

## The Future of the ICBM Force: Should the Least Valuable Leg of the Triad Be Replaced?

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Perhaps the most controversial aspect of the plan to overhaul the nation's nuclear arsenal is the replacement program for the intercontinental ballistic missile (ICBM) force, the land-based leg of the nuclear triad that also includes submarine-launched ballistic missiles (SLBMs) and heavy bombers. The current deployed fleet of 400 silo-based Minuteman III ICBMs are distributed across three bases touching five states and are expected to be removed from service by the U.S. Air Force in the mid-2030s.<sup>1</sup> A follow-on ICBM system—known as the Ground-Based Strategic Deterrent (GBSD)—is scheduled to replace the Minuteman IIIs (and their supporting infrastructure) on a one-for-one basis between 2028 and 2035.<sup>2</sup> Many have questioned the need for this program, including former Secretary of Defense William Perry, who has argued for eliminating all ICBMs.<sup>3</sup>

The latest independent Pentagon acquisition cost estimate to design and build the ICBM replacement ranges from \$85 to over \$140 billion (in then-year dollars),<sup>4</sup> while the cost to operate and sustain the weapons system over its expected 50-year service life is projected at roughly \$150 billion.<sup>5</sup> This ICBM recapitalization cost is but one piece of a larger plan to sustain and upgrade the nuclear arsenal over the next thirty years, with the total price tag projected to exceed \$1.2 trillion (in 2017 dollars).<sup>6</sup> Separate modernization programs planned for U.S. conventional forces will require additional outlays. These upgrades will necessitate either a significant and prolonged increase in defense spending, which is unlikely to be forthcoming, or a reallocation of resources within the defense budget.<sup>7</sup> Hard choices will likely be required among competing programs.

The Trump administration's Nuclear Posture Review published in February endorses replacing and upgrading the current Minuteman III force with the GBSD program. It will be up to Congress to assess the program's cost-effectiveness and evaluate alternatives. This paper will examine this issue in several stages: first, by considering whether ICBMs are needed to hedge against threats to the strategic submarines; second, by discussing their possible benefits and risks as a warhead "sponge"; third, by examining whether ICBMs possess necessary capabilities absent from other legs of the triad; and last, by considering the stability implications of developing a new ICBM with enhanced capabilities. Finally, the paper evaluates alternative options to the costly GBSD program of record.

### HIGHLIGHTS

- The deterrent value of the ICBM force is small and diminishing.
- Without ICBMs, the current absence of any foreseeable threat to the U.S. strategic submarines assures that no adversary can preempt massive retaliation by the United States.
- ICBMs should not be considered an acceptable hedge against possible future threats to the strategic submarines.
- ICBMs provide no unique nuclear strike capabilities not already provided by other legs of the strategic triad.
- The enhanced capabilities planned for the GBSD are either unnecessary or may adversely affect strategic stability.
- Consequently, the United States should consider eliminating its land-based missiles or abandoning or scaling back the planned GBSD program.

## **Are ICBMs needed to hedge against foreseeable SSBN vulnerabilities?**

A central, if not the central, rationale for maintaining the ICBMs rests upon fears of vulnerability in the strategic nuclear submarine (SSBN) force.<sup>8</sup> If the SSBNs are unable to withstand threats to their survivability and deliver nuclear weapons to the homeland of an adversary, it is argued, then the ICBMs provide a backup to carry out that mission. Absent any such threats, maintaining the ICBMs for the purpose of deterring nuclear attacks is more difficult to justify.

Concerns that technology may one day render SSBNs vulnerable have existed since nuclear weapons were first placed on submarines during the Cold War. And while U.S. SSBN vulnerability was last studied in the public domain several years ago, no prior scholarship has revealed any doubt about the survivability of the sea-based leg of the triad. Among these previous studies includes one 1983 paper by Richard Garwin that suggested the extraordinary demands of holding an SSBN in trail by passive acoustics<sup>9</sup> would not threaten the force, and in any case, that countermeasures would very likely deter the attempt.<sup>10</sup> Garwin further concluded that short-range sensors would be required by the “hundreds of thousands” to make the SSBN force vulnerable to attack.<sup>11</sup> A different study claimed that countermeasures are even easier to deploy against attempts to acquire an active acoustic trail and that such threats are easily neutralized.<sup>12</sup>

Another study from 1994 by Eugene Miasnikov relied on the fundamental physics of sound propagation in the ocean to calculate the maximum range at which Russian strategic submarines could be detected. Miasnikov found that the ranges were so short that not only were covert trailing threats using passive acoustics implausible, but that the increasing silence of submarines in both the United States and Russia risked causing accidental collisions.<sup>13</sup> This suggests that unintended mishaps have been the greater threat to SSBN survivability than from any capability intended to hold them at risk.

In addition, no nonacoustic means of detection has been found to present a survivability threat. All indications suggest that every possible nonacoustic signal—with the possible exception of subsurface water motions detected on the ocean surface by synthetic-aperture radar—can be attenuated if SSBNs patrol at greater ocean depths or if certain operational procedures or other countermeasures are implemented.<sup>14</sup>

Of course the possible detection of a U.S. SSBN is an insufficient basis upon which to judge their vulnerability. Once detected, an SSBN would need to be localized to

within the range and accuracy of the weapon used to destroy it, and then successfully trailed while other U.S. SSBNs at sea were detected, localized, and trailed with acceptable confidence. Only after concluding that this circumstance may arise within a considered period could the survivability of the sea-based leg be brought into question.

Recent advancements in technology, however, have raised questions about possible future vulnerabilities. In particular, improved acoustic sensors, lasers, signal processing advancements, and unmanned undersea vehicles (UUV) have been mentioned as possible threats to the ability of submarines to remain concealed.<sup>15</sup> Despite this concern and the need for an up-to-date review of fundamental survivability prospects in the public domain, no analysis has yet challenged the conclusions of the studies cited above.

Any review of SSBN survivability should consider whether these technological advancements neutralize the survivability gains made by the modernization and deployment of increasingly quiet submarines over the past few decades. What’s more, the U.S. Navy is planning to replace the existing fleet of 14 Ohio-class submarines with 12 new Columbia-class submarines that will use new technologies related to stealth to ensure the new boats will remain serviceable through the 2080s.

Factors that should be evaluated include: What is the maximum range at which any technology can detect an SSBN? If further localization to bring the target SSBN within range of a weapon to destroy it is necessary, what would be required? How do UUVs and advanced computer processing capabilities affect the challenge of trailing SSBNs? If any evolving technology adversely affects SSBN survivability, are there any countermeasures that could prevent an adversary from identifying real SSBNs? Even if the U.S. government has not developed countermeasures for certain detection technologies, how would an adversary reach this conclusion if possible countermeasures could be imagined? Could the U.S. government develop the necessary countermeasures? What confidence would an adversary then need before convincing itself that detecting and destroying U.S. SSBNs is possible before a second strike response from the United States?

It is important to note that one Ohio-class SSBN is armed with roughly 100 warheads—each with a yield of 100 kilotons (kt)—and carries 500 times more explosive energy than did the atomic bomb dropped over Nagasaki at the end of World War II.<sup>16</sup> This is almost certainly an underestimate given that some deployed warheads on SSBNs have yields of 455 kt.<sup>17</sup> If a single survivable SSBN



**An unarmed Minuteman III intercontinental ballistic missile launches during an operational test at 2:10 a.m. Pacific Daylight Time Wednesday, August 2, 2017, at Vandenberg Air Force Base, Calif.** (Photo: Ian Dudley/U.S. Air Force)

only had a single 100 kt nuclear warhead uploaded onto each of its 20 Trident II D5 SLBMs, the total explosive energy would be equivalent to 100 Nagasaki bombs. Without ICBMs, each of these SSBNs at sea, both SSBN bases at Kings Bay, Georgia, and Bangor, Washington, and all nuclear-capable heavy bombers would need to be destroyed by an adversary before either a bomber or SSBN could retaliate with nuclear weapons in a second strike.<sup>18</sup>

Moreover, the long-acknowledged vulnerability of the ICBMs<sup>19</sup> make them an unsuitable hedge against any threat to the SSBNs. To provide a useful backup, the ICBMs must be launched under attack, and possibly even on warning of an attack.<sup>20</sup> This is unattractive because to prevent their destruction by Russia (and perhaps China in the future) a decision to launch would need to be made in only a few minutes, if not less, after detection and before knowing whether the attack is a false alarm. The deterrent value of this launch posture then rests upon the United

States demonstrating commitment to it and hoping that an adversary believes it. While an argument could be made that the prospect of launching ICBMs under attack enhances deterrence, convincing U.S. adversaries that Washington would risk starting an accidental nuclear war to defend the life of the United States—when no adversary is capable of preempting massive U.S. retaliation—should be considered unacceptable.

If concerns exist about SSBN vulnerability, consideration should be given to developing a mobile or another more survivable ICBM basing mode with plans to deploy it quickly if any threat to the SSBNs arises. Mobile missiles would probably force an attacker to barrage a deployment area with nuclear weapons and deceptive basing modes would proliferate an attacker's aim points, but both would provide a more survivable SSBN backup. Due to drastically higher costs and land constraints, however, alternatives to the fixed silo-based ICBMs appear politically infeasible;



**The Ohio-class ballistic-missile submarine USS Maryland (SSBN 738) dives before test firing an unarmed Trident II D5 missile off the coast of Florida, August 31, 2016.** (Photo: John Kowalski/U.S. Navy)

indeed, the current GBSD program plans to retain silo-basing. In any case, given expected SSBN invulnerability, threats to a more survivable ICBM are more likely to materialize first.

No rationale based upon fears of SSBN vulnerability therefore exists for spending a large sum of money to replace the ICBM force, and vulnerable silo-based ICBMs with a launch under attack option should not be considered an acceptable hedge against possible future SSBN threats.

### **Limitations of the ICBM “sponge” rationale**

During his January 2017 confirmation hearing before the U.S. Senate Armed Services Committee to become Secretary of Defense, General James Mattis stated that the deterrent value of the ICBMs is derived from the notion “that they are so buried out in the central U.S. that any enemy that wants to take us on is going to have to commit two, three, four weapons to make certain they take each one out. In other words, the ICBM force provides a cost-imposing strategy on an adversary.”<sup>21</sup>

This is a common justification for retaining a large and distributed ICBM force given the unlikely prospect of an adversary successfully destroying 400 targets. If an adversary also accepts Mattis’s premise, the large number of ICBMs could provide meaningful deterrence. Even if an adversary imagined it was possible to destroy all 400, their need to use a significant fraction of their arsenal to do so

would then limit the number of warheads remaining to target U.S. cities. This is known as the warhead “sink” or “sponge” rationale for retaining the ICBM force.

Yet this reasoning has significant limitations, beginning with how improving missile accuracy will make the ICBM force less of a warhead “sponge” in the future. Today the probability of destroying a Minuteman III missile silo with a single Russian warhead could exceed 98 percent given advancements in inertial guidance that could be aided with a Global Positioning System (GPS) and maneuverable reentry vehicles (MaRVs) to improve accuracy.<sup>22</sup> While this may be an overstatement now, it should not be expected to remain one.

From the New Strategic Arms Reduction Treaty (New START) level of 1,550 warheads, a successful 1:1 attack on each of the 400 U.S. ICBMs would leave Russia with 1150 strategic nuclear warheads free to target U.S. command and control and civilian population centers. Even if two Russian warheads were needed to destroy each Minuteman III silo with the desired probability, 750 warheads would still remain—more than enough to destroy American society.

Furthermore, a 1986 study calculated that the nuclear blast and radioactive fallout from an attack with two 500 kt warheads exploding over each of the then 1,000 operational U.S. ICBM silos, 100 launch control centers (LCCs), and 16 missile test silos at Vandenberg Air Force Base would cause between 2.4–15.0 million deaths and an additional 4.0–31.8 million casualties.<sup>23</sup> While this



calculation should be updated, a nuclear attack on 400 ICBMs today could still cause millions of fatalities given the larger populations living downwind of the bases.<sup>24</sup>

Maintaining the ICBMs for use as a warhead “sponge” requires that Russia direct its warheads at the American homeland in order to target missiles that can destroy their country in the event of a nuclear war. Conversely, Russia would not need to threaten millions of American lives in this manner if the ICBMs did not exist. The number of homeland targets used for launching nuclear weapons should therefore be kept as small as possible to limit the number of nuclear warheads an adversary would be required to detonate inside the United States. As nuclear strategist Thomas Schelling wrote in 1987:<sup>25</sup>

“If we unilaterally dismantled our land-based missiles, we would instantly deprive a large part of the Soviet land-based missile force for its *raison d’être*. It might look to them as if they had much less to preempt. They actually would not, because the U.S. missiles they might have preempted were redundant in the first place. Looking over a seascape inhabited by U.S. submarines and at bombers likely to be launched on warning, they would see, without the smoke and the ruins, what would have been left over after they preempted. So if we cannot dismantle their land-based missiles by negotiation, we may gain a lot by dismantling their targets instead.”

Schelling went on to add that, “It may be hard to know which it is that the land-based missile forces on both sides would lament most—the loss of their missiles or the loss of their favorite targets.”<sup>26</sup>

If one still accepts the “sponge” rationale, however, a new GBSD missile is unnecessary because an adversary would still be required to attack life-extended Minuteman III missiles to limit damage. In any case, there is no way to eliminate the capability to target American cities other than by reducing the number of nuclear weapons through arms control.

Yet this analysis of the ICBMs as a warhead “sponge” is incomplete, having thus far only suggested that more American lives would be saved without an adversary needing to target U.S. ICBMs in a nuclear war. But what about the effect of ICBMs on the likelihood of nuclear war itself? Does the ICBM force increase or decrease the chances of a nuclear exchange?

Despite whatever complications may exist for executing a successful first strike on 400 ICBMs, reliance on them to deter attacks is problematic given their vulnerability,

## **The number of homeland targets used for launching nuclear weapons should therefore be kept as small as possible to limit the number of nuclear warheads an adversary would be required to detonate inside the United States.**

and the consequent deterrence value they provide should be considered small. That being said, how would the motivation arise during peacetime to attempt such an attack if the SSBNs—and possibly other survivable means of retaliation by the American military—could not also be destroyed? It is doubtful that ICBM vulnerability in this case invites preemptive attack.

In a severe crisis that involves missile exchanges, major battles, or the loss of some strategic nuclear targets by conventional means, however, an adversary could conclude that escalation to the nuclear level is imminent. And if they decide that it is preferable to be attacked with fewer weapons rather than more,<sup>27</sup> attention could turn to the ICBMs and other vulnerable U.S. military targets. This concern is supported by both Russian and U.S. nuclear counterforce doctrines designed to limit damage if nuclear war appears inevitable, with the risk heightened from ever-improving counterforce capabilities against silo-based ICBMs due to missile accuracy improvements worldwide. In this case, nuclear warheads directed against 400 ICBM targets would kill millions of more Americans than if only vulnerable U.S. command and control targets, bomber bases, and SSBN bases were preemptively destroyed.

This appears to be the most likely circumstance in which the ICBM force could be targeted—an escalating conflict that convinces an adversary to do as well as possible. The benefits imagined from destroying more versus fewer targets could then increase the likelihood of an attack. In such a crisis, it may therefore be better to demonstrate more clearly what forces cannot be preempted rather than what can. As Thomas Schelling wrote about the prospect of the United States dismantling its ICBMs: “It looks like a posture quite stable against all the motivations that could lead to an outbreak of unwanted nuclear war.”<sup>28</sup>

## Do ICBMs provide other benefits?

Beyond complicating the execution of a successful first strike, the ICBMs are assumed to offer other benefits. One of these is that of the three triad legs, the ICBMs can be launched most quickly. As a December 2016 report by eight U.S. Senators in the ICBM Coalition claimed, the “ICBMs give the President a timely response option.”<sup>29</sup>

Yet a 1993 report by the Government Accountability Office (GAO) stated that Communications, Command, and Control (C<sup>3</sup>) to SSBNs “is about as prompt and reliable as to ICBM silos, under a range of conditions.”<sup>30</sup> The same report also found “no operationally meaningful difference in time to target” between the ICBMs and SLBMs indicating that the ICBMs were not needed for any time-sensitive targets.<sup>31</sup>

There also exists a presumption that ICBMs either are or should be used for targeting an adversary’s nuclear forces and command and control—known as “counterforce” targeting—to limit damage to the United States. While this is possible, their vulnerability would require a “launch under attack” option to destroy targets of any value. Avoiding this unattractive option leaves doubt about whether any ICBMs would survive an attack, and then the consequent demand that targeting requirements be satisfied without them would be as if the ICBMs did not exist at all.<sup>32</sup>

In addition, ICBM flight trajectories to plausible targets in China, North Korea, and Iran must pass over Russian territory.<sup>33</sup> If Russia interprets a U.S. ICBM launch intended for another state as an attack on them, they may retaliate with a nuclear strike of their own. This possibility should rule out applying any credible deterrence rationale for the ICBM force to these other US adversaries because all could reasonably conclude that retaliation with ICBMs is unlikely if it risks triggering an unwanted nuclear war with Russia. In other words, without other weapons systems to deter nuclear attacks by other adversaries, ICBMs should not be expected to deter.

Without ICBMs, the United States could still deploy an arsenal of 1,150 New START accountable warheads against the following counterforce targets:<sup>34</sup>

**Russia:** WMD targets (456 warheads in 2-on-1 attacks against 228 missile silos); leadership command posts (110 warheads); war-supporting industry (136 warheads). At least 80 of these warheads would likely be assigned to destroy targets in the greater Moscow area alone  
**China:** WMD targets (150 warheads in 2-on-1 attacks against 75 missile silos); leadership

command posts (33 warheads); war-supporting industry (136 warheads).

**North Korea, Iran, Syria:** Each country would be covered with (43) warheads.

This plan lays out how U.S. warheads could be directed against the fixed targets of plausible adversaries. The total number could exceed 1,150 because each bomber is only counted as one under New START counting rules. Also neglected here are the very substantial counterforce capabilities of U.S. tactical nuclear weapons and conventional forces. This destructive power is more than sufficient to deter any rational adversary and provides the same counterforce coverage to limit damage to the United States regardless of whether the ICBMs are maintained.<sup>35</sup>

In sum, any imagined benefits regarding the promptness of ICBMs to deliver nuclear warheads to their assigned targets and counterforce targeting capability are practically nonexistent. The “launch under attack” requirement for using ICBMs in counterforce would also reduce the time the president has to evaluate response options, thereby increasing the risks posed by false warnings or miscommunication in a crisis.

## A technological arms race may adversely affect strategic stability

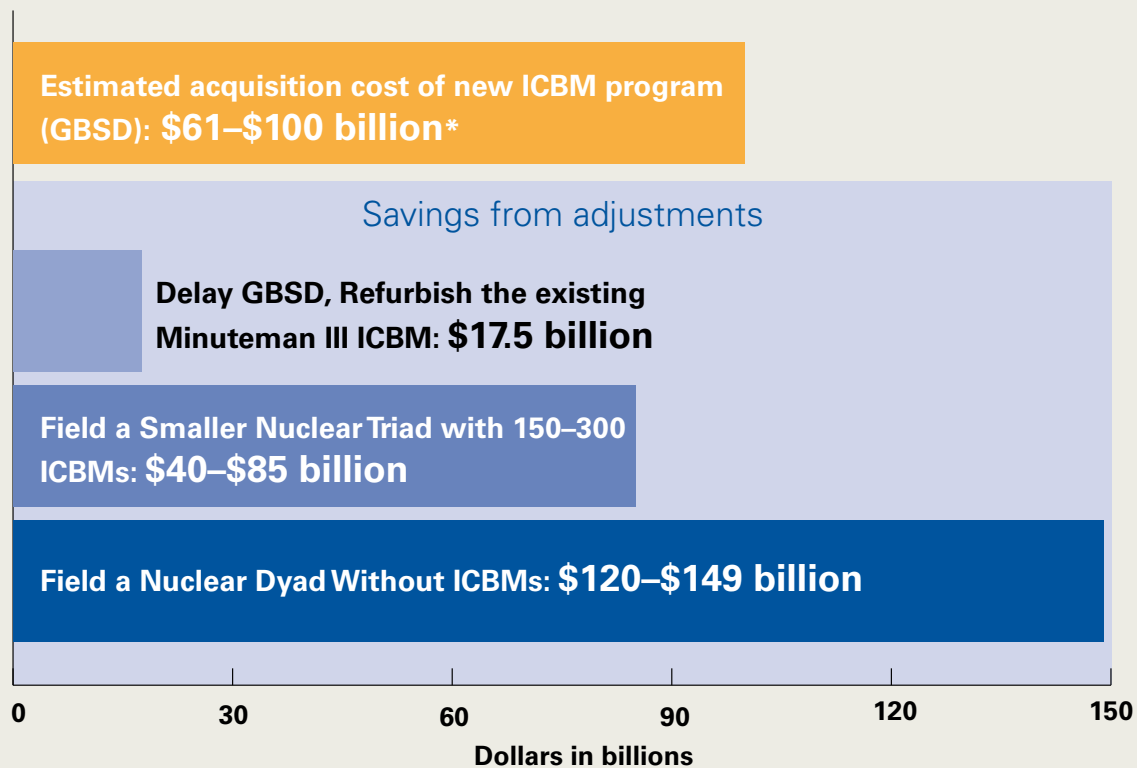
Proponents of the ICBM leg also argue that replacing the Minuteman III with the GBSDB should be valued for the capability enhancements to be included on the new missiles. In particular, some claim that new capabilities are necessary for penetrating the future ballistic missile defenses of U.S. adversaries and improving counterforce capabilities.

When asked at a congressional hearing why the new ICBM needed more capability and accuracy, General Robin Rand, commander of Air Force Global Strike Command, replied:<sup>36</sup>

“Potential adversaries are continuing their modernization efforts of their defensive systems to attempt to minimize what our ICBM force can effectively hold at risk. In order to maintain a credible deterrent, the ICBM force must have the performance to overcome these defensive measures.

Improved ICBM capability and accuracy has the benefit of providing ICBM strike planners the weaponeering options of either achieving a higher probability of effect on a given target; using fewer warheads per target while still achieving the desired level of effect and thus allowing more targets covered; or provide opportunities to potentially

## Savings from Adjustments to U.S. ICBM Sustainment Plans, FY17–46



All figures are in FY 2017 constant dollars unless otherwise noted  
 \*In FY 2016 constant dollars  
 Sources: Congressional Budget Office, Defense Department

reduce yield size while still achieving the desired level of effect. These weaponizing options will be critical if changes to the current strategic weapon stockpile would otherwise adversely impact what targets could effectively be held at risk.”

This claim is not convincing. The land-based leg of the triad can utilize a whole repertoire of countermeasures to overpower growing ballistic missile defenses: adding additional warheads on each missile; deploying decoys or radar-reflecting wires (chaff) to complicate warhead detection; jamming adversary radars or leading an attack with a nuclear explosion to blind infrared detectors; or adding thrusters to warheads to enable maneuvers.<sup>37</sup> And this is only a small sample of potential options. The claim that new capabilities on the GBSD are necessary to defeat future missile defense deployments therefore requires much greater scrutiny before it can be seriously considered.

A more serious implication is what the stated need for this missile may suggest to the world about U.S. motivations. As discussed, ICBMs must be launched

under attack to be used in counterforce, but a strong presumption against this risk requires that targeting requirements be satisfied without them. What General Rand’s comments suggest instead is that the United States may wish to improve the first-strike counterforce capabilities on its ICBMs.

Advancing this prospect by equipping U.S. ICBMs with improved accuracy is unnecessary, and together with new low-yield options for its warheads, could be destabilizing. If hypersonic delivery becomes possible with a follow-on ICBM that shortens the warning time of an incoming attack, strategic stability may be further adversely affected. These acquisitions risk driving a technological arms race around the world where a country’s growing awareness that an increasing fraction of its nuclear deterrent may be successfully destroyed—possibly without warning—coupled with that same country’s growing confidence in its own counterforce capabilities against an adversary’s targets may increase the chances that nuclear weapons will be used. These evolving capabilities would only add to crisis stability concerns previously discussed.



**An unarmed Minuteman III ICBM shoots out of its silo during an operational test launch February 25, 2012 at Vandenberg Air Force Base, Calif.** (U.S. Air Force photo)

Therefore, a new ICBM is unnecessary to defeat ballistic missile defenses and does not require enhanced counterforce capabilities given existing capabilities on other legs of its triad. Regardless of whether other states pursue new technological enhancements for their weapons, similar acquisitions by the United States will only drive these destabilizing efforts further.

### **Options for ICBM force deployment**

Given the excessive redundancy, risks, and costs associated with the existing ICBM force, “launch under attack” posture, and replacement plans, the United States should consider several alternative deployment options. The alternatives presented here range from comparatively small ICBM reductions and cost savings to more substantial changes. Each of the following alternatives would still

allow for a deployed strategic nuclear force with more than sufficient retaliatory capacity to deter nuclear attacks on the United States or its allies.

1. Eliminate one squadron (50 missiles and their silos) at each of the three Air Force ICBM bases, reducing the number of deployed ICBMs to 300.<sup>38</sup> If the number of SSBNs were also reduced to 10—but 1,550 warheads remained deployed—the Congressional Budget Office (CBO) estimates that \$40 billion would be saved over the next three decades.<sup>39</sup> This force structure would still allow the United States to deploy the 1,550 warheads allowed under New START. With only 150 ICBMs, 8 SSBNs, and 1,000 deployed warheads, \$85 billion would be saved over the next three decades.<sup>40</sup> (See chart on page 7.)
2. Reduce the total number of ICBMs and rotate the remaining missiles among the 400 remaining silos. This would preserve the “sink” rationale by requiring an adversary to attack every remaining silo—unless it could confirm which are empty—to ensure destruction of every ICBM. More money could be saved if some of the silos were also eliminated.
3. Extend the life of the Minuteman III force. A 2014 study from the RAND Corporation found no evidence that long-term sustainment of the Minuteman III missiles, with incremental modernization, could not continue in perpetuity.<sup>41</sup> And a recent CSIS report suggested that the life of Minuteman IIIs could be extended beyond 2030 for a period of time while deferring a decision on GBSD.<sup>42</sup> If GBSD was deferred for 20 years, CBO estimates that \$37 billion could be saved over this period and \$17.5 billion over the next thirty years by simply life extending the Minuteman III.<sup>43</sup> This would leave open the option for gradually reducing the size of the deployed ICBM force over time, either through unilateral reductions or in conjunction with a nuclear arms reduction agreement.
4. Eliminate the ICBM force. The Congressional Budget Office (CBO) estimates that \$149 billion could be saved between 2017–2046 if the ICBM force was eliminated immediately, and that \$120 billion could be saved over this period if the ICBMs were eliminated at the end of the Minutemen IIIs service life.<sup>44</sup> In the unlikely event that future SSBN vulnerabilities arise and it is determined by national decision-makers that a backup to the SSBN force is required, a more survivable ICBM basing option



could be developed and deployed. However, it is important to note that this would likely involve a mobile ICBM, which would likely cost more to acquire than the GBSD.

## Conclusions

Without a technically valid explanation for how an adversary could imagine it is possible to destroy the U.S. SSBN force, the land-based ICBMs are redundant for deterring nuclear attacks on the United States. Their location and vulnerability also hold at risk millions of American lives that no adversary would be required to threaten if the ICBMs did not exist. And because they require a “launch under attack” alert posture to be survivable, should be considered an unacceptable backup to SSBN vulnerability. ICBMs are also unnecessary for time-sensitive targets and counterforce targeting requirements must be satisfied without them in the event of a nuclear war.

Perhaps most importantly, ICBM vulnerability may attract a preemptive nuclear attack in an escalating conflict that U.S. opponents believe will inevitably escalate to the nuclear level or that threatens their lives, regimes, or other vital interests. These motivations are consistent with both U.S. and Russian nuclear counterforce doctrines which posit that it is better to be attacked with fewer weapons rather than more. Growing confidence in counterforce capabilities against fixed silo-based ICBMs only heighten this risk.

Lastly, a new ICBM with enhanced capabilities officially supported for the purpose of penetrating the modernizing missile defense systems of U.S. opponents and improving counterforce kill probabilities is unnecessary and potentially destabilizing. The range of countermeasures that can overwhelm missile defense systems are extensive and already accessible for inclusion on current weapons, and steps that indicate the United States may be motivated to develop disarming first-strike capabilities could accelerate a technological arms race that increases the chances of nuclear use.

The public debate over the new Nuclear Posture Review and start of the GBSD program provide an opportunity to reevaluate the least valuable leg of the U.S. nuclear triad. Given the confluence of growing budget pressures, unnecessary risks, and diminishing benefits of maintaining the ICBMs outlined here, U.S. interests would best be served by deciding to significantly reduce or eliminate them.

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## ENDNOTES

- 1 Lauren Caston, et. al., “The Future of the U.S. Intercontinental Ballistic Missile Force,” RAND Corporation, 2014. <http://www.rand.org/pubs/monographs/MG1210.html>
- 2 Hans M. Kristensen and Robert S. Norris, “United States Nuclear Forces, 2017,” *Bulletin of Atomic Scientists*, Volume 73, 2017, pp. 48–57. <http://www.tandfonline.com/doi/full/10.1080/00963402.2016.1264213>
- 3 William J. Perry, “Why It’s Safe to Scrap the ICBMs,” *New York Times*, September 30, 2016. <https://www.nytimes.com/2016/09/30/opinion/why-its-safe-to-scrap-americas-icbms.html>
- 4 Kingston Reif, “New ICBM Replacement Costs Revealed,” *Arms Control Today*, March 2017. <https://www.armscontrol.org/act/2017-03/news/new-icbm-replacement-cost-revealed>
- 5 Kingston Reif, “Price Tag Rising for Planned ICBMs,” *Arms Control Today*, October 2016. [https://www.armscontrol.org/ACT/2016\\_10/News/Price-Tag-Rising-for-Planned-ICBMs](https://www.armscontrol.org/ACT/2016_10/News/Price-Tag-Rising-for-Planned-ICBMs)
- 6 “Approaches to Managing the Costs of U.S. Nuclear Forces, 2017–2046,” U.S. Congressional Budget Office, October 2017, p. 2. <https://www.cbo.gov/system/files/115th-congress-2017-2018/reports/53211-nuclearforces.pdf>
- 7 Unless it is revised or replaced, the Budget Control Act (BCA) of 2011, which includes caps on military spending through the end of the decade, will force a significant scaling back of the Trump administration’s defense budget proposal over the next five years. An aging population, increased interest payments on the national debt, and projected increases in healthcare costs will only add to pressures for assigning priorities in defense spending after the BCA expires.
- 8 The 2010 Nuclear Posture Review (NPR) stated that while the strategic nuclear submarines (SSBNs) were the most survivable leg of the triad, all three legs must be maintained as a hedge against potential future technical problems or vulnerabilities.
- 9 Passive acoustics relies upon detecting the sound emitted by submarines, whereas active acoustics involves the generation of sound and detecting its reflection from them.
- 10 Richard Garwin, “Will Strategic Submarines Be Vulnerable?” *International Security*, Vol. 8, No. 2 (Fall 1983), pp. 52–67.
- 11 *Ibid.*, p. 66.
- 12 Donald C. Daniel, *Anti-Submarine Warfare and Superpower Strategic Stability*, (Urbana and Chicago: University of Illinois Press), 1986, p. 23.
- 13 Eugene Miasnikov, “Can Russian Strategic Submarine Survive at Sea? The Fundamental Limits of Passive Acoustics,” *Science & Global Security*, Vol. 4, No. 2 (1994), pp. 213–251.
- 14 Tom Stefanick, *Strategic Antisubmarine Warfare and Naval Strategy*, Institute for Defense & Disarmament Studies, (Lexington and Toronto: Lexington Books), 1987.
- 15 See Bryan Clark, *The Emerging Era in Undersea Warfare* (Washington, D.C.: Center for Strategic and Budgetary Affairs, 2015); James Holmes, “Sea Changes: The Future of Nuclear Deterrence,” *Bulletin of the Atomic Scientists*, Vol. 72, No. 4 (July 2016), pp. 228–233; and Bryan Clark, “Undersea Cables and the Future of Submarine Competition,” *Bulletin of the Atomic Scientists*, Vol. 72, No. 4 (July 2016), pp. 234–237; Keir A. Lieber and Daryl G. Press, “The New Era of Counterforce,” *International Security*, Volume 41, Issue 4, (Spring 2017), pp. 9–49.

16 Kristensen and Norris, "United States Nuclear Forces, 2017."  
17 Ibid.  
18 The 14 Ohio-class SSBNs operate out of two bases in Bangor, Washington, and Kings Bay, Georgia, with around eight to 10 at sea at any given time and typically five on "hard alert" in patrol areas. The bombers are organized into three bases: Minot Air Force Base in North Dakota, Barksdale Air Force Base in Louisiana, and Whiteman Air Force Base in Missouri. Assuming only eight SSBNs are at sea, the U.S. nuclear deterrent is then distributed over only 13 targets. See Kristensen and Norris, "United States Nuclear Forces, 2017."  
19 Thomas C. Schelling, "Abolition of Ballistic Missiles," *International Security*, Vol. 12, No. 1 (Summer 1987), pp. 179–183.  
20 "Launch on warning" is a launch in response to a sensor indication of an attack on the continental United States, while "launch under attack" is a launch after a high-confidence determination of a massive attack. Because "launch under attack" requires more time to reach that higher level of confidence, a decision about whether to launch with this option must be made in a shorter time for ICBMs to survive the incoming attack. The definitions for these launch postures are approximately those provided by the Air Force, as mentioned in Richard L. Garwin, "Launch Under Attack to Redress Minuteman Vulnerability," *International Security*, Vol. 4, No. 3 (Winter, 1979-1980), pp. 117–139.  
21 U.S. Congress, Senate, Committee on Armed Services, *To Conduct a Confirmation Hearing on the Expected Nomination of Mr. James N. Mattis to be Secretary of Defense*, 115th Cong., 1st sess., January 12, 2017.  
22 If the circular error probable (CEP) of an 800 kt warhead from a Russian ICBM is 200 m, the single-shot kill probability (SSKP) against a U.S. Minuteman III silo is 0.88. If the CEP = 150 m (still a conservative estimate and less accurate than the U.S. Minuteman III), the SSKP is 0.98.  
23 William Daugherty, Barbara Levi, and Frank von Hippel, "The Consequences of "Limited Nuclear Attacks on the United States," *International Security*, Volume 10, Number 4, Spring 1986, pp. 3–43.  
24 This is also likely true because a Russian nuclear attack today on U.S. ICBMs would require the use of warheads with a yield of 800 kt—the most common yield among Russian ICBMs—not the 500 kt modeled in Daugherty, Levi, and von Hippel, "The Consequences of "Limited" Nuclear Attacks on the United States."  
25 Schelling, "Abolition of Ballistic Missiles."  
26 Ibid., pp. 180–181.  
27 This danger exists on the U.S. side as well.  
28 Ibid., p. 180.  
29 Senate ICBM Coalition, "The Enduring Values of America's ICBMs," December 2016. [https://www.hoeven.senate.gov/imo/media/doc/ICBM Coalition White Paper December 2016 - final.pdf](https://www.hoeven.senate.gov/imo/media/doc/ICBM%20Coalition%20White%20Paper%20December%202016%20-%20final.pdf)  
30 U.S. Governmental Affairs Committee, Evaluation of the U.S. Strategic Triad, S. Hrg. 103-457, (1994). U.S. General Accounting Office, The U.S. Nuclear Triad: GAO's Evaluation of the Strategic Modernization Program (plus 8 classified volumes), GAO/TPEMD-93-5, (1993). <http://www.gao.gov/products/GAO/TPEMD-93-5>  
31 Ibid.  
32 It deserves mention that the ICBMs receive some support for their potential use as first-strike counterforce weapons. Because one never knows how a nuclear exchange may begin, however, ICBMs cannot

be used in counterforce targeting unless the United States is willing to commit to a "launch under attack" posture or the decision arises in a conflict to use them first before any warning of an incoming attack. The psychological effect that the presence of ICBMs may have on an adversary in contributing to nuclear deterrence due to their potential use as first-strike weapons is not necessary given the absence of any technically valid rationale for how an adversary could preempt massive retaliation by the SSBNs. Their presence is more likely to contribute towards convincing an adversary that the United States is about to launch a disarming first-strike—thereby increasing the chances of nuclear use—and as mentioned, their vulnerability only adds to the chance that they will be attacked first in an escalating conflict.  
33 "Global Zero U.S. Nuclear Policy Commission Report: Modernizing U.S. Nuclear Strategy, Force Structure, and Posture," *Global Zero*, May 2012. [http://www.globalzero.org/files/gz\\_us\\_nuclear\\_policy\\_commission\\_report.pdf](http://www.globalzero.org/files/gz_us_nuclear_policy_commission_report.pdf)  
34 These numbers were taken from the report "Global Zero U.S. Nuclear Policy Commission Report: Modernizing U.S. Nuclear Strategy, Force Structure and Posture," Global Zero, 2012, and numbers for Russian and Chinese nuclear missile silos were obtained from Hans M. Kristensen and Robert S. Norris, "Russian nuclear forces, 2017," *Bulletin of Atomic Scientists*, 73:2, 115–126, and Hans M. Kristensen and Robert S. Norris, "Chinese nuclear forces, 2016," *Bulletin of Atomic Scientists*, 72:4, 205–211. Three warheads were added to each total in the Global Zero report for warheads covering North Korea, Iran, and Syria to make the total number of warheads add up to 1,150. China may not currently have as many as 75 ICBM silos, but it could have more than this in the future.  
35 It deserves mention that there is no meaningful difference in kill probabilities between ICBMs or SLBMs against the strategic targets of U.S. adversaries and that SLBMs are able to reach any target within range of the ICBMs.  
36 U.S. Congress, House of Representatives, Committee on Armed Services, *Hearing on National Defense Authorization Act for Fiscal Year 2017 and Oversight of Previously Authorized Programs*, 114th Cong., 2nd sess., March 2, 2016.  
37 George N. Lewis, Theodore A. Postol, and John Pike, "Why National Missile Defense Won't Work," *Scientific American*, August 1999.  
38 Eliminating 50 silos at each of the three ICBM bases reduces the total number of ICBMs to 300 and not 250 because there are currently 50 empty silos that contain no ICBMs. This recommendation assumes that these empty silos were eliminated along with 100 others that contain ICBMs.  
39 "Approaches to Managing the Costs of U.S. Nuclear Forces, 2017–2046," p. 37.  
40 Ibid., p. 48.  
41 Caston, et. al., "The Future of the U.S. Intercontinental Ballistic Missile Force."  
42 Todd Harrison, "Options for the Ground-Based Leg of the Nuclear Triad," *Center for Strategic and International Studies*, September 2017. <https://www.csis.org/analysis/options-ground-based-leg-nuclear-triad>  
43 "Approaches to Managing the Costs of U.S. Nuclear Forces, 2017–2046," p. 30.  
44 Ibid., p. 37.