward trend of graduates receiving advanced degrees in scientific and technical fields, it will lose its ability to maintain and expand its leadership role in these areas.

The U.S. should continue to work closely with its allies and the UN to help meet their security needs and eliminate nuclear weapons overseas. Reducing and, eventually, eliminating U.S. nuclear weapons overseas will have a stabilizing effect on relations with European nations and others around the world. The pursuit of more “nuclear weapons free zones” further enhances peaceful relations by minimizing the possibility of WMD materiel falling into the hands of nation-states and non-state actors with evil intent.

To help meet global security needs, and to counter the effects of WMD proliferation, the U.S. should continue development and deployment of a robust missile defense system. While the old adage, the U.S. has to be effective all the time against attack while the enemy only has to be effective once, still applies, having a missile defense system is one more layer of defense against such attack. Sharing the technology with our allies and having them play an active role in our nations’ mutual defense only strengthens our relationships and further hampers an enemy. A robust and effective defensive system also allows the U.S. to further reduce its reliance on offensive systems, both here and abroad, thus minimizing the need to keep such systems at their current levels.

Pursuing missile defense programs also allows the world's nuclear powers to meet their NPT Article VI obligations. The U.S. and Russia can lower the levels of their nuclear warhead stockpiles while still providing for the collective security of their allies from rogue attack. Having fewer warheads also has the collateral effect of keeping such warheads out of the hands of these rogue actors. Such posturing also sets an example for other countries that currently possess or are pursuing indigenous nuclear weapons. Although there will, most likely, always be countries that desire to have nuclear weapons of their own (Iran and North Korea come to

mind) the leadership of the U.S., Russia, and their allies can rally the court of world opinion against these rogue states.

The current division of labor between agencies responsible for various aspects of the U.S. nuclear weapons complex seems adequate, but needs continued government oversight. Although the roles between research and development, requirements and employment, and inspections and oversight provide a type of “checks and balances” for the program, areas highlighted earlier in this paper, primarily research, inspections, and oversight, need to be closely monitored to ensure the United States’ program, as well as other nation’s programs, remain safe and secure.

Finally, the evidence is clear that the U.S. has not been a good steward of its nuclear infrastructure. Each organization must take an active role in seeing that systems and facilities under its purview are properly funded, maintained, modified, or eliminated, as needed, to ensure the Nation’s nuclear arsenal continues to remain current, effective, credible, safe, and secure. Just because the primary threat for which much of the nuclear weapons complex was developed is no longer viable, maintaining that infrastructure, or making a concerted effort to adjust it to meet current world realities, has never been more important. A structure built on sand will eventually crumble and fall, but one built upon a solid foundation will withstand the test of time.

What, then, is the answer to the question at the beginning of this paper, “The Future of U.S. Nuclear Forces: Boom or Bust?” It should be clear by now that, while this Nation is not expanding its nuclear weapons complex at the explosive rate seen during the 1960’s to 1980’s, neither is it being reduced to nonexistence. The United States’ nuclear forces are undergoing an evolution to meet the realities of the world in which we live. The Soviet Union is no more, but rogue states and non-state actors are actively pursuing their own nuclear programs, to include weapons of mass destruction. The U.S. is meeting its national security needs, the needs of its friends and allies, as well as adhering to its international treaty obligations, by reducing the levels of its nuclear forces, developing a missile defense system, investing in its nuclear infrastructure, and ensuring it recruits and retains an effective and forward thinking workforce.

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