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Section IX. An Assessment of Minimum Deterrence Claims Regarding the Cost Benefit of Deep Nuclear Force Reductions

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Table of Contents

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Introduction: The Minimum Deterrence Narrative

Minimum Deterrence proponents often claim that U.S. nuclear modernization programs are unnecessary and unaffordable, and that substantial cost savings would result from their proposed cuts to the size and scope of the U.S. nuclear arsenal. While the exact amount of defense dollars to be saved varies from proposal to proposal, the common theme is clear: cuts to the size of the U.S. nuclear force will save considerable resources in the defense budget and make those resources available for other, higher priority, defense needs. The following quotes are generally representative of Minimum Deterrence claims:

- "The current plan involves spending $355 billion over the next 10 years to maintain and modernize our nuclear arsenal, and $1 trillion over the next 30 years. This is an absurd waste of taxpayers' dollars on weapons that must never be used. The time has come for the United States—in words and deeds—to support the global elimination of nuclear weapons."[1]

- "The request is the administration's biggest down payment to date on a planned unaffordable and unsustainable nuclear spending binge to rebuild all three legs of the nuclear triad and their associated warheads and supporting infrastructure."[2]

- "Given the tightly constrained federal budget, an expenditure of this magnitude [$1 trillion] is unrealistic. Fortunately, much more modest plans can meet U.S. security requirements while saving hundreds of billions of dollars over the next three decades."[3]

- "America needs to make reasoned decisions regarding defense investments. It would be unwise to attempt to simultaneously modernize and replace the entire oversized Cold War arsenal of nuclear warheads, production facilities, and strategic delivery vehicles. Doing so would risk the hollowing of conventional forces in order to recreate a bloated, ill-conceived nuclear force structure and backward-looking Cold War nuclear strategy that is unaffordable and unnecessary."[4]

The claims that planned U.S. nuclear modernization will be too expensive and substantial savings are otherwise available fit into the Minimum Deterrence narrative in four ways.

First, Minimum Deterrence proponents argue for deep U.S. nuclear force reductions on the grounds of saving scarce U.S. defense resources. While the sizes of the proposed cuts and savings vary, the central point is that nuclear warheads and delivery systems are expensive to

build and maintain – and reducing them will save a substantial amount of money now and in the future. Moving to Minimum Deterrence force levels would allow the United States to meet all nuclear requirements while reducing the strain on the defense budget. For example:

- "…President Obama should cancel the LRSO. It would: … Save $30 billion from being spent on an unneeded, redundant weapons system."[5]

- "Shifting to a submarine-based monad would serve U.S. deterrent needs and eventually save taxpayers roughly $20 billion a year, with the savings coming from delivery vehicles and support costs."[6]

- "If adopted, this [Global Zero] agenda would reduce U.S. spending on nuclear weapons programs by as much as $100 billion over the next decade."[7]

Second, Minimum Deterrence proponents claim that money saved from cuts to nuclear forces can be shifted and spent instead on conventional forces to meet pressing defense needs. This claim is important because it assumes that funds originally planned for nuclear forces can be shifted to fund conventional forces or other programs. For example:

- "The land-based leg of the nuclear triad should be retired. It is dangerous, redundant, and unaffordable. Every dollar spent on the land-based ICBM force will be wasted and will short change other national defense priorities."[8]

- "Pressing forward with current nuclear modernization plans will drain funds needed for conventional forces, leaving our armed services without the funding essential to maintain combat readiness and projected levels of operation."[9]

- "Rebuilding the arsenal in its Cold War image is unaffordable and unnecessary, and must be rethought. The payoff for doing so would be huge. Instead of investing scarce resources in unneeded nuclear weapons, the Pentagon could redirect funds to higher priorities, such as stopping Ebola, fighting the Islamic State and shoring up conventional forces. … Plans to rebuild the US nuclear arsenal pose financial and opportunity costs that can't be justified in the current economic and security climate. Washington can safely reduce spending on nuclear weapons and redirect funds to where they are needed most."[10]

- "The good news is that the nuclear piggy bank is over-stuffed and ripe for a withdrawal. … Overinvesting in nuclear weapons just starves the programs we really need."[11]

Third, Minimum Deterrence proponents assert that conventional forces can substitute for the nuclear forces for deterrence and assurance purposes, in whole or part. They thus recommend

that the United States move to a conventional-focused deterrent force thereby reducing the reliance on and need for sustaining nuclear forces and their cost. For example:

- "U.S. conventional deterrence of Soviet aggression went far to deter Soviet aggression. Today it goes even further, limiting the reliance on nuclear threats. Also, fewer states have revisionist territorial agendas, let alone the capability to act on them. Moreover, the wars the United States fights and contemplates are increasingly against insurgents or weak states without nuclear weapons. Because these wars barely affect the nation's safety, few people support using nuclear weapons to win them. Nuclear threats are therefore not credible and nuclear weapons unusable in the vast majority of real and imagined U.S. military contingencies. … Because less is asked of nuclear deterrence, it demands fewer weapons."[12]

- "A submarine-based monad, along with conventional capability, can provide all the deterrence we need, and save roughly $20 billion a year."[13]

- "While our nuclear arsenals may be perceived by some as playing a role in deterring a nuclear-armed state like North Korea from attacking us or our allies… In fact, strong conventional forces and missile defenses may offer a far superior option for deterring and defeating a regional aggressor. Non-nuclear forces are also far more credible instruments for providing 21st century reassurance to allies whose comfort zone in the 20th century resided under the U.S. nuclear umbrella. Precision-guided conventional munitions hold at risk nearly the entire spectrum of potential targets, and they are useable."[14]

- "My contention is that U.S. non-nuclear strategies and capabilities can provide the necessary rebalancing, and credible deterrence when developed and given prime strategic roles and missions."[15]

Fourth, Minimum Deterrence proponents assert that nuclear weapons are of declining value in today's strategic environment and thus, correspondingly, should receive lower priority in funding. For example:

- "Nuclear weapons are the dinosaurs of military hardware. This plump piggy bank should be raided to address the real high-priority emerging threats. The United States does not have to break the congressional budget deal and increase defense spending to do so. We've got the world's most expensive, most sophisticated nuclear deterrent – and the irony is that it has no deterrent effect on the most pressing conflicts we face. Surely we don't need to go out and buy new, shiny version."[16]

- "Pentagon procurement decisions worth tens of billions of dollars should not be based on obsolete strategy. The Pentagon and the White House need to adjust the nuclear strategy and budget to the declining threat. The worst thing we could do right now is waste scarce resources on yesterday's weapons, starving the programs we really need."[17]

In short, central tenants of the Minimum Deterrence narrative are that substantial savings are available via deep cuts to U.S. nuclear forces, and that these cuts can be undertaken without jeopardizing U.S. deterrence and assurance goals because nuclear forces are of declining value and because non-nuclear forces can provide much of the deterrent effect previously provided by nuclear forces.

Minimum Deterrence claims, however, often are overstated. In addition, they do not appear to take account the value of U.S. nuclear forces for the deterrence of foes and the assurance of allies; nor are the added costs for and realistic limitations of conventional forces considered in the claim that they can, with great savings, substitute for nuclear forces for deterrence and assurance purposes.

The following discussion addresses each of these problems with Minimum Deterrence claims regarding the great savings available via deep nuclear reductions.

The Claimed Savings Are Overstated

As noted above, Minimum Deterrence proponents often cite current and projected total costs attributed to the nuclear force and claim that large cost savings would result from their recommended reductions.[18] A few Minimum Deterrence proposals are explicit about the estimated cost savings from nuclear reductions. For example, one proposal states, "A submarine-based monad, along with conventional capability, can provide all the deterrence we need, and save roughly $20 billion a year."[19] Some proposals even provide detailed accounting for the claimed savings.[20] However, in general, the purported savings from reducing the size and composition of the nuclear force are overstated by Minimum Deterrence proponents.

Any investigation into costs and potential savings from reductions in the nuclear force needs to examine separately the funding attributed to the National Nuclear Security Administration (NNSA) and the Department of Defense (DoD). They are related, of course, but the costs and associated drivers of budgets for each department are very different. Below is a summary of findings regarding potential savings from nuclear reductions.

NNSA Funding and Potential Savings

The NNSA is a semi-autonomous agency within the Department of Energy (DOE). The enacted DOE budget for FY2015 totals about $27.18 billion and, within the DOE, the budget for NNSA totals about $11.4 billion.[21] Among other things, the NNSA is responsible for the national laboratories and production infrastructure for the stockpile of nuclear warheads and nuclear gravity bombs. These activities are funded from a category of the NNSA budget referred to as "Weapon Activities." For FY2015, the enacted Weapon Activities budget is $8.18 billion. Contrary to claims of significant savings implied by Minimum Deterrence advocates, the potential savings in the NNSA budget from significant nuclear reductions are not proportional to the relative size of the stockpile of nuclear warheads. That was the bottom line in the February 2013 testimony of NNSA's Deputy Administrator for Defense Programs, Dr. Donald Cook. Cook, stated that the desire of President Obama to reduce the number of nuclear weapons is "not principally been driven by cost,"[22] and, "there are not substantial additional costs in going small..."[23] How can this be? This issue is discussed in the next few paragraphs.

Table 1 (below) provides an overview of the major funding categories for the NNSA "Weapons Activity" budget and shows the amount of funding in then-year dollars for Fiscal Year 2014 and the requested amount for Fiscal Year 2015.[24]

NNSA Weapons Activity Funding Categories	FY 2014 $M Enacted	FY 2015 $M Request
Directed Stockpile Work	2,442.0	2,746.6
Science Campaign	369.7	456.4
Engineering Campaign	149.9	136.0
Inertial Confinement Fusion Ignition and High Yield Campaign	514.0	512.9
Advanced Simulation and Computing Campaign	569.3	610.1
Readiness Campaign	55.4	125.9
Secure Transport Asset	210.0	233.8
Readiness in Technical Base and Facilities	2,067.4	2,055.5
Site Stewardship	87.3	82.4
Nuclear Counterterrorism Incident Response	228.2	173.4
Counterterrorism/Counterproliferation Programs	0	76.9
Defense Nuclear Security	665.0	618.1
Information Technology and Cyber Security	145.1	179.6
Legacy Contractor Pensions	279.6	307.1
Domestic Uranium Enrichment Research, Development, Demo	62.0	0
Adjustments	(64.0)	0
Weapons Activities Total	**7,781.0**	**8,314.9**

Table 1. Overview of Future Years Nuclear Security Program Budget for Weapons Activities, in Fiscal Years 2014 (Enacted) and 2015 (Requested)

Two main conclusions emerge from examining the programs funded by the NNSA budget for Weapon Activities. The first conclusion is that very few of the activities funded by the Weapon Activity budget are directly related to the size and composition of the nuclear stockpile. This is because many of the funding sub-categories support campaigns (NNSA-speak for initiatives) to advance general science, engineering, and production technologies, infrastructure capabilities, and counterterrorism/counterproliferation programs. These activities would not be affected significantly (or at all) by a reduction in the size of the stockpile of nuclear warheads. The only category that would be directly affected by cuts in the number of nuclear warheads is *Directed Stockpile Work* which accounts for only about one third of the total Weapon Activity budget. Therefore, over two-thirds of the NNSA Weapons Activities budget would be largely unaffected by cuts in the size and composition of the stockpile. Only about one-third of the overall Weapons Activities budget—the *Directed Stockpile Work* portion—is directly and significantly affected by stockpile size.

Second, even the *Directed Stockpile Work* portion of the budget would not be reduced fully in proportion to cuts in the size of the stockpile. In fact, an examination of the costs directly attributable to maintaining the nuclear stockpile and the total number of nuclear warheads in the active stockpile clearly shows this dynamic. Figure 1 (below) graphically displays this data from 1967 to 2013. Several factors contribute to this counterintuitive cost versus stockpile size dynamic.

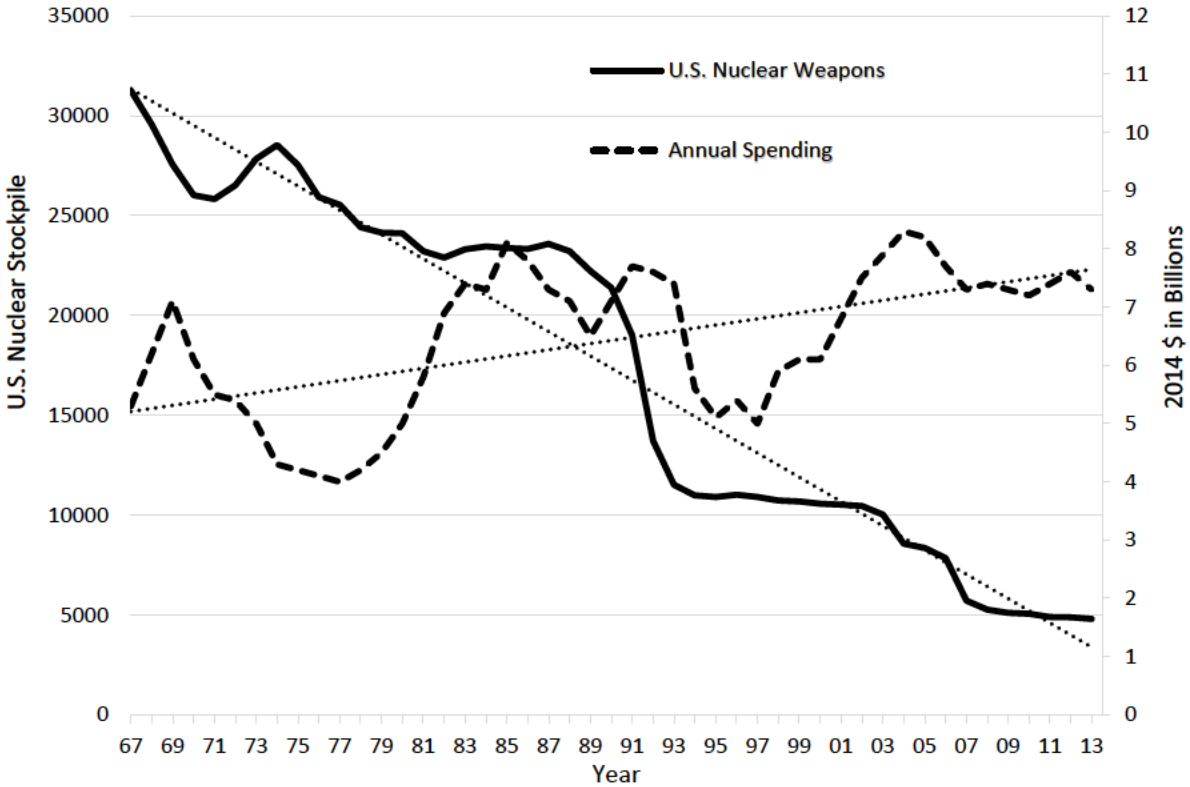
- First, the *Directed Stockpile Work* funding category also supports work not related to the size of the active stockpile—for example dismantlement and disposition activities. Thus, not all funding in the *Directed Stockpile Work* is subject to change in proportion to the size of the stockpile or the sustainment and modernization activities for warheads.

- The research, development, and production infrastructure that sustains the nuclear warhead stockpile is totally government funded. No commercial establishments provide a ready source of skills and infrastructure that would enable the government to downsize and quickly rehire staff to meet changing demands. Scientists and engineers with a wide variety of skills must be retained and ready to meet whatever national security needs arise. Therefore, the NNSA laboratories and plants must be kept in a state of relative readiness and all critical skills must be sustained along with a next generation of personnel in training. This means that NNSA funding does not always rise and fall in proportion to the level of work associated with warhead maintenance and life extension programs. The cancellation of a warhead life extension program, for example, would not mean that all costs attributed to that program could be eliminated and the savings

pocketed. For example, many of the people involved would be retained as part of the long-term, skilled work force and reassigned to other projects.

- Finally, cost analyses conducted by NNSA have shown that significant cost savings associated with stockpile reductions are realized only when an entire type of nuclear warhead is eliminated. The national laboratories, for example, maintain a physics design and engineering team for each type of warhead. These teams provide the expertise to examine warhead surveillance data, assess reliability, and plan life extension programs. The size and composition of a warhead team does not change much (if at all) whether thousands of warheads of a certain type exist in the stockpile or just a few tens. NNSA plans already call for a reduction in the number of warhead types—from "twelve warhead or bomb variants within seven warhead families"[25] to only five types of warheads—a level that is designed to manage warhead reliability risk in an environment without nuclear testing. Minimum Deterrence proposals that call for further reductions in warhead types do not address how the additional risk from such reductions would be managed. Further cuts in the types of nuclear warheads below the current NNSA plan are unlikely to be enacted by senior government leaders as reliability risk would increase; therefore, large savings are unlikely.

Figure 1. AEC/ERDA/DOE/NNSA Annual Spending for Nuclear Weapons Research, Development, Testing, and Production versus Size of the Active Stockpile of Warheads[26]

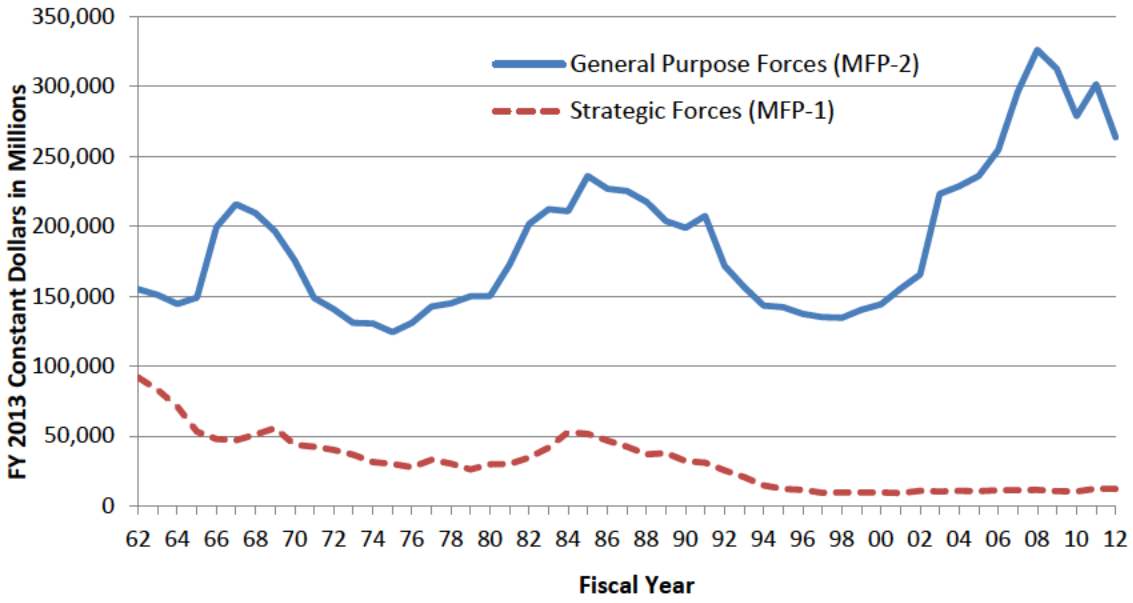


In general, as long as the United States maintains at least several types of nuclear warheads, large cost savings from NNSA funding would not accrue from Minimum Deterrence-proposed nuclear reductions—any savings would certainly not be in proportion to the reduction in the size of the warhead stockpile.

DoD Funding and Potential Savings

For the DoD budget, the potential for savings is more straightforward to estimate than for NNSA. However, the annual funding for strategic nuclear forces is already a very small percentage of the overall DoD budget. Figure 2, below, shows the relative amount of funding for Strategic Forces compared to the funding for General Purpose Forces from 1962 to 2013.

Figure 2. Costs (Total Obligational Authority) for General Purpose and Strategic Forces[27]



Any savings from foregoing some nuclear modernization programs would depend largely on the specifics of modernization plans, the nuclear forces to be retained, and forces eliminated. Findings regarding potential savings associated with reductions in each leg of the nuclear force are summarized below.

Bomber Leg. Bombers are the most costly leg of the nuclear triad to operate. If bombers were eliminated from the nuclear mission, however, they would be retained for general purpose force missions. In fact, general purpose military requirements determine the size of the heavy bomber force. If the bomber leg of the nuclear triad was eliminated, some savings would accrue

primarily from no longer having to maintain secure storage for nuclear weapons at bomber bases and from not having to nuclear certify the next generation heavy bomber. However, costs saved would be relatively small in proportion to overall funding for the modernization and operation of the bomber force.

Some Minimum Deterrence advocates assert that savings from eliminating the nuclear mission of the bomber leg would be large because the next-generation bomber would not be needed or could be delayed and the development of a new air-launched cruise missile (ALCM) could be cancelled.[28] Both aspects of purported savings are doubtful because both the new bomber and the ALCM are planned to be dual-capable and are needed for general purpose/conventional missions. Therefore, in practice little overall savings would be realized from eliminating the bomber leg of the triad.

ICBM Leg. The silo-based ICBM force is typically cited as the least expensive leg of the nuclear triad to operate. Some proposals call for the total elimination of the ICBM leg.[29] Others call for scaling back the number of deployed ICBMs. Estimated cost savings from the elimination of the ICBM leg would depend on the measures to life extend, modernize, or replace the existing Minuteman III missiles and the operation of ICBM fields. According to a recent RAND study, the total 39-year life cycle costs for ICBM modernization options range from $60-$90 billion at the low-cost end to a high of $135-219 billion for a road-mobile ICBM.[30] If the ICBM modernization effort planned to develop a new mobile missile, then cancellation of that effort would, at least on paper, save a large amount. If, however, the modernization of ICBMs is based on the incremental upgrading of the Minuteman III and launch control facilities, the cost (and if canceled, savings) would be much less. As mentioned earlier, DoD has reportedly decided against the more costly option of developing a mobile ICBM.

Also, any savings from modernizing and retaining, but down-sizing, the ICBM force would depend on the details of the basing plans. As a RAND study on basing options concluded, "only complete closure of an ICBM-only base would result in significant annual operation and support cost savings."[31]

SSBN Leg. Minimum Deterrence proponents often cite the high cost of developing and producing *Ohio*-class replacement submarines. Typically, the SSBN leg is referred to as the most expensive component of the nuclear modernization program.[32] Almost all Minimum

Deterrence proposals call for retaining some SSBNs in the nuclear force because of survivability considerations.[33] If only a few new SSBNs are to be built, some savings would accrue from truncating the build of submarines to less than the twelve planned submarines. Claims of savings are generally valid, but fail to acknowledge that no savings would accrue in the research and development phase and that the unit costs for the first few SSBNs are the most expensive. The follow-on submarines are less costly than those built early in the program. Of course, the value of any potential savings would need to be considered against the risk associated with having fewer SSBNs at sea at any time. U.S. Strategic Command cites the *Ohio*-class replacement program as its highest priority nuclear modernization program.[34] And, both STRATCOM and the Navy assert that the twelve planned *Ohio*-class replacement submarines are the minimum needed to sustain the undersea leg of the triad for the long term.[35] Therefore, large cuts in the planned number of SSBNs to be procured to replace the aging *Ohio*-class submarines are unlikely. The potential for savings claimed by Minimum Deterrence advocates associated with a much smaller SSBN force are typically overstated and unlikely to be implemented.

Nonstrategic Nuclear Forces. Almost all Minimum Deterrence proposals call for the complete elimination of the remaining U.S. nonstrategic nuclear force. Currently, this force involves only dual-capable aircraft—F-15, F-16, and in the future, F-35 aircraft—and associated nuclear weapons and weapon maintenance and storage capabilities. The nuclear mission does not drive the number of fighter aircraft needed. As with heavy bombers, force sizing is dominated by general purpose military requirements. Potential savings from eliminating all nonstrategic capabilities would be limited to savings from no longer sustaining and modernizing nuclear weapons storage sites in Europe and the cancellation of actions to nuclear certify the F-35.

Minimum Deterrence advocates also cite savings from the cancellation of the B61 gravity bomb life extension program. However, even if the nonstrategic nuclear mission is eliminated and some elements of the warhead life extension program determined not to be of value for strategic missions on heavy bombers, the cancellation of this program would be unlikely to result in savings of $4 billion—the amount claimed by one group.[36] As discussed earlier with respect to the NNSA budget, many of the personnel would be retained and reassigned to other programs.

Summary of Potential for Savings

This section focused on claims of large cost savings from Minimum Deterrence proposals for nuclear reductions. In general, an examination of the claimed savings reveals that, of course, some savings would result, but claims of large savings are overstated. The difficult-to-predict dynamics of the NNSA budget are partly to blame. Also, Minimum Deterrence proponents seem to base purported savings on high-side estimates of possible modernization options.

These findings are consistent with the conclusion of Secretary of Defense Ashton Carter. In July 2013, as then-Deputy Secretary of Defense, Carter told an audience at the Aspen Security Forum, "You all may be surprised to know that nuclear weapons don't actually cost that much. ... they're not the answer to our budget problem. They're just not that expensive."[37]

Next, the subject of value versus cost will be examined. And later, the discussion will turn to the additional costs associated with the challenge of attempting to provide conventional forces as a substitute, in part or full, to support the enduring U.S. strategic goals of deterrence, assurance, and defense.

The "Affordability" Argument

Minimum Deterrence proponents often frame their arguments favoring significant U.S. nuclear weapons reductions in terms of affordability – specifically, what they see as the unaffordability of maintaining the current level of nuclear forces in an environment of budgetary restraint. For example, in arguing against additional funding for the nuclear modernization programs necessary to ensure the enduring efficacy of the U.S. nuclear deterrent, Minimum Deterrence supporters have cited Frank Kendall, Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)), who stated: "We've got a big affordability problem out there with those programs."[38] In addition, the National Defense Panel Review of the 2014 Quadrennial Defense Review concluded that current plans to modernize the strategic nuclear Triad – on which the nation's nuclear deterrent rests – are "unaffordable" given current budgetary restraints.[39]

Likewise, advocates for U.S. nuclear arms reductions argue that "spending on these weapons at these levels cannot be sustained," declaring that current nuclear modernization plans are "unaffordable."[40] These claims often resonate with those who those who see excessive spending and budget deficits as major national security threats. In a recent report, the Arms Control

Association concluded "Reducing nuclear weapons spending now is a smart way to trim the budget."[41]

The "Zero Sum Game" Argument

Minimum Deterrence proponents also argue that spending on nuclear forces detracts from needed investments in other, more important, conventional military capabilities. As the National Defense Panel also noted in its July 2014 report, improvements to U.S. nuclear forces "would likely come at the expense of needed improvements in conventional forces."[42] As one critic of nuclear modernization put it, "Overinvesting in nuclear weapons just starves the programs we really need."[43] Other advocates of sharp nuclear reductions have been equally forceful in their assertions that spending on nuclear weapons will diminish the overall military capability of U.S. armed forces, arguing "Pressing forward with current nuclear modernization plans will drain funds needed for conventional forces, leaving our armed services without the funding essential to maintain combat readiness and projected levels of operation."[44]

Other Minimum Deterrence supporters have also sought to suggest that spending on nuclear forces is a "zero-sum game" where budget increases in one area automatically translate into decreases in other areas. For example, the Arms Control Association has asserted that "Shielding nuclear programs from budget reductions will force deeper cuts into other, higher priority conventional systems."[45]

A Question of Priorities

In reality, these arguments are based on several false premises and questionable logic. First is the notion that continued investments in the U.S. nuclear deterrent are unaffordable. While defense spending, like other types of discretionary spending, involves trade-offs, those trade-offs are a function of decision-makers' assessments of political and military priorities, not economic capacity.

Despite challenging economic trends and the perceived imperative to cut budget deficits and reign in government spending, the U.S. economy remains robust and resilient enough to provide sufficient resources for the defense of its citizenry. This, after all, is the first imperative of government, as reflected in the nation's founding documents. The real issue is not whether the

nation can afford to spend money on maintaining the efficacy of its nuclear deterrent (which constitutes an exceedingly small percentage of the defense budget), but instead how to prioritize that spending in the face of other pressing requirements. In other words, spending on nuclear deterrence is a question of political will and the imperative of making choices, not economic capacity; it is a question of priority, not affordability. As one budget analyst recently testified, "Affordability is a choice – it's whether or not we are willing to make the resources available."[46]

Confusing Cost with Value

Second, arguments that highlight the monetary cost of nuclear investments as "excessive" or "unsustainable" are intellectually disingenuous. What the critics generally ignore is the fact that cost is not synonymous with value. The value of the American nuclear deterrent arguably far exceeds the monetary cost of maintaining it. Indeed, the costs associated with recovering from a nuclear conflict that failed to be prevented by maintenance of an adequate nuclear deterrent are likely to be orders of magnitude greater than the costs of ensuring the adequacy and reliability of the U.S. nuclear deterrent in the first place. While it is not possible to ascribe an exact value to the cost of preventing a World War III, surely the value of successfully deterring such an outcome for the past 70 years – to which U.S. nuclear forces have unquestionably contributed – cannot be overlooked and should not be discounted.

Because of the value they provide, maintaining the efficacy and reliability of the nation's nuclear force is arguably one of the most cost-effective investments within the overall defense budget. Historically, nuclear forces have been relatively inexpensive compared to conventional forces, and this has factored into the evolution of U.S. military strategy. During the Cold War, for example, the United States sought to deter Soviet conventional aggression against Western Europe by relying on forward-deployed nuclear forces, as these forces provided a significantly less expensive deterrent than the costs of matching the massive conventional force capabilities of the Soviet Union and its Warsaw Pact allies.

Spending on nuclear weapons accounts for roughly 3 percent of the total Department of Defense (DoD) budget. As noted above, then-Deputy Secretary of Defense Ashton Carter stated in 2013, "nuclear weapons don't actually cost that much.... They're just not that expensive."[47] He added that DoD spending on nuclear delivery systems constitutes approximately $12 billion, with

another $4 billion or so on the associated nuclear command, control, and communications systems. This is hardly "large" or "unjustifiable," as some analysts who favor the abolition of nuclear weapons contend;[48] rather, it is a small fraction of the overall defense budget, which exceeds $500 billion. In addition, while defense spending in general has increased significantly over the last decade, the amount of money invested in nuclear weapons has remained relatively constant.

Some Minimum Deterrence supporters estimate the costs associated with the U.S. nuclear weapons arsenal to be higher; one estimate places it at $31 billion for all strategic nuclear weapons, including costs allocated to the Department of Energy's National Nuclear Security Administration, which oversees the nuclear enterprise.[49] But higher cost estimates also often include the costs of non-nuclear supporting capabilities and infrastructure, much of which is dual-purpose and can be used to strengthen U.S. conventional military capabilities, such as communications networks, refueling aircraft, and other enablers. Therefore, eliminating these supporting capabilities would negatively impact the very capabilities that Minimum Deterrence supporters argue are being "starved" for funding. Other estimates place the costs of the U.S. nuclear arsenal as high as $60 billion annually, but that includes the cost of environmental remediation and health care resulting from exposure to radioactive elements and contaminated sites dating back decades.[50] These are costs that will not be "saved" by cutting the budget for nuclear weapons.

When factoring in the anticipated additional costs of modernizing the nuclear Triad over the next decade – including the costs associated with developing and deploying next-generation delivery platforms such as ICBMs , bombers, and strategic ballistic missile firing submarines – the costs are still relatively modest. For example, the Congressional Budget Office (CBO) estimates that "the costs of nuclear forces represents roughly 5 percent to 6 percent of the total costs of the [Obama] Administration's plans for national defense for the next 10 years."[51] These percentiles of the overall defense budget are within the historical norm and are not unaffordable in any objective sense. Again, the question is whether such spending is deemed acceptable to pay for the deterrence and assurance that American nuclear forces help provide.

The Need for Flexibility and Adaptability

While Minimum Deterrence advocates argue that the cost savings from nuclear weapons reductions will allow funds to be invested elsewhere in greater priority programs, they fail to acknowledge the dynamism of the international security environment and the fact that U.S. deterrence requirements are likely to change and evolve over time. The possibility that effective deterrence may require bolstering the number or capabilities of U.S. nuclear forces to meet dynamic challenges or unanticipated contingencies is generally dismissed by Minimum Deterrence proponents as unrealistic or improbable.

Yet the realities of the international geo-political environment do not provide cause for optimism on this front. Once eliminated, nuclear forces will be difficult at best to reconstitute, and doing so is likely to be exceedingly costly, especially after the scientific, technical, and engineering knowledge, along with the production infrastructure associated with the weapons themselves, have been degraded or eliminated. Therefore, the presumed cost savings from the elimination of nuclear forces seen by Minimum Deterrence advocates as "excess" to U.S. deterrence needs is likely to be a fraction of the costs of reconstituting those forces if made necessary by adverse changes in the international security environment. In other words, the cost savings from eliminating existing nuclear weapons and their associated infrastructure are likely to be much less than the costs of regenerating and refurbishing the nuclear enterprise and restoring, rebuilding, and redeploying nuclear weapons if and as needed. Therefore, the presumed cost savings cited by Minimum Deterrence supporters are ill-founded, given the volatility of the international security environment.

Should unforeseen threats develop, reconstituting a more robust nuclear force would not only be expensive, but potentially dangerous. It could be seen or characterized by others as provocative and destabilizing, leading to increased political pressure on American decision-makers to avoid such a course of action, lest it trigger a series of undesired political or military consequences.

Moreover, a rapid rearmament program to respond to unfavorable global developments, though it may be politically or militarily necessary, is likely to be economically inefficient as a significant amount of monetary resources is applied on an expedited and priority basis. Historically, rapid rearmament programs have been viewed as wasteful of fiscal resources. The defense buildup of

the 1980s, for example, led to serious charges of waste, fraud, and mismanagement in the defense budget. Similarly, the rapid effort to bolster U.S. counter-terrorism capabilities after the 9/11 attacks resulted in the creation of new bureaucracies and was criticized by some as an "overreaction." By some estimates, the U.S. intelligence budget rose by at least 250 percent with more than 30 new buildings built for the intelligence community at a cost of billions of dollars.[52]

Minimum Deterrence advocates who propose cutting nuclear weapons spending tend to discount or ignore entirely the possibility that the United States may need to reconstitute rapidly a credible and effective nuclear deterrent to deal with unexpected threats – albeit it at a much higher cost than that which would be saved by forgoing already planned investments in nuclear modernization efforts.

Challenging the "Opportunity Cost" Assumption

While it is certainly true that money spent in one area is unavailable for other activities (the economic term for this is "opportunity cost"), the argument by Minimum Deterrence proponents that U.S. conventional forces will "starve" for funding and their ability to maintain combat readiness will deteriorate *because* of spending on nuclear weapons is repeatedly promulgated without any supporting empirical data. In reality, it is no more valid than arguing that conventional forces will suffer because of the money spent on military salaries, non-proliferation programs, or other defense or even non-defense investment priorities.

As previously noted, government spending reflects national priorities, and while it is legitimate to debate the appropriateness of how government spending is prioritized, it is disingenuous to assert that an inadequate level of spending in one area is the direct result of what is argued to be an excessive amount of resources invested elsewhere.

Internal Contradictions

Importantly, the two main arguments used by Minimum Deterrence proponents to criticize spending on nuclear forces are internally contradictory. First, they argue that increased spending on nuclear weapons and modernization programs is "unaffordable." Second, they contend that such spending "starves" the conventional programs that are currently underfunded. Yet they offer no data to support the contention that a reduction in nuclear weapons funding would

necessarily translate into increased funding for conventional forces; nor do they explain why such increased conventional force spending would be "affordable" when spending on nuclear forces is not. Logically, both arguments cannot be true simultaneously. This inconsistency is never addressed by Minimum Deterrence proponents, and is seldom challenged; nevertheless, "savings" are really not savings if they are simply reinvested in other accounts.

Those who contend the United States should reduce its nuclear arsenal to save money are in fact suggesting that the United States doesn't need nuclear weapons – or at least many such weapons. Indeed, Minimum Deterrence advocates see nuclear weapons as a waning asset, unresponsive to what they perceive as more likely and urgent contemporary threats. Indeed, one analyst has referred to them as "nuclear dinosaurs."[53] This belief forms the backdrop for their arguments over the unaffordability of U.S. nuclear modernization plans and the greater urgency of ensuring more robust non-nuclear capabilities. The cost savings argument adds a level of attractiveness to proposals to reduce the nuclear stockpile, especially when budgets are tight, deficits are high, and government spending is being challenged across the political spectrum.

The Cost of Preserving Survivability at Low Nuclear Numbers Could be High

As noted earlier, Minimum Deterrence proposals for the nuclear force typically range from a few tens of U.S. nuclear weapons to a few hundreds. One potential cost that is overlooked by Minimum Deterrence proponents is the additional cost of ensuring the survivability of the relatively small Minimum Deterrence force.

During the Cold War, survivability concerns affected the design and posture of all legs of the nuclear triad. Since end of the Cold War, the ballistic missile submarine (SSBN) force has borne most of the burden of ensuring that some U.S. nuclear forces would be survivable. In addition, silo-based ICBMs have been retained in numbers sufficient to make any adversary's attempt to destroy land-based nuclear forces uncertain, at best. However, if the nuclear force was reduced per Minimum Deterrence proposals, the survivability of those few weapons would be a serious concern.

An adversary that devised methods to destroy or otherwise disable all or most of the small U.S. Minimum Deterrence force could exert tremendous leverage over the United States and its allies. Some U.S. allies already worry about the long-term viability of the U.S. nuclear capabilities that

underpin extended deterrence. To strengthen deterrence and assurance, U.S. defense planners may be motivated to take actions to enhance the survivability of any small Minimum Deterrence nuclear force. Minimum Deterrence proposals, however, overlook this concern and do not address the potential need for enhanced survivability measures.

Assumptions about Survivability from Minimum Deterrence Proposals

One frequent theme espoused by proponents of Minimum Deterrence is that a small, assured, second-strike capability will deter any adversary and—because submarines are invulnerable when at sea—all or most of the U.S. nuclear force can be based on SSBNs. The following quotes are examples of such claims from articles promoting Minimum Deterrence:

- "A submarine-based monad, along with conventional capability, can provide all the deterrence we need, and save roughly $20 billion a year."[54]

- "To eliminate the need to ever make a decision to launch nuclear weapons before the situation is completely clear, the bulk of U.S. nuclear forces should be deployed at sea, where they are invulnerable while on patrol and could ride out any attack."[55]

- " [I]f, for example, the United States maintained two submarines at sea, each armed with 24 missiles carrying three warheads each, that should be enough to ensure survivability. This approach might require four submarines, of which two would be in port or undergoing retrofitting at any given time. ... there is no reason to maintain a full triad of forces. The high degree of redundancy in current forces is unnecessary for deterrence. "[56]

Such proposals do not acknowledge that the planning assumptions—including the assumption of SSBN invulnerability over the long term—could prove wrong. Of course, there is no way to guarantee the assured invulnerability of the future SSBN force over the long term as called for in many Minimum Deterrence proposals. *Ohio*-Class Replacement SSBNs are currently slated to enter service in 2031 and to remain in service until about 2080. No predictions about possible technology breakthroughs and operational tactics involving anti-submarine warfare or undersea detection technology can be credible 65 year into the future.

In addition, Minimum Deterrence proponents do not address the issue of what might be needed for survivability and how the proposed force would provide the force structure for an adequate response to mitigate adversary capabilities that threaten the survivability of the down-sized nuclear force.

Additional Costs to Enhance Survivability

Should survivability concerns about the smaller force arise, a number of response options would be possible, but at a cost. The type of response options needed would depend on the nature of the threat, the types of nuclear forces retained, and the immediacy of need. Crash programs initiated in response to a newly discovered threat would, almost certainly, be extremely costly. The potential for an enterprising adversary to be able to negate a significant portion of the U.S. nuclear force should motivate U.S. actions to enhance nuclear force survivability. Such actions could include one or more of the options identified below.

Enhancing the Survivability of SSBNs. The *Ohio*-class replacement SSBN is scheduled to enter service in 2013 and remain in service until about the 2080 timeframe. The *Ohio*-class SSBN and its predecessors were designed to be able to operate in hostile environments and, therefore, were armed with a full array of self-defense and offensive anti-submarine capabilities. In contrast, the *Ohio*-class replacement SSBN is not being developed as a multi-purpose submarine. The Navy plans to rely primarily on stealth for survivability. According to the Navy's program executive for the new SSBN, "This is a single function submarine that does strategic deterrence."[57] With no perceived need for these submarines to operate in hostile environments, the Navy has scaled back war-fighting accoutrements for the future SSBN force.

In the future, a credible threat to U.S. SSBNs. even when at sea,[58] could trigger a number of possible responses. A new SSBN design, development and construction program could be initiated to replace the "single-function" SSBNs that were deemed to be at risk. That effort would likely take more than a decade to complete. In the interim, deployed SSBNs could be escorted by attack submarines if the primary threat was from adversary undersea vessels. Alternatively, U.S. SSBNs could be moved to operate in more protected (e.g., bastion-like) waters. To sustain a bastion-like SSBN deployment posture, additional operating and support bases would probably have to be constructed near the new deployment locations. Of course, the response would depend on the nature of the threat. If a new-design SSBN was needed, the development and acquisition costs for a twelve-boat force could exceed $100 Billion in constant Fiscal Year 2014 dollars.[59]

Enhancing the Survivability of ICBMs. Many Minimum Deterrence proposals call for a drastically reduced ICBM force or the complete elimination of the ICBM leg.[60] If some number

of ICBMs are to be retained, Minimum Deterrence proposals call for them to be silo-based. Should the need arise for the survivability of the extant ICBM force to be enhanced, one available option could be to increase the number of silo-based missiles so that an adversary would not be confident that an attack on the entire force could be successful. Of course, for this option to be executable, non-used silos would need to have been maintained in warm standby or restorable condition and additional missiles, reentry vehicles, and warheads would have to be newly produced or reactivated. Another option which would be even more costly would be to develop, produce, and deploy new mobile ICBMs as was planned during the last decade of the Cold War.

Estimating the cost of a future mobile ICBM is difficult. The Peacekeeper program is the only all-new ICBM program developed and completed in the past 30 years. A 2014 RAND report on ICBM modernization options listed Fiscal Year 2012 dollar costs for the Peacekeeper program as $26.8 billion for development, $17.5 billion for procurement of 102 missiles, and $700 million for military construction. Estimates for rail- and road-mobile ICBM programs that were planned but never completed are much higher. For Peacekeeper Rail: $4.7 billion for development; $6.1 billion for procurement of 50 missiles; and $1.1 billion (in Fiscal Year 2012 dollars) for military construction. The total costs for the Small ICBM program are estimated to be $21.4 billion for development, $8.7 billion for 623 missiles, and $3.8 billion for military construction. In 2014, RAND concluded that, for the Air Force to develop a mobile ICBM to replace the existing Minuteman III system, the additional cost over and above that for a silo-based modernization program would be $29.4 billion to $41.2 billion (in Fiscal Year 2012 dollars).[61] According to a 2013 GAO report, the Air Force, when considering options to replace or modernize the Minuteman III system, "quickly eliminated" mobile basing options based on cost.[62]

Enhancing the Survivability of Bombers. Minimum Deterrence proposals that retain nuclear-capable bombers typically call for a relatively small number of these aircraft. For example, one proposals calls for only ten future heavy bombers to be nuclear capable and for all of these bombers to be based at a single location.[63] Near-term survivability enhancement options could include disbursing the bombers and maintenance/support crews to other bases, placing several loaded bombers on alert status, and adapting and certifying quickly some number of the conventional-ordnance bombers for nuclear weapons carriage. Of course, nuclear storage sites at alternate locations would also have to be built and certified. Re-purposing some of the

conventional bombers for nuclear use could result in a shortfall in long-range bombers for general purpose missions. Thus, the production of additional bombers might also be needed. The cost of each new long-range strike bomber (LRS-B), now in development, has been as estimated at about $550 million per aircraft—and up to about $800 million per aircraft fully outfitted.[64]

Defending Offensive Nuclear Forces. Of course, depending on the nature of the threat, another possible option could be to build and deploy active defenses in sufficient quantities to cause an adversary to be uncertain over the probability of sufficiently disabling the U.S. nuclear force. As noted in the 2010 report of the National Research Council, *Making Sense of Ballistic Missile Defense*, the twenty year life cycle costs for a new site supporting different ballistic missile defense concepts could range anywhere from a few billions to tens of billions of dollars, and for space-based concepts up to several hundreds of billions.[65] The Congressional Budget Office has reportedly estimated the five-year cost of building a ground-based midcourse missile defense system on the East Coast to be about $3.5 billion.[66] The National Research Council report estimates the twenty-year cost for a new East Coast missile defense site at $19 to $25 billion.[67]

In short, for a very small, Minimum Deterrence nuclear force the cost of ensuring the survivability of the nuclear force could be very high. The potential need for enhanced force survivability is never considered by Minimum Deterrence proponents and, therefore, the potential additional costs are excluded from discussions of cost savings associated with a Minimum Deterrence posture. Given the stakes associated with these assumptions being wrong, this approach seems imprudent. A better option would be to discourage adversaries from investing in capabilities to try to destroy or neutralize the U.S. nuclear force by making such an option extremely complex and uncertain to succeed. A nuclear force such as that planned to comply with the New START Treaty seems more likely to discourage adversaries from investing in concepts to destroy or otherwise negate the U.S. nuclear force and the costs involved in modernizing those forces seem modest when compared with the potential additional costs—including that of ensuring survivability—at the force levels typically recommended by Minimum Deterrence proponents.

The Prospective Cost of Attempting to Substitute Conventional Strike Capabilities for Nuclear Forces for Deterrence Purposes

As discussed above, Minimum Deterrence proponents maintain that conventional strike weapons can effectively threaten a significant fraction of targets now held at risk by nuclear weapons, that this possibility validates the recommendation of deeper U.S. nuclear reductions, and that the result will be substantial cost savings. The discussion here argues that, to the contrary, in many cases current conventional strike capabilities cannot replace nuclear arms in threatening comparable destruction against targets of potentially critical importance for deterrence, and that the expense of the qualitative and quantitative improvements necessary to make conventional substitution plausible would eliminate or far eclipse the cost savings from the related nuclear reductions. Moreover, even if considerable substitution were feasible and affordable, there is no certainty that that the physical damage conventional weapons could cause would exert the same deterrent effect as the threats posed by U.S. nuclear capabilities.

Substituting conventional for nuclear weapons would require much greater expenditures for five reasons. First, against many or most targets now covered by nuclear weapons, some multiple of conventional weapons would be necessary, which also could increase the number of aircraft, missiles, submarines and surface ships used for their delivery. Second, most existing conventional strike systems lack the long range of strategic nuclear forces, which means new nonnuclear systems like hypersonic boost-glide vehicles would have to be developed and deployed in number. Third, if conventional strike weapons were to be part of the deterrent to nuclear attack, their delivery means would need an added level of pre- and post-launch survivability comparable to that of strategic nuclear forces. Fourth, both conventional weapons and delivery vehicles designated as substitutes for nuclear capabilities would, like nuclear forces, require protective measures to harden their electronics against nuclear effects, particularly the electromagnetic pulse (EMP) produced by high-altitude nuclear explosions. And fifth, new and more conventional weapons with guidance independent of the Global Positioning System (GPS) might needed, given the potential vulnerability of that constellation of navigation satellites. Each of these reasons for the sizable cost of suiting conventional weapons for a role in helping deter or, if necessary, wage a conflict involving nuclear use is elaborated below.

More Conventional Weapons and Associated Delivery Vehicles

A report by the Global Zero advocacy group claims that against a number of potential U.S. adversaries, modern conventional weapons could pose a lethal threat to portions of the "target bases previously covered by nuclear forces." It estimates conventional weapons could cover "practically" 100 percent of the North Korean, Iranian, and Syrian target bases, 10-30 percent of "an expansive Russian target base," and 30-50 percent of a Chinese target base "roughly one-half the size of the Russian target set."[68] (These figures are echoed in a Cato Institute report that also favors Minimum Deterrence.)[69]

The Global Zero claim deserves little credence, however, because the report provides no substantiation for the estimates made and neglects to specify the types and numbers of conventional weapons that would substitute for nuclear arms. Even if the asserted percentages of targets covered were granted, conventional weapons would still be inadequate against 70-90 percent of the presumed Russian target base and 50-70 percent of the Chinese, which calls into question the notion that conventional-for-nuclear substitution would permit much larger nuclear reductions and cost savings. In fact, the possibilities for substitution are likely more limited than Global Zero alleges and, where feasible, generally will entail an increase in the number of conventional weapons much greater than the number of nuclear weapons cut.

According to current as well as past U.S. nuclear employment strategy, capabilities for a "wide range of options" are required to "defend the vital interests" of the United States, its allies, and partners, "deter nuclear attack," and respond appropriately "should deterrence fail." This guidance "requires the United States to maintain significant counterforce capabilities against potential adversaries" and "not rely on a 'counter-value' or 'minimum deterrence' strategy."[70] In support of this strategy, U.S. nuclear weapons have been targeted "to hold at risk our potential adversaries' military forces, war-supporting industry, command and control capabilities, and military and national civilian leadership."[71]

Most of the targets that fall within these categories cannot be effectively or efficiently "held at risk" by conventional weapons. This is due to the characteristics of the targets and the simple fact that conventional weapons lack the immense destructive power of nuclear weapons—the power so often emphasized by Minimum Deterrence advocates. For example, to duplicate the

blast effects of a nuclear weapon with a 20-kiloton explosive yield (the yield of the Nagasaki bomb), some 2,000 tons of TNT equivalent would need to be delivered with high accuracy in conventional weapons of typical size. All the long-range bombers in the current U.S. force could not deliver that much conventional explosive in a single strike.

Adversaries' "command and control capabilities" and "military and national civilian leadership" centers usually are very hard (facilities constructed of steel-reinforced concrete) and very deeply buried (a few hundred meters underground), making them highly resistant, if not invulnerable, to conventional attack. "War-supporting industry" targets tend to be large in size and number, which would require large numbers of conventional weapons for their destruction if deterrence were to fail. Targets associated with nuclear forces—such as missile silos, tunnels, and launch control facilities—in many cases are extremely hard in construction and difficult to threaten with conventional munitions. The bases for other military forces generally are large in number, often considerable in size, and sometimes hardened, all of which would pose significant challenges for the effectiveness of conventional strike capabilities. The examples that follow illustrate some of the problems in using conventional weapons to threaten these types of targets, particularly the ineffectiveness of conventional weapons against certain targets and the need for multiple weapons to inflict sufficient damage against others.

In the 1981 attack on Iraq's Osirak nuclear reactor, Israeli aircraft dropped 16 2,000-lb. bombs after calculating that eight direct hits would be necessary to destroy the target. While these bombs were not precision-guided weapons, they were delivered with precision accuracy.[72]

During the 1999 NATO Allied Force air campaign against the forces and regime of Serbian President Slobodan Milosevic, eight precision-guided Joint Direct Attack Munitions (JDAMs) delivered by a B-2 bomber were needed to drop a single bridge, one that already had been the target of a number of unsuccessful sorties by Allied fighter-attack aircraft that also were armed with precision weapons.[73] In the campaign overall, a B-2 in a typical sortie hit two to three targets with the 16 JDAMs in its bomb bays, an average of five to eight weapons per target.[74]

While a single nuclear weapon could destroy an air base, "[h]istorical evidence illustrates that large number of precision weapons would be needed to knock a hardened military air base out of

commission for a substantial period."[75] At least one conventional weapon would have to be targeted against each aircraft shelter or storage bunker. In addition, "soft" aircraft parking areas and hangars would need to be struck. For the air bases in China alone, there are, according to one source, nearly 400 hard aimpoints.[76] Even conventional attacks on less well-protected air bases would involve large numbers of weapons. A RAND Corporation analysis, for example, reportedly determined that more than 30 Chinese conventionally armed missiles would be necessary to attack the soft aircraft parking areas at the U.S. air base (Kadena) on Okinawa.[77]

Similarly, a missile or naval base would comprise multiple targets for conventional weapons. For missile bases, each launcher building, maintenance facility building, and weapon storage bunker would have to be targeted with at least one conventional weapon. For naval bases, targets would include berthing areas, in-port warships, repair and maintenance facilities, and weapons storage bunkers.

In addition, as seen in past conflicts, targets of conventional strikes—military bases, industrial plants, power, communications, and transportation networks—can be repaired in the course of a conflict and returned to operation. This may necessitate restrikes, which means more weapons and probably more weapon delivery vehicles. Nuclear war, in contrast, obviously would afford limited opportunities for target reconstitution.

If, say, one-third of Russian or Chinese targets previously assigned to U.S. nuclear force instead were covered by conventional weapons, the amount of nonnuclear ordnance necessary probably would significantly exceed current weapons inventories, the delivery capacity required would be well beyond what today's long-range strike capabilities in the aggregate could provide in a single large attack, and the time needed to delivery all weapons to their targets would be measured in weeks rather than days.

To get some sense of what the conventional component of a strategic retaliatory attack against one of the these major nuclear powers could involve, consider the effort devoted to waging the much smaller-scale Allied Force air campaign against the Yugoslav regime, its forces, and their sources of support. Some 350 strike aircraft participated in the campaign. These aircraft flew more than 10,000 sorties. They delivered 23,000 munitions, a third of which were precision

weapons.[78] Naval ships fired nearly 220 sea-launch cruise missiles (SLCMs).[79] In addition to mobile ground forces, more than 400 fixed targets were struck, only a third of which were destroyed.[80] Twenty-one U.S. bombers—one-fifth of the operational force at the time—participated, flying 320 sorties and delivering 11,000 munitions, most of which were unguided.[81] The length of the campaign was 11 weeks.

Depending on the extent of conventional-for-nuclear substitution, the nonnuclear contribution to the retaliatory threat meant to discourage Russian or Chinese nuclear aggression could require weapon and delivery vehicle numbers several times those for Allied Force, which would carry a high cost. In particular, more long-range strike capabilities would be needed, because the dual-role fighters and sea-launched cruise missiles that played important roles in bringing the Milosevic regime to heel would be subject to range and other limits in holding Russian or Chinese targets at risk.

Even if conventional weapons could be delivered in sufficient numbers, most would have little or no capability against many hard and deeply buried targets. These are critical targets for deterrent purposes because they protect adversary leaders and commanders who make decisions of war or peace and the weapons of mass destruction (WMD) and associated delivery means that threaten the United States and its security partners.

A report by the National Academy of Sciences (NAS) found that,

> Potential adversaries worldwide are using underground facilities to conceal and protect leaders, military and industrial personnel, weapons, equipment, and various other assets and activities. These facilities include hardened surface bunkers and tunnel facilities deep underground. Specifically, many underground command, control, and communications (C3) complexes and missile tunnels are between 100 and 400 meters below the surface, with the majority less than 250 meters deep. A few are as deep as 500 or even 700 meters, in competent granite or limestone rock.
>
> …The DOD [Department of Defense] estimates that 10,000 HDBTs exist in the territory of potential adversaries worldwide.[82]

"Many of the most important strategic hard and deeply buried targets," the NAS report concluded, "are beyond the reach of conventional explosive penetrating weapons and can be held

at risk of destruction only with nuclear weapons. Many—but not all—known and/or identified hard and deeply buried targets can be held at risk of destruction by one or a few nuclear weapons."[83] In this regard, it is important to recognize that Russia inherited from the Soviet Union an extensive nuclear hardening program that included hard and deeply buried facilities, and has continued to build more. This includes the massive underground command-and-control bunker system in and around Moscow.[84] These HDBTs may be the reason the Ground Zero report claims that if "Cold War targeting principles" were followed "Moscow alone would be covered by eighty (80) [nuclear] warheads."[85]

Tunnel complexes likewise would be beyond the reach of all but a relatively small number of specialized conventional weapons, and even those could be inadequate to hold at risk targets of this type. A Defense Science Board (DSB) task force on "future strategic strike forces" reported that "past test experience has shown that 2,000-lb. penetrators carrying 500 lbs. of high explosive are relatively ineffective against tunnels, even when skipped directly into the tunnel entrance."[86] In the Allied Force air campaign, a large-scale attack with precision weapons failed to destroy or render inoperable a tunnel complex housing aircraft at the Pristina airfield in Kosovo; a British journalist reported that "after NATO halted its bombing and just before the Serbian military began withdrawing, 11 MiG-21 fighters emerged from the tunnels and took off for Yugoslavia."[87] Today China is said to have thousands of kilometers of tunnels that are hundreds of meters underground and contain missiles and other military assets.[88] The GBU-28, a laser-guided, 5,000-lb. conventional penetrating bomb in the current U.S. inventory, reportedly can drive through only six meters of concrete or 30 meters of soft earth.[89] The GPS-guided, 30,000-lb. Massive Ordnance Penetrator (GBU-57) perhaps could penetrate 20 meters into rock,[90] but weapon is small in number and is only carried by the dozen and a half B-2s in the bomber fleet.

Missile silos can be cited as a last type of target that would be difficult to destroy with existing conventional weapons. "Some targets, like missile silos," a Los Alamos associate director has written, "are sufficiently hard that no conventional weapon will have the energy to defeat them."[91] Open sources indicate Russian silos might be capable of withstanding blast overpressures as high as 10,000 to 25,000 pounds per square inch (psi).[92] According to the head of one of the Russian missile design bureaus, Russian silos have been tested "twice by full scale nuclear blasts" and nuclear weapons would have to be delivered within 10 meters of silos to

destroy the structures.[93] (While this may be an exaggeration, the fact remains that the silos are extremely hard.) Other Russian sources report that the new Russian heavy intercontinental ballistic missile (ICBM) now under development will be protected by upgraded silos, electronic jamming (which could counter GPS-guided weapons), and air and missile defenses.[94] These measures would further undermine the ability of conventional weapons substitute for nuclear weapons in threatening Russian silos.

In short, conventional-for-nuclear substitution would call for many more conventional weapons than the number of nuclear weapons eliminated. This could increase the cost for strike capabilities in two ways: 1) inventories of conventional weapons would need to be expanded; and 2) more aircraft, missiles, and missile-carrying naval vessels very likely would be necessary to deliver the additional weapons. Even with greater conventional strike capabilities, certain key targets would be essentially invulnerable to nonnuclear attack, and an insufficient ability to hold these targets at risk could adversely affect deterrence.

More Long-Range Conventional Strike Systems

For the flexibility to threaten targets located throughout the territories of potential U.S. adversaries, long range is an indispensable force attribute. This is particularly true with regard to Russia and China, given their vast expanses extend well into the Eurasian interior. The U.S. capability for long-range strike today is found in bombers—B-52H, B-1B, and B-2 aircraft—and ballistic missiles—Minuteman III ICBMs and Trident submarine-launched ballistic missiles (SLBMs). The dual-capable B-52Hs and B-2s can carry conventional or nuclear weapons, while the B-1B is configured for conventional missions alone. ICBMs and SLBMs carry only nuclear weapons. All of these bombers and ballistic missiles have ranges of a few to several thousand miles. Dual-role fighters and missiles armed with conventional weapons, in contrast, have ranges of several hundred miles, which limits their utility for strikes against targets much beyond the outer areas of Eurasia, especially when anti-access/area-denial measures to inhibit U.S. force projection are in place.

The United States now has 96 operational bombers, out of a total inventory of 154 aircraft.[95] If a nuclear triad were retained within a Minimum Deterrence force, some number of those bombers would still have nuclear missions, which would limit their availability for conventional strikes.

Less than 100 bombers probably would be not be enough to deliver the significant number of additional conventional weapons required by conventional-for-nuclear substitution.

One way to increase capacity for long-range conventional weapon delivery would be to build more bombers. Present plans call for 80-100 new Long-Range Strike-Bombers (LSR-Bs) at a cost of $550 million each, with older bombers retired over the coming decades.[96] If, say, just 20 additional LRS-Bs were acquired to support the substitution of conventional for nuclear weapons, the cost would be substantial—more than $10 billion. Moreover, there would be a need for additional aerial refueling tankers, probably one per bomber; the new KC-46 tanker has a unit cost of well over $200 million.[97]

Another potential option would be to retrofit a portion of the launchers on existing Ohio-class ballistic missile submarines (SSBNs) with conventionally armed SLBMs (something the Bush administration proposed but Congress rejected), deploy some number of conventional missiles on the 12 Ohio Replacement SSBNs now planned, or build more submarines of that type to carry conventional missiles, which would cost around $5 billion for each additional SSBN.[98] Similarly, existing land-based missile boosters or future ICBMs might be armed with nonnuclear hypersonic boost-glide vehicles or less exotic conventional weapons. Each ICBM or SLBM, however, could only deliver a munitions payload of a few thousand pounds, the equivalent weight of one or two 2,000-lb. air-delivered bombs.[99] Building several hundred nonnuclear intercontinental-range missiles—a not-implausible number for substitution purposes—would cost "several tens of billions of dollar" and "[missile] launchers would add billions more."[100] Their high cost for the delivery of relatively small conventional payloads is one reason conventional prompt global strike (CPGS) systems are seen by defense officials as "niche weapons" for limited strikes (against time-sensitive terrorist targets, for example) rather than the basis for a large force of long-range nonnuclear missiles.[101]

Augmenting the long-range conventional strike capability of the United States, then, would require acquisition of more long-range bombers and missiles than are currently deployed or planned for the future. The cost for this aspect of conventional-for-nuclear substitution could run in the several tens of billions of dollars.

Additional Measures for Conventional Force Survivability

Essential to the U.S. strategy for deterring nuclear attack has been the principle that U.S. forces must be manifestly capable of surviving a comprehensive first strike and retaliating in a controlled but devastating manner. Were capabilities for conventional strike to become part of the deterrent to nuclear attack, they would have to be at least as survivable as the nuclear forces they replaced. The fact that nonnuclear operations generally involve the use of strike aircraft and missile-launching ships for repeated attacks over extended periods would be an added reason to provide enduring survivability for the home bases or other areas where these delivery platforms would refit, refuel, rearm, and then return to the fight. Minimum Deterrence advocates who propose conventional-for-nuclear substitution rarely if ever recognize the imperative to make nonnuclear capabilities survivable and never reckon the cost.

Survivability for U.S. nuclear forces is afforded in a number of ways. ICBMs are protected by silos and a high peacetime alert rate; placing the missiles on mobile launchers, as the Russians and Chinese have, is a basing option that has been considered by the United States but never adopted. A portion of the SSBN is always kept at sea. Bombers, located at five main operating bases, can be placed on ground alert in periods of crisis or dispersed to alternate airfields. (In the early decades of the Cold War, round-the-clock airborne alert for part of the force was another practice used to increase survivability). All of these measures come with a cost. For example, to keep 10 SSBNs operational—the current requirement—a total fleet 40 percent larger (14 submarines) is required.[102]

Hardening, mobility, dispersal, concealment, redundancy, and active defense could be used to reduce the vulnerability of conventional strike systems to nuclear attack—at a price. The large number of conventional delivery vehicles alone would make for increased costs, such as expenditures for new bases. Land-based conventional ballistic missiles could be deployed in silos or on mobile launchers. As crude estimates, for a force of 500 missiles, silos could cost on the order of $10 billion to build, while the acquisition cost for road-mobile basing might be $40 billion.[103] Ten Ohio Replacement SSBNs could carry 160 conventional SLBMs (16 missiles per submarine) at an acquisition cost of roughly $50 billion ($5 billion per submarine, exclusive of the cost of the missiles).[104] In addition, construction of more bases might be necessary to accommodate a fleet larger than the 12 nuclear-armed Ohio Replacements now planned.

Similarly, more bomber bases might be needed if many more than the planned 80-100 LRS-Bs were acquired to help with conventional missions. Preparations for conducting operations from many alternate airfields also might be needed for the enduring survivability of the bomber force. The numbers of long-range strike aircraft and land-based ballistic missiles might be increased by some margins to hedge against prelaunch losses to enemy attack. Another margin might be added to the aircraft number to account for possible losses inflicted by the advanced surface-to-air missiles (SAMs) and fighter-interceptors of Russia, China, and other potential adversaries. Against a prolonged conventional air offensive in which strike aircraft are flying numerous sorties, even a relatively small attrition rate imposed by an air defense network can result in significant losses. Finally, a buildup in U.S. missile and air defenses might be called for to aid the survivability of air bases and missile launchers.

Nuclear Hardening for Conventional Strike Systems

Another threat to the survivability of conventional strike systems in a nuclear conflict is the danger posed by electromagnetic pulse. EMP, generated by nuclear detonations, can cover continental-sized areas and disrupt or destroy electronic equipment critical to the functioning of delivery vehicles and weapons. As an illustration of the danger, consider the consequences of an EMP attack for

> U.S. forces stationed overseas, for example on the Korean Peninsula or in the Persian Gulf. By exploding a nuclear weapon over the theater, the ability of U.S. and allied forces to make full use of their electronic systems, including fire control systems, radar systems, and certainly the networked systems envisioned for our 21st-Century forces, would be degraded to some degree. Depending on the yield of the weapon, the height at which the weapon was detonated, and the degree of EMP hardening enjoyed by U.S. and allied systems, such degradation could range from a nuisance to a major hindrance in the employment of electronic systems throughout the theater.[105]

While the nuclear EMP threat to the United States and its military forces remained after the Cold War, emphasis on EMP hardening evaporated with the tight post-Cold War defense budgets.[106] Despite some efforts to correct EMP vulnerabilities, a 2011 Defense Science Board report found that "the survivability, effectiveness, and adaptation of GPF [general-purpose forces] to NWE [nuclear weapon effects, including EMP] is at best unknown. If GPF were subjected to a nuclear event in the foreseeable future, mission execution would depend upon a combination of luck and ingenuity in workarounds for failed equipment."[107]

Particularly if they were to serve as part of the deterrent to nuclear attack, conventional strike systems would need to be hardened against EMP as well as other nuclear effects, including prompt radiation and the extreme heat produced by nuclear weapons. In this regard, it is important to recognize that an adversary might launch a nuclear attack specifically designed to hamper retaliation by damaging the electronic equipment necessary for the effective operation of U.S. forces. Moreover, the nuclear warheads that reportedly arm many Russian SAMs and anti-ballistic missile interceptors could be especially deadly for unhardened conventional strike aircraft, guided bombs, cruise missiles, and ballistic missile payload delivery vehicles.[108]

Hardening conventional strike systems against EMP could be expensive. The cost is suggested by the findings of the congressionally chartered commission to assess the EMP threat to the United States. For the electronic components found in critical infrastructure, including "Supervisory Control and Data Acquisition (SCADA) modules, mobile communicators, radios, embedded control computers," the commission estimated that new units could be hardened for one-to-three percent of what non-hardened units would cost, "if hardening is done at the time the unit is designed and manufactured." On the other hand, "retrofitting existing functional components is potentially an order of magnitude more expensive."[109] While costs are system specific, existing conventional weapons would need to be EMP tested, fitted with shielding material, which probably would require expensive redesign of internal components, retested for EMP hardness, flight tested, and built in large numbers, either in the form of a retrofit or new production. Were it necessary to make changes to the airframe of a weapon type, cost would increase further, particularly for stealth systems.

Retaining Precision Accuracy Without GPS

Nuclear-armed ICBMs, SLBMs, air-launched cruise missiles (ALCMs), and gravity bombs are not guided by signals from the Global Positioning System satellite constellation. In contrast, the conventional weapons in the U.S. inventory have, since the end of the Cold War, shifted from guidance modes survivable in a nuclear and GPS-denial environment to those that are not. GPS guidance has been has been widely adopted for many weapons because it is all-weather, effective in low- and medium-intensity conventional conflicts, and relatively inexpensive. But an important problem is that GPS guidance can be denied, especially in a high-intensity conventional conflict or war involving nuclear use. That the threat of GPS denial is real is

indicated by the fact that the Air Force fighter and bomber crews now train to operate under conditions in which GPS is unavailable.[110]

GPS can be denied by antisatellite (ASAT) attack, jamming, and cyber attack. ASAT attack may be the most dangerous threat because it can eliminate the entire GPS system, or at least seriously degrade it. In early 2015, the director of national intelligence gave Congress this assessment of foreign jamming and antisatellite capabilities:

> Threats to US space systems and services will increase…as potential adversaries pursue disruptive and destructive counterspace capabilities. Chinese and Russian military leaders understand the unique information advantages afforded by space systems and services and are developing capabilities to deny access in a conflict. Chinese military writings highlight the need to interfere with, damage, and destroy reconnaissance, navigation [GPS], and communication satellites. China has satellite jamming capabilities and is pursuing antisatellite systems. In July 2014, China conducted a non-destructive antisatellite missile test. China conducted a previous destructive test of the system in 2007, which created long-lived space debris. Russia's 2010 military doctrine emphasizes space defense as a vital component of its national defense. Russian leaders openly assert that the Russian armed forces have antisatellite weapons and conduct antisatellite research. Russia has satellite jammers and is pursuing antisatellite systems[111]

Complete loss or serious degradation of the GPS network would undercut the effectiveness of large numbers of U.S. conventional weapons—including bomber-delivered Conventional ALCMs (CALCMs), bomber- and fighter-delivered Joint Air-to-Surface Standoff Missiles (JASSMs), nonnuclear SLCMs, and Joint Direct Attack Munitions (JDAMs)—many of which presumably would be candidates for the conventional-for-nuclear substitution proposed by Minimum Deterrence supporters. In the case of JDAM, as an example, loss of GPS would leave the weapon with only its inertial navigation system (INS), which is reported to provide only a 30-meter circular error probable (CEP, the radius of the circle within which half the weapons would be expected to fall).[112] This degree of accuracy would not result in many direct hits, which would reduce the potential effectiveness of JDAM against hard targets, and require the expenditure of more weapons against soft targets.

The United States has laser-guided bombs that would not be affected by the loss of GPS. Laser-guided bombs, however, can only be used in clear weather conditions. More modern versions (Paveway II and Paveway IV) combine laser with GPS guidance. But in the event of bad weather and loss of GPS, these versions would have a reduced accuracy comparable to that provided by the JDAM (INS).

Acquisition of GPS-independent, precision-guided, all-weather conventional weapons is possible, but would come at a very high cost. The Pershing II intermediate-range ballistic missile, with a maneuvering reentry vehicle and active radar guidance, reportedly had a CEP of 30 meters.[113] (The missile was banned by the 1987 Intermediate-range Nuclear Forces Treaty.) The bomber-delivered, stealthy Advanced Cruise Missile (ACM) with terrain correlation matching (TERCOM) guidance, reportedly also had a 30-meter CEP. (The ACM was withdrawn from service in 2007.)[114] Both the Pershing II and ACM were nuclear-armed, but had accuracy sufficient for the delivery of conventional payloads. The original version of the Tomahawk Land-Attack Missile (TLAM) used TERCOM and digital scene matching area correlation (DSMAC) for guidance, while modern versions use GPS. The cost of the Cold War-era TLAM was roughly $2-3 million (in then-year dollars), while today's GPS-guided Tactical Tomahawk costs about $1 million each. The higher unit costs for weapons with GPS-independent guidance takes on greater significance in light of the large stocks implied by conventional-for-nuclear substitution. It should be noted that there appears to be no Air Force or Navy program for a GPS-independent, precision-guided conventional weapons, almost certainly due to the likely high cost.

The Presumption of American Conventional Force Dominance

As discussed above, Minimum Deterrence proponents often claim that the United States can make significant reductions in nuclear weapons without undermining deterrence because the superiority of U.S. conventional forces enables them to substitute in whole or part for nuclear forces. This argument is consistent with the notion expressed in the 2010 Nuclear Posture Review (NPR) that "the growth of unrivaled U.S. conventional military capabilities" allows the United States to pursue "significantly lower nuclear force levels… with reduced reliance on nuclear weapons."[115] Further, the NPR declares that "the United States today has the strongest conventional military forces in the world."[116]

While U.S. conventional force dominance is generally assumed, the level of conventional force advantages enjoyed by U.S. forces varies from geographic region to region. To provide an effective and credible conventional deterrent, U.S. military forces must be physically present to deter aggression and assure allies. That presence depends on forward deployment or the ability to flow forces into an area quickly. However, the U.S. military "footprint" is being scaled back

in various regions, and the ability to rapidly move forces into a potential conflict area is being increasingly called into question as budget cuts take a toll on all military Services.

By most accounts, U.S. military forces are being stretched thin in every theater of operation worldwide. End-strength in all the Services is declining and the United States is seeking to "rebalance" its global presence to improve the capability to respond to unforeseen challenges and developments in areas where the threats to U.S. security and interests are expanding. To implement this strategy, the Obama Administration has sought to focus greater attention on the Asia-Pacific region. Yet the United States continues to confront threats to its security and that of its allies and strategic partners in areas of traditional conflict like Europe and the Middle East.

NATO Supreme Allied Commander Europe, Gen. Philip Breedlove, has highlighted Russia's belligerent actions in Ukraine and its annexation of Crimea, warning that Russia has deployed "forces that are capable of being nuclear" on Crimean soil.[117] Russia's actions in Ukraine, in violation of the 1994 Budapest Memorandum on Security Assurances, suggest that U.S. conventional forces in Europe are an insufficient deterrent to Russian aggression. Russia's actions have caused some in Ukraine to question the wisdom of that country surrendering its nuclear weapons capability, and have raised concerns among others in the region, particularly in the Baltic states, about the credibility of U.S, security guarantees and whether Russia will be emboldened to launch a similar aggression against Latvia, Lithuania, or Estonia.[118] In addition, some analysts now believe Russia's expansive military modernization program gives Moscow the ability to project superior conventional firepower around the country's periphery.[119]

The expansion of China's military capability is also a source of concern. Lt. Gen. Vincent Stewart, Director of Defense Intelligence Agency, has testified that the U.S. technological edge over China is "at risk" as a result of Beijing's cyber activities.[120] Indeed, the theft of sensitive U.S. information as a result of cyber warfare attacks has compromised U.S. technological advantages. Among the many instances of reported Chinese cyber theft: Published documents indicate Chinese hackers gained access to sensitive design information on the U.S. F-35 Joint Strike Fighter, allowing China to produce its own variants of the modern fighter aircraft, known as the Chengdu J-20 and Shenyang J-31.[121] A recent study released by the Senate Armed Services Committee identified multiple cyber intrusions by China into the computer networks of

U.S. defense contractors – more than 50 such intrusions over a 12-month period – most of them occurring without detection.[122]

The U.S. Technological Edge

Importantly, U.S. conventional force superiority is predicated on the maintenance of technological advantages that may well be fleeting. Consequently, the notion that the United States will enjoy in perpetuity a relative conventional force advantage over all potential adversaries in all theaters of conflict is dubious. In fact, there are indications that the predominance of U.S. conventional forces is diminishing and, in some instances, may have already deteriorated to the point that it can no longer be seen as a credible or effective offset to nuclear deterrence. Minimum Deterrence proposals tend to discount this possibility.

The Department of Defense has already acknowledged that the U.S. technological edge that has traditionally enabled U.S. battlefield superiority is in jeopardy. As Deputy Secretary of Defense Robert Work recently stated, "we have concluded, without question, that the tremendous margin of technological superiority that the United States has typically enjoyed since end of World War II is eroding, and it is eroding at what we consider to be an accelerated pace."[123]

In addition, other military experts both in and out of government have pointed to the impending loss of U.S. technological supremacy that enables American conventional predominance on the battlefield. For example, a September 2014 White Paper produced by the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (AT&L) concludes that "there has been a remarkable leveling of the state of technology in the world, where commercial technologies with military applications such as advanced computing technologies, microelectronics, sophisticated sensors, and many advanced materials, are now widely available."[124] Commenting on the decline in research and development investments, former Under Secretary of Defense for Policy Eric Edelman recently testified that over the past decade the United States has been "eating the seed corn" necessary to maintain the U.S. technological edge.[125]

Even the perceived U.S. advantage in precision-strike weaponry, long considered to enable U.S. supremacy on the battlefield, is no longer guaranteed. As one analyst has explained: "For much

of the past several decades, the U.S. military enjoyed a virtual monopoly on precision-guided weapons. That monopoly is now gone and the barriers to entry into precision-guided strike have been lowered to the point that even non-state actors can gain access to guided rockets, artillery, mortars, and missile systems."[126]

In addition, various military Service publications suggest that U.S. technological supremacy is not assured and can no longer be assumed. For example, the Marine Corps' "Expeditionary Force 21" document, which provides guidance on how the Marine Corps will be structured to carry out its full range of mission responsibilities, states that "the erosion of U.S. technological advantages in areas where we have long enjoyed relative superiority, is likely to continue."[127]

President Obama has suggested that the U.S. enjoys conventional military superiority over Russia, stating that Moscow understands "that our conventional forces are significantly superior to the Russians."[128] Yet Russian President Vladimir Putin has challenged statements of American conventional military superiority, noting "No one should entertain any illusions regarding their chances of asserting military superiority over Russia, we will never allow that to happen… thanks to our military doctrine and advanced weapons."[129]

Implications for Deterrence

The loss or absence of American conventional military dominance would carry significant implications for the Minimum Deterrence contention that U.S. conventional forces will be an adequate substitute for the loss of nuclear capabilities that they propose to eliminate. Even assuming the United States does enjoy conventional superiority, the importance of maintaining a robust and effective nuclear deterrent may actually *increase*, contrary to the assertions of Minimum Deterrence advocates. In fact, U.S. conventional superiority is likely to encourage adversaries to develop nuclear weapons capabilities to offset their conventional force inferiority vis-à-vis the United States. As one analyst has noted, "Paradoxically… the unassailable lead of the United States in military power and technology might actually invite other nations to acquire the bomb as a way to influence or even deter American foreign policy initiatives."[130] According to General K. Sundarji, the former Chief of the Indian General Staff, a key lesson learned after the first Gulf War was "Don't fight the United States unless you have nuclear weapons."[131]

This kind of asymmetric challenge to the United States may be appealing to those states seeking to "level the playing field" with the United States without shouldering the financial burden of developing significant conventional military capabilities. Because nuclear weapons are relatively inexpensive compared to conventional forces, they are an attractive option for adversaries seeking to threaten the United States or to deter U.S. actions contrary to their own interests. Indeed, a nuclear-armed Iran would likely change the calculus of deterrence for the United States in ways that could significantly limit American freedom of action in the region due to the potential of escalation to the use of nuclear weapons.

Ironically, Minimum Deterrence supporters do not acknowledge the connection between U.S. conventional military superiority and nuclear deterrence. They tend to assume that the former weakens the need for the latter; yet the opposite is the case.

Indeed, the 2010 NPR stated that U.S. conventional superiority allowed the United States to pursue nuclear reductions; yet there is no recognition in the document that the conventional superiority that provides a form of deterrence "safety net" enabling nuclear reductions may simultaneously encourage adversaries to seek nuclear weapons as a counter-balance to U.S. military might. Because of this, the nuclear reductions advocated by Minimum Deterrence proposals make questionable strategic sense, as they would undermine the robustness and flexibility of the U.S. nuclear deterrent that is essential to dissuading adversaries from either engaging what has been referred to as a "race for nuclear parity" or engaging in more provocative actions that directly challenge the United States, its allies and strategic partners, and its vital interests.

Importantly, in areas where the United States enjoys a conventional military advantage, adversaries may not only seek offsetting nuclear capabilities but may threaten to escalate any conflict to the nuclear level. The use of nuclear or other types of weapons of mass destruction (WMD) threats is not uncommon among those who seek to deter U.S. conventional military action. China, for example, has made veiled nuclear threats against the United States, suggesting that any U.S. involvement in a military dispute between Beijing and Taiwan could lead to a nuclear response on the part of China.

During a period of rising tensions in the Taiwan Straits, one Chinese general famously warned against U.S. intervention in any conflict over Taiwan, declaring "In the end you care more about Los Angeles than you do about Taipei," suggesting that China was willing to escalate a conflict to include nuclear strikes on the United States. [132] Another senior Chinese military official stated "If the Americans draw their missiles and position-guided ammunition on to the target zone on China's territory, I think we will have to respond with nuclear weapons." Major General Zhu Chenghu also declared "If the Americans are determined to intervene [then] we will be determined to respond. We Chinese will prepare ourselves for the destruction of all of the cities east of Xian. Of course the Americans will have to be prepared that hundreds… of cities will be destroyed by the Chinese."[133]

North Korea has also threatened to unleash nuclear and WMD strikes on the United States, Japan, and South Korea, repeatedly threatening to turn Seoul, for example, into a "sea of fire."[134] North Korea has also threatened the United States, identifying targets from Hawaii to Washington, D.C., including "the White House, the Pentagon and the whole U.S. mainland."[135]

Although these verbal threats are often seen in the West as lacking credibility and characterized as little more than propaganda, the possibility that a conventional conflict could lead an adversary to escalate to the use of nuclear weapons cannot be dismissed – especially if an opponent confronts a superior U.S. conventional force. Therefore, the credibility of the U.S. nuclear deterrent remains an important consideration.

Banking On An Uncertain Future

Based on the above, the argument of Minimum Deterrence proponents that nuclear weapons reductions make sense because of the overwhelming superiority of U.S. conventional forces is dubious. First, given technological trends and the global proliferation of advanced technologies, the presumption of American conventional force superiority cannot be reliably assumed for the future. Second, even if one assumes U.S. conventional force dominance in the near-term or in certain theaters of operation, that may encourage others to seek nuclear weapons as an offset to U.S. conventional force advantages. It is unclear that U.S. non-nuclear forces train to fight in a nuclear environment, a condition that could encourage enemies to see nuclear weapons as an effective offset to U.S. conventional capabilities.[136] It may also lead adversaries to threaten

nuclear use against the United States, its deployed forces, or its allies as a deterrent to U.S. action. Finally, a position of U.S. conventional force inferiority vis-à-vis adversaries may encourage provocative actions on the part of opponents that have the potential to escalate, making a credible and effective U.S. nuclear deterrent all the more imperative.

Conventional Forces Cannot Substitute for U.S. Nuclear Forces for the Assurance of Some Key Allies

The United States has defense commitments to over 50 countries in Europe, Asia, the Middle East, and Latin America and extended nuclear deterrence commitments to 30 allied countries. These alliances were established to serve a variety of U.S. interests such as protecting friends against aggression, providing forward operating and support bases for deployed U.S. forces, and limiting the proliferation of nuclear weapons. The assurance of allies is a long-standing U.S. policy goal and involves a combination of methods tailored to each ally or alliance so that allies are convinced that the United States is committed fully to its security guarantees and capable of protecting each ally. In many cases, this includes extending the U.S. deterrence umbrella to allies.[137] Minimum Deterrence advocates typically claim that no unique nuclear force requirements are derived from the policy goal of assuring allies. According to these advocates, all non-strategic nuclear weapons and a significant amount of the strategic nuclear triad can be eliminated while still meeting extended deterrence and assurance goals for allies. This, they argue, is because U.S. conventional weapon capabilities will be adequate to assure allies. Two examples of such claims are quoted below:

- "Arguably the best way to strengthen the credibility of U.S. extended deterrence would be to stress that conventional capabilities of the U.S. and its allies alone are sufficient to defeat all foreseeable adversaries in any scenario other than nuclear war."[138]

- Non-nuclear forces are also far more credible instruments for providing 21st century reassurance to allies whose comfort zone in the 20th century resided under the U.S. nuclear umbrella. Precision-guided conventional munitions hold at risk nearly the entire spectrum of potential targets, and they are useable."[139]

The assurance of allies and Minimum Deterrence claims regarding assurance is the primary topic of Section 5 of this series of reports. That chapter discusses the history of the assurance of allies as a U.S. policy goal and looks at the past and current perspectives of certain U.S. allies in close proximity to severe threats. Detailed discussion of these issues will not be repeated in this

section on cost. However, appropriate for this discussion is a summary of the relevant factors associated with assurance and the related Minimum Deterrence claim of cost savings.

The Nature of Assurance

Whether or not a certain ally is assured depends on the ally—not on U.S. opinions on what *should* assure each ally. Just as the success of deterrence depends on the perceptions of adversary leaders and their decisions regarding war or peace, the success of assurance depends on the perceptions of the leaders of countries with whom the United States is allied.

Allies with a history of having been a witness to or victim of military aggression are likely to have unique views on the importance of extended deterrence and the capabilities needed to feel assured that all possible steps are being taken to deter adversaries. As Margaret Thatcher has reportedly stated, "There is a monument to the failure of conventional deterrence in every French village."[140] And, Thomas Schelling reminds us that the world environments of 1914 and 1939, the years that mark the beginning of each world war, were nuclear-free. Yet, they resulted in the loss of approximately 80 million lives and tremendous devastation.[141]

Views of U.S. Allies in Proximity to Severe Threats

U.S. allies that currently do not perceive near-term, severe threats to their security or vital interests may be reasonably assured with minimal U.S. efforts to demonstrate its defense commitments. As one Australian defense analyst opines, "The Australian government believes that a failure of US extended nuclear deterrence—currently offered as an assurance to nearly forty countries—would not simply be a serious problem for Australia but would likely precipitate a wave of nuclear proliferation that would be destabilising for global and regional order." [142] At the same time, because nuclear deterrence is not a hot topic among Australian voters, this same analyst characterizes his government's silence on this issue as stemming from the belief that "the less said the better."[143] In contrast, U.S. allies in close proximity to potentially severe threats may express strong views on the U.S capabilities, including nuclear capabilities, desired for extended deterrence and assurance.

Typically, threatened allies want U.S. military capabilities, including nuclear weapon capabilities, to be as strong as possible to deter common adversaries and, in the event that deterrence fails, to respond promptly and be able to limit damage to allies and the United States. As former Air Force Chief of Staff General (ret.) Michael Loh observed, "We have made it clear

to our friends and allies that they can depend on us to provide their nuclear deterrent. This extended deterrence is vitally important for Japan, South Korea, Australia, our NATO partners and our friends in the Middle East."[144]

A survey of U.S. allies in proximity to severe threats reveals two commonly expressed concerns with Minimum Deterrence proposals for the U.S. nuclear force: 1) some allies fear that an adversary might be able to sufficiently threaten the United States and thereby undermine U.S. commitments to the security of allies; and 2) allies seek to prevent the destruction to their country that would likely result from a war—even a conventional war—that is eventually won by the United States. Instead, the goal is to prevent war—to deter. In general, allies in high-threat regions don't seem to place great faith in advanced conventional weapons alone for extended deterrence. They state the need for the United States to possess strong capabilities across the board—both conventional *and* nuclear. Evidence of such thinking is not difficult to find. A few examples are discussed briefly below to illustrate this point.

Central and Eastern European (CEE) Countries in NATO. NATO CEE allies perceive the greatest threat as coming from a newly aggressive Russia. These states are adamant about the need for the continued deployment of U.S. nuclear bombs and NATO dual-capable aircraft in Europe. In May, 2012 NATO released its public statement on the results of its *Deterrence and Defense Posture Review* (DDPR).[145] The DDPR makes clear that the alliance has decided to retain an alliance-wide nuclear capability, including U.S. nuclear weapons deployed to Europe. It also states the conclusion that *both* conventional and nuclear capabilities are desired by the alliance. The DDPR states, "[d]eterrence, based on an appropriate mix of nuclear and conventional capabilities, remains a core element of the Alliance's overall strategy." And, "[t]herefore, NATO will maintain an appropriate mix of nuclear and conventional forces."[146]

In 2014, Matthew Kroenig and former Under Secretary of Defense for Policy Walter Slocombe summarized the views of some European allies, including the CEE states, on the value of U.S. nuclear weapons to deter war:

> An ultimately successful conventional defense [of eastern European allies against Russia] is likely to entail huge costs, especially to the immediate target of the aggression, and take a long time. The likely immediate victims, which could conceivably include the Baltic states or Poland, might therefore prefer that Russia be deterred not only by the prospect of conventional defeat resulting in their [i.e., NATO members'] potentially delayed and destructive "liberation," but also by the possibility that a Russian attack would be met by early nuclear strikes by the United States or other allies.[147]

Recent aggressive actions by Russia, such as moving nuclear-capable Iskander missiles to the Baltic enclave of Kaliningrad accentuate the security fears of CEE states. NATO's supreme commander, General Philip Breedlove referred to this type of action as the Kremlin's "pattern of continuing to coerce its neighbors in Central and Eastern Europe."[148] In response, CEE states want credible assurances from the United States that NATO Article Five protection is certain and that deterrence-related and damage-limiting capabilities are as strong as possible.

Japan. Japanese leaders have stated that significant threats are posed by North Korea, China, and Russia.[149] A 2010 report from the Japanese National Institute for Defense Studies expressed Tokyo's worry over future nuclear reductions:

> Further progress in nuclear disarmament by the United States, if accompanied with a decrease in the role of United States nuclear weapons, may diminish the relative weight of the nuclear umbrella in the overall extended deterrence. In such circumstances, the US allies will inevitably feel less confident in the US nuclear umbrella. Much less confident in the case of Japan whose immediate neighbors are China that shows no signs of slowing down in its plans to bolster its nuclear forces and North Korea which is pushing ahead with the development of nuclear weapons.[150]

According to Brad Roberts, a former Obama administration defense official, a variety of proposals have been made by Japanese defense experts, including, for example, modifications to Japan's three no's policy to allow future nuclear deployments based on certain conditions, improvements to U.S. military infrastructure in the region (e.g., Guam) to enable timely future deployments of DCA to the western Pacific, and creation of NATO-like nuclear consultative mechanisms.[151] Given the myriad military threats faced by Japan, it's representatives have been clear about the specific U.S. nuclear weapon capabilities they value. Several of these capabilities—prompt response missiles to limit damage, discriminate capabilities, and deployable weapons[152]—are the specific capabilities that many Minimum Deterrence advocates would eliminate and on which the claimed cost savings depend. For example, one Minimum Deterrence proposal states that the objective of Minimum Deterrence "is no longer to destroy enemy nuclear forces so as to achieve an advantage in a nuclear exchange or limit damage against the United States or to 'win' a nuclear war. Nor is it to deter use of chemical or biological weapons or to deter conventional wars."[153] These are capabilities that Japanese leaders and other allies value for assurance. Without a huge outlay of additional spending for greater numbers and new types of conventional weapons, conventional capabilities would be unable to fully assure threatened allies, such as Japan.

ROK. South Korean leaders express concern about the threat from North Korea. In 2013, ROK official, M. J. Chung, was asked why he favored the reintroduction of nuclear weapons to South Korea and why the same result could not be obtained through conventional capabilities. His response provides a unique South Korean perspective: "If our ultimate ... goal is winning the war, we can simply reinforce conventional forces. But if our ultimate goal is to prevent the war, the reinforcing of conventional forces itself has not helped very much. ... But winning the war is not our objective. We want to prevent the war, we want to deter the war. There's a difference."[154]

Summary of Assurance Through Conventional Capabilities Alone

The overwhelming preponderance of evidence does not support the assertion by Minimum Deterrence proponents that allies will be assured solely by conventional U.S. military capabilities and that assurance places no unique requirements on the nuclear force. Therefore, Minimum Deterrence-related claims of cost savings associated with assurance needs are invalid.

Views of key allies provide empirical evidence that those allies in proximity to severe threats want the protection afforded by U.S. nuclear weapons. Meeting extended deterrence and assurance goals do indeed place unique requirements on the U.S. nuclear force. A wealth of respected leaders and defense analysts share that conclusion. For example, the 2009 report of the bipartisan Strategic Posture Commission stated as an imperative, the United States must ensure that its "deterrent is strong and effective, including its extended deterrent for allies." Furthermore, the commission reported, some "allies believe that their needs can only be met with very specific U.S. nuclear capabilities."[155]

Defense analyst David Yost is one of the foremost U.S. experts on the views of allies. According to Yost, observers in Europe said that U.S. "nuclear force reductions to low numbers might be perceived as a disengagement from extended deterrence responsibilities in Europe and other regions." In 2013, Yost reported that one European official said, "Once doubts emerge about US capability and commitment, concerns will be acute, especially in Japan, South Korea, Poland, and the Baltic States."[156]

The 2014 National Defense Panel, co-chaired by former Secretary of Defense William Perry and General John Abizaid reported similar conclusions:

> We also observe that U.S. strategic forces continue to play an essential role in deterring potential adversaries and reassuring U.S. allies and partners around the world. ... Finally,

> we strongly believe that any future nuclear deterrent posture should continue to provide credible, effective deterrence and reassurance, including in the context of extended deterrence. Specifically, any new configuration of U.S. nuclear forces should be at least as capable in terms of its relevant attributes (such as survivability, flexibility, controllability and discrimination, and penetration capability) as the current posture.[157]

In short, some key U.S. allies remain unconvinced of Minimum Deterrence claims that U.S. conventional forces can suffice for deterrence or assurance purposes. Assertions of cost savings from relying largely or entirely on conventional weapons for assurance of allies appear to be at odds with overwhelming evidence from allies.

Conclusion

In conclusion, the Minimum Deterrence narrative focuses considerable emphasis on the cost of U.S. nuclear programs in its argument for deep reductions in U.S. nuclear forces. That cost, according to the narrative is:

- Unaffordable given austere defense budgets;
- Wasteful given the declining value of U.S. nuclear weapons for U.S. strategic goals and other U.S. defense priority needs; and,
- Unnecessary given the adequacy of very low U.S. nuclear force numbers and the potential for U.S. conventional capabilities to substitute for nuclear forces in support of U.S. strategic goals.

On this basis, Minimum Deterrence proponents recommend deep reductions in U.S. nuclear programs and claim that these reductions will allow the United States to save billions of dollars and allocate greater resources to non-nuclear defense needs. This review of those various claims, however, demonstrates that they appear to:

- Overstate the cost of U.S. nuclear programs;
- Conflate budget prioritization with “unaffordable”;
- Ignore the significant added prospective cost of much great reliance on conventional forces for deterrence and assurance;
- Make the questionable assumption of enduring U.S. conventional force superiority;

- Ignore the prospective added costs needed to ensure the survivability of much lower nuclear force numbers;

- Ignore the technical and operational limitations of conventional forces for threatening the enemy assets that may be critical for some deterrence purposes; and,

- Dismiss the demonstrable requirements for U.S. nuclear forces for the assurance of at least some key U.S. allies.

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