

Slouching Toward Zero: *Considering U.S. Nuclear Weapons Programs and Policy*

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Introduction

Since the 1960s the United States has operationally deployed nearly all its strategic nuclear forces in a Triad of delivery systems comprising land-based intercontinental ballistic missiles (ICBMs); submarine-launched ballistic missiles (SLBMs); and bombs and cruise missiles delivered by aircraft. In 2010, coincident with the New START negotiations, the Obama administration presented a plan to modernize each component of the Triad, starting development of a new submarine around 2016, sequencing through new land-based ICBMs and a new bomber, and concluding with a new submarine-launched ballistic missile around 2040. The first of the new submarines is expected to be operational around 2030 and be serviceable for about 40 years, which might suggest the next modernization wave would begin sometime in the 2070s.¹

Essentially a recapitalization of the Cold War force posture, this program is justified as a need to replace older capabilities, rather than as a response to emerging contingencies. Presenting difficult budget challenges without the motivation of an urgent external threat, the plan quickly found its schedule being revised, its proposed designs questioned, and itself the battleground for renewed debate over the future role of nuclear weapons.²

This modernization effort is the first for the Triad since the end of the Cold War, and it is being done in the face of strategic uncertainties, doctrinal and empirical, more pervasive than during the 1980s when the Triad was last renewed. Some of these uncertainties are endemic to strategic affairs; others are created by unilateral US policies proscribing new weapons manufacturing, underground testing, and remanufacturing of components and work on new weapons designs (except by agreement between the president and Congress). Under these conditions, the strategic uncertainties of the future are probably better met with a relatively heavier investment in general purpose forces, renewed preparations for operating in nuclear environments, a more incremental approach to nuclear force modernization, and plans for statecraft under an undeclared no-first-use policy on nuclear weapons.

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Ambiguous Doctrine

Options for nuclear force structure, posture, and strategies reflect differing answers to two basic questions: why have nuclear weapons, and how can they be used as tools of statecraft. The answer to the first question, as summarized by General Larry Welch (USAF-ret.), is that the United States developed nuclear weapons so that Hitler would not be the only one to have them, and consonant concerns continue to be an “irreducible motivation” today.³ They apply equally in peace, crisis, and war, and so mandate taking care to prevent being preemptively disarmed, to ensure the continued effectiveness of the relevant systems for intelligence and warning, warheads and delivery, and command, control, and communications.

How to do so depends on plans for using the weapons. How many of what kind need to be protected, for how long and in which ways? What should they be capable of doing? A force designed to be survivable, suitable, and sufficient for some purposes might be a poor match for others. There could be times when it would make sense to launch under attack, or to retaliate massively, or to withhold forces, or to target residual nuclear forces, or conventional force concentrations, or national communications nodes, or ethnic boundaries, or even population centers.

Similar complexity arises from the second question, about the role of nuclear threats in statecraft—“the non-employment of nuclear weapons through judicious exploitation of the fact that they exist.”⁴ Is the horror of the power of these weapons and their long-lasting poisons enough to forestall their intentional use? Can national interests be sufficiently clear and vital as to hazard national suicide? Can the existential interests of the United States extend to a suicide pact with other countries?⁵ Would the United States use nuclear weapons to resolve less-than-existential threats? “The value of arms,” Knorr reminded, “lies in their capacity to gain worthwhile objectives; their value does not necessarily rise in proportion to their destructiveness.”⁶ The power of nuclear weapons can limit their political utility.

Such difficulties bedevil American efforts to shape national and alliance policies intended to deter nuclear attacks. What is known, or even knowable, about adversary views and calculations and decision-making and execution? What, for that matter, can be taken as certain about American views, calculations, decision-making, and execution under the stress of a nuclear crisis? Does having more non-nuclear options make nuclear threats more credible or less so? Does having more “usable” nuclear weapons increase or reduce stability? The lack of empirical data confuses debate on these questions. As Kissinger complained over forty years ago, “Slogans like ‘superiority,’ ‘parity,’ ‘assured destruction,’ compete unencumbered by clear definitions of their operational military significance, much less a consensus on their political implications.”⁷ Indeed, the entire topic has become foggier, with public authorities—perhaps, one hopes, intending merely to rally morale – proclaiming that America’s nuclear deterrence strategy has proven successful and that the nation needs to “wage deterrence” around the world.⁸

Kissinger shared this complaint as well: “Deterrence is tested negatively by things which do *not* happen. But it is never possible to demonstrate *why* something has not occurred. Is it because we are

pursuing the best possible policy or only a marginally effective one?”⁹ The answer, concerning policy during the Cold War, seems to have been “marginally effective.” American hopes for deterrence depended on Soviet views of issues and the strategic balance, and American views of Soviet views were none too accurate, as shown by research conducted soon after the end of the Cold War. The term “deterrence” itself was not understood in common, for example, and other central terms, such as “stability,” had meanings that were nearly opposites. American and Soviet views of silo vulnerability were quite different, as were estimates of whether ground or air bursts were more effective against them.¹⁰

But there was a core similarity: the bedrock of assessments by each side was the technical evaluation of deployed forces. The many American discussions and declared policies of retaliation, preemption, escalation, and targeting were efforts to shape expectations and explain intentions (and rationalize budget allocations). It seems, though, to have been the inherent capabilities of the force postures that informed sizing, deployment, and operations, analytic bumfuzzlement notwithstanding. US “declaratory policy” played little if any role in shaping Soviet assessments and force postures and had at best distal and delayed influence on US force sizing and modernization.¹¹ Both the United States and the Soviet Union acquired and configured forces depending principally on technical assessments of capabilities together with military judgments about wartime operations.

Depending on such assessments not only made sense militarily but may have been the only practical course of action in the face of vague declaratory statements. Deterrence is commonly thought to entail clear statements of what the adversary is not to do and the consequences if he should nevertheless do it. Allison, for example, worried that the Bush Administration was courting failure in its efforts to deter North Korea’s nuclear program by not making sufficiently specific threats: “Effective deterrence required three components: clarity, capability and credibility. Clarity meant bright lines and unacceptable consequences.”¹² But Hirschbein contends that “the faith-based nature of strategizing” precludes any consensus as to whether “messages about nuclear policy should be clear and distinct or deliberately ambiguous,”¹³ and in fact US policy pronouncements about the use of nuclear weapons have often been ambiguous and even “confusing, contradictory, and intellectually untidy.”¹⁴ Such imprecision is not necessarily to be corrected, Gallois found: “a widely publicized but vague determination is more valuable than specific promises that cannot always be kept and that would furnish the other side valuable indications as to the policy the latter could pursue with impunity.”¹⁵

What then are the prospects for the United States being able to shape the views and plans of competitors and adversaries—and to assure allies and partners—today? Will newly minted and aspiring small nuclear powers share superpower views of escalation and crisis management? Can policies be tailored to address the specifics of the situations of each friend and ally, in the hope of deterring or assuring without contradicting or complicating what is said elsewhere? Can US influence be sustained regionally without creating local “cold wars?” Can large nuclear powers stand apart from regional nuclear crises? Is the nuclear posture of the Cold War likely to have the desired effects on states as different as China, North Korea, Pakistan, India, Iran, and tomorrow’s Russia?

Problematic Assessments

Answering these questions would be much easier if there were a general formulation describing what the weapons are for and how they would be used, such as a fundamental theory of deterrence, but there is too much intrinsic ambiguity in strategic force postures to permit such comfort. “There is no deterrent in a general or abstract sense,” Aron wrote; “it is a case of knowing *who* one can deter *from what, in what circumstances, by what means* (by threats or by organizing defense).”¹⁶ Deterrence is relational, situational, conditional, and mutable; “tailored deterrence” is a redundancy; and choosing force structures and postures to give the term operational significance is discretionary.

Finding answers would also be easier if there were a clear consensus about the need for and role of US nuclear weapons. Some argue that there was such a consensus during the Cold War, but if so, it disappeared long ago (probably at least by the time the Washington tried to convince its NATO allies to shift from “massive retaliation” to “flexible response”).¹⁷ By the early 1980s, former Secretary of Defense Robert McNamara found in the national debate “three quite contradictory and mutually exclusive views of the military role of nuclear weapons.”¹⁸ One believed that nuclear weapons could be used in controlled and discriminating ways to defend the United States and its allies, and so advocated a warfighting, flexible response approach to deterrence. Another believed that any use of nuclear weapons would escalate uncontrollably, resulting in horrible damage to both sides, and so the only role for nuclear weapons is to deter the first use of nuclear weapons by an adversary. A third view agreed that nuclear use would escalate uncontrollably but believed that the threat of using nuclear weapons

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would deter both nuclear and conventional attacks and would be much cheaper than building up conventional forces, and therefore the threat of using nuclear weapons early should never be withdrawn.

These differences are still to be found, but today they are cast in a different global context, one in which questions of arms reduction and disarmament have come to involve both projected military requirements and hopes for advancing global nuclear disarmament.¹⁹ The end

of the Cold War brought fewer worries about war between the United States and Russia but more concern about nuclear weapons in other hands worldwide. Agreements between the nuclear superpowers helped reassure each that reductions would not cede a perceived advantage to the other. But in the new strategic environment, the United States saw the more immediate risk of nuclear weapons being used as higher elsewhere, which raised the relative importance of efforts to inhibit and counter their proliferation.²⁰ At the same time, the United States would need to maintain its own nuclear arsenal at a level judged adequate for its nuclear deterrence purposes, including precautions to enable timely rearmament if necessary. The 1994 Nuclear Posture Review accordingly sought “an appropriate balance between showing U.S. leadership in responding to the changed international environment and hedging against an uncertain future,” recognizing that “lead” occasionally conflicted

with “hedge.”²¹

This outlook, as described by Secretary of Defense William Perry in 1994, became known as the “Lead But Hedge” approach to questions of nuclear arms control and reductions: the United States would lead the way toward a world with ever fewer nuclear weapons, while maintaining its ability to reverse course quickly if necessary. A decade later, Perry apparently concluded that developments since 1994 warranted emphasizing “lead” much more than “hedge.” He, Henry Kissinger, George Schultz, and Sam Nunn jointly urged the United States to be “working energetically” to achieve ridding the world of nuclear weapons, because there is no way to ensure they will not be used (intentionally, by error, or through miscalculation).²² Nunn explained that while a complete path to that goal was not in sight at present, there were several steps toward it that would help achieve a “base camp” from which routes to a nuclear-free summit could be seen.²³

The more dramatic conclusions advanced by Perry et al. continue to be debated. There are questions about conflict resolution, monitoring and verification, the importance of US leadership, and whether a world without nuclear weapons might be less peaceful. To see nuclear abolition as a fantasy is less a failure to recognize the end of the Cold War than a recognition that the Westphalian international system did not end: accommodations and agreements among governments can occasionally be arranged and some may even last for several years, but the actors are sovereign, they do compete, and power is the dominant and recurring allocation mechanism.

About the less dramatic parts—“leading and hedging”—there has been broad agreement. That the international context is different, that the more immediate nuclear threats are not from Russia, and that nuclear deterrence must be maintained at least for now, are views clearly sustained by US policy over the past twenty years. During that time, national support for particular policies and programs has increasingly reflected points on which adherents of the “Lead But Hedge” and “Base Camp” outlooks can agree (even if for different reasons). That common ground includes a purely retaliatory version of the “countervailing” strategy, now understood as the ability to destroy whatever targets are important to the enemy at any time during a conflict, and thereby seems, at least superficially, to obviate long-standing debates over counter-force and counter-value targeting. Originally promulgated during the Schlesinger era and focused on the Soviet Union, the countervailing strategy today informs the “tailored deterrence” notion of recent Bush and Obama administrations and is applied broadly, especially to include non-declared nuclear powers and rogue regimes.²⁴ Common ground has also been found on force levels, types, and postures, as shown in repeated affirmations of the Triad and support for reducing the number of operationally deployed weapons. Those reductions seem to have been taken with an eye to maintaining a force roughly equal in numbers to what Russia deployed, together with an ability to make timely increases if needed.

It is capability, however, not numbers, that is the core strategic issue, whether the current posture is described as “countervailing” or something else, and the adequacy of a particular posture is at root a matter of opinion and hope. The traditional approach to such assessments involves force-balance calculations of weapons and targets. The approach can be cumbersome but is conceptually straightforward: Matching a weapon to a target requires knowing what is needed to deliver the desired

effects on the target (different targets are vulnerable in different ways to various nuclear effects, which are delivered differently by different weapons²⁵) and where the target will be when it is attacked. Whether the target would actually be engaged as planned depends on whether the weapon gets to the right place at the right time and performs as intended, which means it has to survive being attacked and succeed in being launched, transiting to the target area, penetrating defenses, and detonating at the desired location and altitude. It is not only the weapons that must survive the notional attack, then, but also the ancillary functions needed to make them useful—trained people; electrical power; command, control, and communications systems; intelligence, surveillance, and reconnaissance capabilities to find targets and assess residual balances; all in the right amounts and places. Loss of these functions could kill the mission even if the weapon is unharmed.

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The question then becomes whether the usable surviving weapons provide the capability needed for the strategy. Are they all to be used against the attacker, or should some be withheld, either because other states might still possess their full nuclear arsenals or because the weapons might help in negotiations with the attacker? Estimating the size and value of the withheld forces would once again raise questions of strategy and capability.

Here is the deep uncertainty in estimating the adequacy of nuclear forces: how will they work in the environment they might create? Lacking data, planners sought assurance in larger inventories, while analysts usually had recourse to modeling gains and losses under simplistic scenarios contrived to show the numerical consequences of various constraints—what Aron derided as “strategic fiction.”²⁶ Simulations can help decide “how much is enough” for specific weapons or perhaps even for the entire nuclear force under specified assumptions. But the simulation is not the war, and force sizing is not a strategy, and it is not clear that strategic fiction illuminates anything beyond its own assumptions. “An understanding of the physics of any particular kind of experiment, of which nuclear weapon detonations are merely one specific example, based upon numerical simulations is simply a simulated understanding.”²⁷

Uncertain Weapons

US nuclear weapons are used by the military, but they are maintained by the nuclear stockpile enterprise—the three weapons laboratories, Los Alamos, Livermore, and Sandia; four production sites, Pantex, Oak Ridge, Kansas City, and Savannah River; Y12; and the Nevada National Security Site (formerly Nevada Test Site)—under the management of the National Nuclear Security Administration, an agency within the Department of Energy. The principal sources of uncertainty about the nuclear warheads themselves are unilateral U.S. policies proscribing new manufacturing (the most recent warhead was built in 1991), underground testing (the most recent test was September 1992), remanufacturing of components (except when approved by the President and by an act of Congress)

and work on new weapon designs (ditto).

The goal of the nuclear weapons enterprise has thus become, while working within those policy restrictions, to preserve confidence in the safety, security, reliability, and effectiveness of the weapons, without actually testing them. Congress stopped the underground testing program in September 1992, by which time the United States had conducted 1054 nuclear tests generating 1149 detonations. Of the detonations, 100 were tests of weapons effects (“conducted, usually by the US Department of Defense to determine the effects of nuclear detonations on military offensive and defensive systems”) and 891 were weapons related (“conducted to gather data on nuclear devices”).²⁸ The Clinton, Bush, and Obama administrations, with congressional support, repeatedly extended the moratorium, now beginning its third decade.

With no testing, confidence in the reliable effectiveness, safety, and security of the weapons rests on the opinions of experts. Those opinions are informed by various tests and analyses, including disassembly of selected weapons, and by more detailed understanding of the physics of nuclear explosions. There have also been some “sub-critical experiments” involving high explosives and plutonium, which comply with the US interpretation of the Comprehensive Test Ban Treaty (CTBT, which President Clinton signed but the Senate did not ratify) because they do not trigger a self-sustaining nuclear reaction or generate a yield. This interpretation, incidentally, is not required by the treaty; as the U.S. State Department reported in 2007, “there was no agreement among the P-5 [the US, USSR/Russia, Britain, France, China] that criticality would be the basis for determining which activities would be permitted under the CTBT and which activities would not be permitted. Therefore, it is left to the individual State Party to decide for itself whether a test that produced more than a zero yield would violate the Treaty.”²⁹

In addition, the weapons are modified through Life Extension Programs (LEPs), which replace the life-limited components of certain weapons and make other changes to correct, counteract, or anticipate the effects of aging and to improve safety and security of the weapon. The United States initially set strict limits on the LEP changes that could be made. The 2009 Congressional Commission, for example, said the Life Extension Program “involves remanufacturing with rigid adherence to the original design. In the remanufacturing process, the only changes allowed to the warhead are as needed to accommodate the dictates of modern environmental regulation and material availability (some materials used in the original production of these warheads are no longer available).”³⁰ Three years later, however, the limits may be loosening. The 2010 Nuclear Posture Review states that “the full range of [Life Extension Program] approaches will be considered: refurbishment of existing warheads, reuse of nuclear components from different warheads, and replacement of nuclear components. . . . In any decision to proceed to engineering development for warhead [Life Extension Programs], the United States will give strong preference to options for refurbishment or reuse. Replacement of nuclear components would be undertaken only if critical Stockpile Management Program goals could not otherwise be met, and if specifically authorized by the President and approved by Congress.”³¹

In its recent review of technical issues involved with the Comprehensive Test Ban Treaty, however, the National Research Council stated that “*refurbishment* describes the case in which individual

components in the [nuclear explosive package] are either retained for continued use or replaced with components of nearly identical form, fit, and function.” *Reuse*, for the Council, “describes the case in which pits and secondary components from *different*, previously fielded warhead designs are introduced into the warhead. This usually implies that the pits and/or components are taken from existing surplus stocks, but if such parts did not exist in sufficient number, the committee would extend ‘reuse’ to include parts newly manufactured to nearly identical specifications.” The Council then describes the third process, *replacement*, as “the case in which pits and/or secondary components introduced into the warhead are based upon previously tested designs but may differ in some respects from such designs.”³²

The National Research Council also contends that because scientists know more than they did ten years ago and because there is more emphasis today on safety and security, the United States “is now considering as serious options changes to the nuclear explosive package incorporating additional safety and security features and/or increased performance margins in addition to the original Life Extension Program approach of refurbishment.”³³

Confidence in the test surrogates seems to vary with confidence in the prospects for global nuclear disarmament, reflecting different opinions about whether the United States might need to reverse recent policy and how ready it should be to do so. Russia is again the test case because of the size of its nuclear arsenal, but there is little evidence in the US programs and schedules for facilities, equipment, and processes to maintain the stockpile reveal no serious worry about renewed cold war tensions. The hedges or safeguards emphasized when testing stopped have not been maintained (just as happened earlier with the ban on atmospheric testing in the 1963 Partial Test Ban Treaty).³⁴ Facilities that would be critical to US design and manufacture have not been modernized or even kept in good working order. Planning for a new facility for plutonium pit production at Los Alamos began during the mid-1990s, and money to build it was proposed with the 2010 modernization initiatives. In 2011 its long-delayed start was postponed another five years. To restart testing at the national test site is now estimated to require three or four years of repair and refurbishment, unless national emergency measures can be imposed.³⁵ Work scheduled to extend the life of weapons in the stockpile has repeatedly fallen well behind schedule, as has the surveillance data required for statistical confidence in the overall stockpile management program (which in any case would take years to accumulate).

These deficiencies reflect the confused structure and culture of the agency in charge of the nuclear enterprise, the National Nuclear Security Administration (NNSA), created by Congress in 1999 as an independent agency within the Department of Energy. NNSA was conceived as a response to management shortcomings within the Energy Department,³⁶ but those deficiencies quickly reappeared in the new agency. Now in its second decade, NNSA seems impervious to reform, despite repeated reviews and recommendations by the General Accountability Office and by the Department of Energy’s inspector general; despite its own repeated reorganizations and assurances that it will start new programs to solve old problems; and despite a general consensus that the organization still exists only because there is no agreement on what to put in its place.³⁷ Perhaps the fundamental reviews called for in the 2013 National Defense Authorization Act (including a congressional advisory panel on governance of the nuclear national security enterprise) will bring some improvement,³⁸ but the record is discouraging, and so is the NNSA’s refusal to acknowledge its problems. After thirteen years in

operation, for example, NNSA could still not provide Congress with systematically collected data about the cost of its programs.³⁹ It is then not surprising that NNSA's estimates of the costs of new programs

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prove highly inaccurate. In its FY 2011 Stockpile Stewardship Management Plan, for example, NNSA estimates the cost of its proposed life-extension program for the B61 bomb to be \$4 billion. By early the following summer the estimate was raised to \$6 billion and soon thereafter jumped to \$8 billion. Analysis by the Pentagon's Cost and Program Evaluation office said a better estimate was probably \$10 billion, and tail-kit assemblies (for better accuracy) would cost a further \$1.25 billion.⁴⁰

The culture and performance of NNSA thus inject further uncertainty into the prospects for being able to maintain a safe, secure, reliable, and effective strategic nuclear force. It seems unlikely that the organization's performance will improve substantially; promised reforms have not taken hold over the past twelve years.⁴¹ And the Energy Department's Annual Financial Reports for FY 2011 and FY 2012 explicitly rejected stockpile management as a management priority.⁴²

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The answer to this question turns on the assumption that today's better science can enable models and simulations that will reliably predict the performance of yesterday's weapons that are now configured in ways that were never explosively tested. Comfort with that assumption is encouraged by the demonstrably improved understanding of the physics involved; by the development of very large, very high-speed computers running highly detailed simulations; by the fact that the original configurations of the weapons in the stockpile were certified to be effective during the time when underground testing was conducted; by the continuing recruitment of scientists to the stockpile programs; by the effort (at least so far) to replicate, whenever possible, original materials and procedures when replacing or modifying parts; and by the annual agreement among the leaders of scientific, technological, military, and political organizations to certify that the stockpile is safe, secure, reliable, and effective. Some members of Congress express even more confidence in the science-based weapons assessments than in actual weapons testing.⁴³

Unease with the assumption is stimulated by the lack of empirical data to validate the tools used to assess and certify the stockpile. The effects of aging and the various Life Extension Programs have changed the weapons in the stockpile today somewhat from their original configurations; at issue is whether those differences mean that test data from twenty-plus years ago can still validate the weapons in today's configurations. A congressionally mandated commission reported in 1999 that there were already concerns about actions that had been taken to change the design of weapons in the stockpile and that "if there were not a moratorium, nuclear tests would have been performed to confirm the validity of these actions."⁴⁴ Confidence would be higher if models built by fitting curves to

past successes were also good at predicting past failures. But, again, the weapons today are not what they were when testing was conducted.⁴⁵ Specific non-critical tests of individual modifications—Tritium charging, new arming/fuzing/firing subsystems and surety features, different materials and manufacturing processes—cannot address the possibility of interactions among these changes and other critical processes. Drell and Adams, for example, note that future issues of concern could arise “from birth defects, design errors, or aging effects such as corrosion. . . . One concern with the current [Life Extension Program] approach is that multiple small changes to the original design of a given weapon could conceivably interact to produce an unforeseen change in performance.”⁴⁶ In addition, as the JASON independent panel of scientists reported, “we do not know to what extent the performance of nuclear weapons is non-deterministic. . . . indeterminacy is important, because it may pose the ultimate limit to reliability.”⁴⁷

There is also concern because stockpile surveillance programs have not been providing the timely data needed to evaluate changes in the weapons in the stockpile. Judgments about reliability and effectiveness, moreover, will not be able to depend on statistical inference because “the data base for [underground tests] is simply too small and not sufficiently diverse (for specific weapons functions) for statistics to be relevant.”⁴⁸ And those judgments, on which the test-free assessment and certification processes depend, rest increasingly in the hands of people without direct experience in designing and testing nuclear weapons. In 2012 the administrator of NNSA said he expects all the test-experienced physicists to have left active employment by 2020.⁴⁹ Interviews and video records of their experiences and recollections might not be enough to maintain the earlier level of confidence in estimates about the effects of aging and future modifications of the weapons, even if scientific understanding of the processes demonstrably improved. And confidence in the course reversal/rebuilding safeguards or hedge will almost certainly decline, because there is no simple recipe for restoring the ability to design, test, manufacture, and deploy new nuclear weapons.

Technical assessments reflect no consensus concerning the assumption that testing will not be required in the future, even if it does not appear to be needed today.⁵⁰ The JASON panel of scientists, for example, applauded the scientific stockpile work, judging that “lifetimes of today's nuclear warheads could be extended for decades, with no anticipated loss in confidence, by using approaches similar to those employed in Life Extension Programs to date.”⁵¹ But this view was conditional. The director of Los Alamos cautioned that “there are certain findings that have been misinterpreted, especially as presented in the unclassified summary.” The director of Lawrence Livermore laboratory wrote that “in the absence of the more complete discussion provided in the classified report” the unmodified JASON statement understated “the challenges and risks encountered in ensuring a safe and reliable nuclear force.”⁵² And the unclassified part of the JASON report itself warned that their central opinion was predicated on several conditions that are in fact at hazard: “Continued success of stockpile stewardship is threatened by lack of program stability, placing any LEP strategy at risk;” and “the surveillance program is becoming inadequate. Continued success of stockpile stewardship requires implementation of a revised surveillance program,”⁵³ views with which the directors of Los Alamos, Lawrence Livermore, and Sandia agreed. The directors also emphasized that future problems with the stockpile were unknowable; “it cannot be assumed that increasing insight and understanding in the future will

necessarily increase confidence in the stockpile; such knowledge is fundamentally unknowable in advance.”⁵⁴

The 2009 Congressional Commission on the Strategic Posture of the United States was divided on the whether the non-testing Life Extension Program could meet stockpile assurance needs well into the future. Its report declared that “the possibility of using this approach to extend the life of the current arsenal of weapons indefinitely is limited” and that “the process of remanufacturing now underway introduces some uncertainty about the expected operational reliability of the weapons.”⁵⁵ But its members could not agree concerning the Comprehensive Test Ban Treaty. Some were comfortable with the non-testing assumption, asserting that “knowledge gained from past nuclear tests and the Stockpile Stewardship Program ensure that the United States can maintain a safe, secure, and reliable nuclear weapons stockpile without additional testing.” Others were not, insisting that “maintaining a safe, reliable nuclear stockpile in the absence of testing entails real technical risks that cannot be eliminated by even the most sophisticated science-based program because full validation of these programs is likely to require testing over time.”⁵⁶

Foster put the problem clearly: “The challenge [since testing stopped in 1992] has been to demonstrate the absence of problems which could cause a warhead not to operate properly and why. This is a very difficult challenge and no proof can be provided that all serious problems are absent and that all known problems can be addressed without testing.”⁵⁷ Others endorse the stockpile stewardship program but also believe that “confirmation that physics knowledge remains adequate may require (and, from a technical point of view, ideally would require) occasional ‘scientific confirmation tests.’”⁵⁸ And still others contend that while “there is a compelling need for . . . nuclear tests as a source of confidence in [assessments of how weapons will perform in an untested configuration], . . . the use of expert judgment is legitimate when it is provisional, in the sense that it is subject to challenge and correction through the scientific process itself. In a post test era, we must continue to rely on expert judgment.”⁵⁹

The laboratory directors and the JASONS also joined several others expressing concern about future human capital: “All options for extending the life of the nuclear weapons stockpile rely on the continuing maintenance and renewal of expertise and capabilities in science, technology, engineering, and production unique to the nuclear weapons program. This will be the case regardless of whether future LEPs utilize refurbishment, reuse or replacement. The study team is concerned that this expertise is threatened by lack of program stability, perceived lack of mission importance, and degradation of the work environment.”⁶⁰

Undeveloped Options

Even during the previous nuclear era, when uncertainty was reduced by years of continued testing, frequent modernization and thousands of operationally deployed weapons, the Absolute Weapon did not bring absolute security. America’s evident nuclear power did not stop lesser nuclear and non-nuclear states from challenging American interests, even to the level of open warfare (North Korea,

China, North Vietnam, and Iraq, for example). They did not, in almost seventy years, provoke a nuclear response. Irrespective of whether a “norm” has developed against the use of nuclear weapons and how powerful it might be,⁶¹ the relevance of nuclear weapons has been, and seems most likely to continue to be, quite narrow; “strategic nuclear forces do not have the scope of usefulness that non-nuclear powers possessed in the past.”⁶²

The record of non-use was established in an earlier, strategically different, era; is it likely to last in a future that promises more diverse nuclear problems? Current worries include threats from North Korea and Iran, surety of weapons in Pakistan, proliferation to other states, acquisition of weapons by non-state organizations, and continued nuclear weapons modernization by other nuclear powers.⁶³ Might those challenges call for an American nuclear response? Perhaps. If there were a nuclear attack on American forces, or if American forces were seriously overmatched by conventionally armed forces of the enemy, the United States might want to respond with a nuclear demonstration or even a limited counterforce attack. The United States would only do so, presumably, in compliance with the “negative security assurance” presented in the 2010 Nuclear Posture Review: “the United States will not use or threaten to use nuclear weapons against non-nuclear weapons states that are party to the NPT and in compliance with their nuclear non-proliferation obligations.”⁶⁴ In that event, would the president have the weapons he might want? Perhaps not: the United States might well find its arsenal had nothing quite appropriate—low yield, minimal persistent radiation, enhanced electromagnetic effects, targetable with tactical precision. The best available option would be a low-yield B61 delivered by a bomber, but radiation levels of the wrong kind could prove higher than desired.

One response would be to develop nuclear weapons that are tailored to such specific eventualities, an option that in the past attracted both US and Russian military planners.⁶⁵ The domestic political context in Washington is not likely to support this approach, however, because it would require reversing the policy strictures against design and test that the government has observed for many years. Moreover, the resulting new weapons would likely be opposed by those who fear that nuclear weapons are more likely to be used if they were made to be more usable, more appropriate to a broader range of military objectives.

But even were the proscriptions against testing and development to be relaxed, perhaps in the wake of a serious national security scare, nuclear explosions, however tailored and modernized, might not be the weapon of choice, considering problems that could be created for continuing operations and escalation control as well as war termination and reconstruction. The United States thus needs to be able to deal militarily with lesser nuclear powers without using nuclear weapons even if the other side did, a need that has long been recognized. At the end of 1993, Secretary of Defense Les Aspin noted that “nuclear weapons can still be the equalizer against superior conventional forces. But today it is the United States that has unmatched conventional military power, and it is our potential adversaries who may attain nuclear weapons. We’re the ones who could wind up being the equalizee.”⁶⁶

Pursuant to President Clinton’s direction (PDD-18), the Defense Department set out to reinforce traditional non-proliferation activities with options for action when proliferation had already occurred. These options were developed under the rubric “counter-proliferation,” and they included developing

general purpose forces that could operate under nuclear attack (in part because pre-emption could not be assumed).⁶⁷ The United States also intends its nuclear forces to assure allies of its support for their national security, often claiming this “extended deterrence” helped keep friendly and allied governments from seeking nuclear weapons of their own. But extended deterrence also posed dilemmas that could sharpen tensions, as NATO’s members know well.⁶⁸ The possible use of nuclear weapons that would seem tactical for the United States would involve the strategic homeland of the ally, while if tensions escalated to the strategic level for the United States, allies would question whether it could credibly risk the destruction of American cities. An increased US emphasis on general purpose forces therefore seems likely to reinforce allies’ confidence that America would help fight their wars, if only because such forces can be credibly hypothecated and even used without provoking the classic “trade New York for Paris” dilemma. General purpose forces can also address a wider range of contingencies and so help ameliorate allied worries about shared views of regional deterrence; South Korea, for example, has posed sharp questions about American deterrence in the face of repeated North Korean attacks, particularly the 2010 sinking of the *Cheonan* and the shelling of Yeongpyeong Island.⁶⁹ With stronger general purposes forces of their own, allies might feel more secure about decisions affecting their strategic interests and more capable of responding to provocations, and those provocations, in turn, might become less serious when American military involvement is somewhat less immediate. While such diplomatic and military adjustments would take thought and care, the emphasis on non-nuclear forces and options could substantially reduce the uncertainties inherent in extended deterrence.

The “counter-proliferation” policy as envisioned in 1993, however, did not lead to a vigorous program. Questions arose almost immediately about the roles, missions, and budgets implied by the new initiative and how it was to be coordinated with policies and programs already ongoing under the rubric of nonproliferation.⁷⁰ Semantic and ad hoc resolutions of these questions continue today, but the military capability envisioned by Aspin does not. As reported by the Defense Science Board in 2005, “the bottom line is that commanders and planners cannot be assured that today’s weapons platforms, command and control (C2), intelligence, surveillance and reconnaissance (ISR), and associated support systems will be available should a nuclear detonation occur.”⁷¹ The Board reported again, five years later, that “for nearly two decades, nuclear survivability via hardening of equipment and/or operational contingencies to enable “fighting through” [by General Purpose Forces] has been neglected.”⁷² After another year’s work the Board found that “the survivability, effectiveness, and adaptation of [General Purpose Forces] to [nuclear weapons effects] is at best unknown. If [General Purpose Forces] were subjected to a nuclear event in the foreseeable future, mission execution would depend upon combinations of luck and ingenuity in workarounds for failed equipment.”⁷³ Unless and until these deficiencies are corrected, the U.S. force structure will present the president not with options and capabilities, but with a dilemma: use nuclear weapons that might not work, or conventional ones that will probably fail.

Barring new policies about testing and design, questions of the future size and posture of United States’ deployed strategic nuclear forces thus reduce essentially to a net assessment vis-à-vis Russia (and perhaps in the future China, if it develops a much larger nuclear arsenal). The object is generally to

ensure that a large nuclear power does not acquire a substantial or perceived nuclear force advantage over the United States, as determined by its own calculations or those of the United States (or perhaps in some circumstances the calculations of others as well). The planned modernization of the strategic forces Triad is intended to preserve that balance.

It then becomes interesting to explore ways in which the modernization of the US strategic posture might incorporate more developmental flexibility, considering such factors as overall size, basing, and warhead interoperability, perhaps to include conventional warheads. The object is to increase the degree to which timely reconfiguration of the modernization programs can be achieved in response to the unfolding future strategic environment.

But it will take almost twenty years or so before the first numbers of those new weapons are deployed, and during that time the United States might come to prefer a different approach. Changes in the composition, size, and posture of the future Russian forces could affect survivability estimates, weapon allocations, and relative dependence on ballistics or air breathers. There might be new targets whose hardness or configuration would be challenging for the current American arsenal. Arms control agreements might constrain the number of weapons and how they might

be configured and deployed. Russian strategic views and assessments might change significantly, prompting changes in U.S. policies and strategies.⁷⁴ Alternatively, the modernization effort might stimulate its own justification: the long required lead time imposes cautious conservatism on estimates of future requirements. If the renewal programs come to be seen as overbuilding in some respect, they can provoke a series of reciprocal increases in opposing forces that defeat any attempt to find a balance.⁷⁵ The effort to preserve some form of balance vis-à-vis Russian forces in the future, that is, may not be just a matter of how many warheads, missiles, and bombers are operationally deployed.

While today's military and financial technologies make unlikely a repeat of Italy's premature modernization in the early 1930s, a dynamic strategic environment compels constant concern about the relative value today of yesterday's investments. It then becomes interesting to explore ways in which the modernization of the US strategic posture might incorporate more developmental flexibility, considering such factors as overall size, basing, and warhead interoperability, perhaps to include conventional warheads. The object is to increase the degree to which timely reconfiguration of the modernization programs can be achieved in response to the unfolding future strategic environment.

A more incremental, time-phased approach, for example, might provide continuing security for the retaliatory forces, more flexibility for adjusting force levels and deployments, and substantial reductions in initial investment.⁷⁶ The Air Force seems to have something like this in mind for the projected new penetrating bomber, which is planned to serve initially in conventional roles and only later to be uprated for nuclear missions, as determined by needs and resources of the time. The Air Force might also be able to follow an incremental and flexible developmental path in modernizing its land-based ballistic missile force. Perhaps the booster for the Missile Defense Agency's Ground-Based Interceptor could be mated with an upper stage and sufficiently energetic fuel to allow full target coverage from existing Minuteman silos. Such a missile could readily be made road-mobile (the booster is delivered on trailers today) in the event a survivability enhancement or signaling option were needed.⁷⁷ Another option would involve developing a common missile for submarines and silos; while technically quite challenging, it would

facilitate rebalancing the force if needed. And another would be to configure at least some strategic missiles to be capable of delivering non-nuclear warheads, in case anxieties among some in the United States about such weapons can be allayed or the United States and Russia do move to “nuclear zero.”⁷⁸

The Navy also plans an incremental approach by deferring modernization of the Trident II sea-launched ballistic missiles until the new submarines are deployed, but the cost of the submarine alone threatens to reduce its multifunctionality and to impair the remainder of the shipbuilding program for several years. Perhaps a submarine less capable than the planned Ohio-class replacement could provide an interim missile platform, pending clues about the future anti-submarine warfare environment.⁷⁹ Or perhaps revisiting some of the basing modes considered thirty years ago for the MX missile could suggest some less expensive initial options for preserving an interim retaliatory capability. (always taking into account concerns for preserving the techno-industrial base).⁸⁰

Conclusion

The United States is not alone in facing uncertainties of strategy and force assessment; similar problems are probably shared by Russia (and, to some extent, China), though they take different forms in practice. Russia, for example, maintains an active remanufacturing program while the United States has none. But these uncertainties weigh on the United States disproportionately. The doctrinal unknowns do so because the United States must plan to be reacting to another’s initiative; while neither may know how a clash will turn out, the initiator at least knows more about how and when it will start. The unknowns in strategic force assessments are more troublesome to the United States because its force posture intends to assure operations in post-strike environments that are highly speculative. Uncertainties about performance of the nuclear weapons are more serious for the United States because its designs and performance margins are considered to be relatively more sensitive to changes in the weapon’s overall configuration. Above all, any move to reduce these uncertainties by revising policies seems sure to be more difficult in the US government.

Soon after becoming president in 2009, Barak Obama noted that he might not live to see a world free of nuclear weapons. But if today’s policies continue in force, effectively proscribing testing, new designs, remanufacture, and manufacture, he may soon see a world in which American leaders would use nuclear weapons only in response to nuclear attacks on the US homeland.⁸¹ Doing otherwise would confront too many unknowns owing to the cumulative influence of strategic, operational, and technical uncertainties—not only risks, but truly unknown factors and quantities, inherent in policy, basing modes, and the weapons themselves, arising from both external and self-imposed constraints.

All these uncertainties—conceptual, analytic, operational, empirical—will play out in a strategic future that is itself deeply uncertain, if only because of the number and variety of actors, state and non-state, with which the United States must contend. Non-state actors have not yet controlled nuclear weapons independently, but the strategic future is scarcely less murky even if they never do. There are today governments whose assessments, processes, and objectives are quite opaque, and whose confidence in asserting new demands on regional affairs apparently rests on their newly acquired

nuclear weapons (or, as with Iran, the threat that they could soon have some).

The US nuclear posture, meanwhile, reflects a doctrine of unresolved ambiguities and consists of nuclear warheads untested for two decades that would be delivered (at least for the next decade and a half) by weapons built during the Cold War, in greatly reduced numbers as determined by agreement with Russia. How well does this posture match the weapons to the times? Is the force structure designed in the bipolar Cold War half a century ago the best answer to emerging nuclear threats? The dynamics of power relations in such a world are just beginning to emerge. Shaping them is sure to require strong and agile general purpose forces that can operate in nuclear environments, together with strategic forces fitted to emerging threats and contingencies. That shaping, however, will not be done without reference to nuclear weapons, which will, in Brodie's image, "remain in being as a keenly sensed pedal tone in all those aspects of our foreign policy that have military implications."⁸²

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