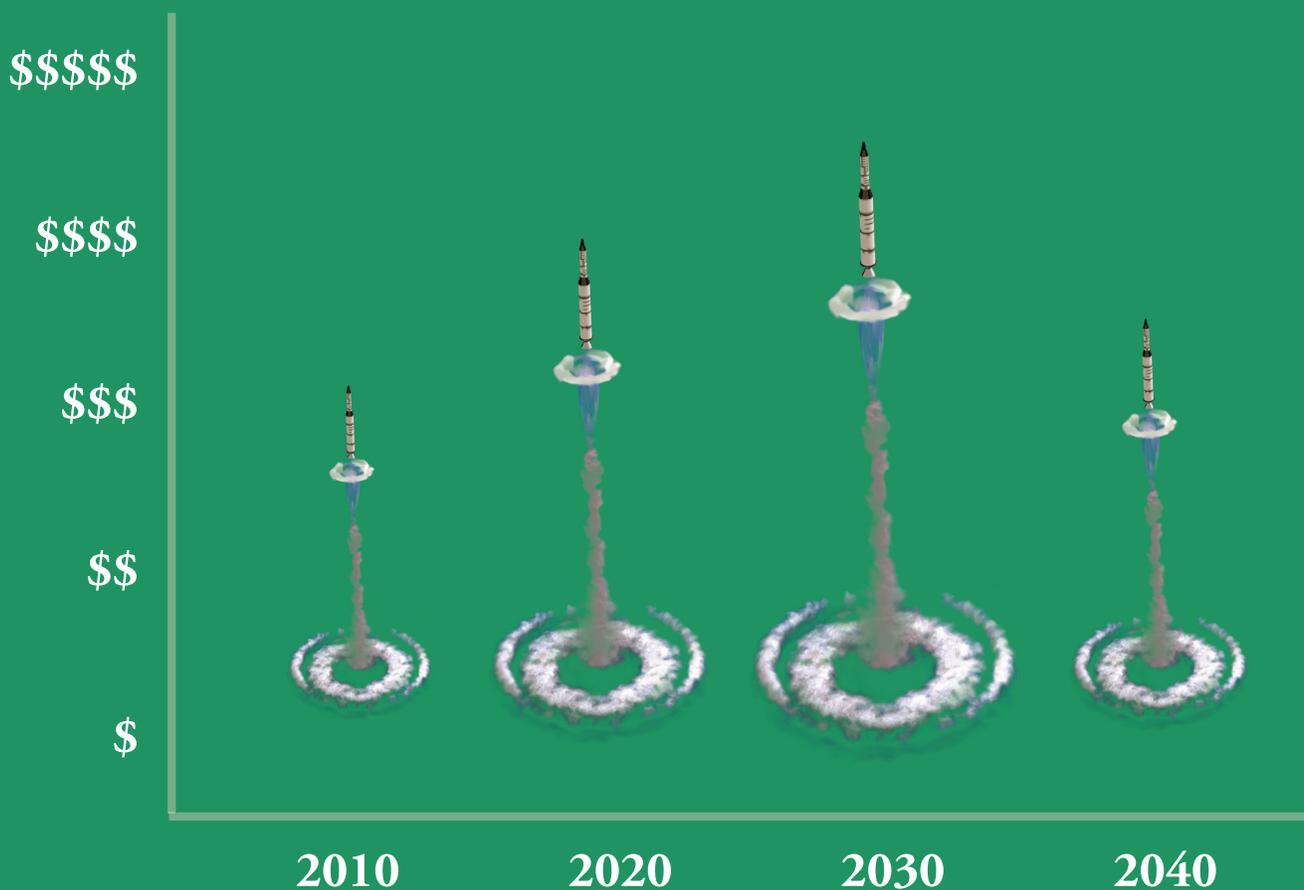


# The Trillion Dollar Nuclear Triad



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January 2014

# **The Trillion Dollar Nuclear Triad**

**US Strategic Nuclear Modernization  
Over the Next Thirty Years**

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## EXECUTIVE SUMMARY

The United States maintains a robust nuclear arsenal deployed on a triad of strategic delivery systems, including land- and submarine-based long-range ballistic missiles and nuclear-capable bombers. In addition, it also has a significant number of nonstrategic and nondeployed warheads not constrained by US-Russian arms control treaties. Over the next thirty years, the United States plans to spend approximately \$1 trillion maintaining the current arsenal, buying replacement systems, and upgrading existing nuclear bombs and warheads. Procurement of replacement platforms and associated warheads will peak during a four to six year window, sometime after 2020. If current projections hold, the United States will spend 3 percent of its defense budget on procuring new strategic systems during these peak years. This percentage is comparable to spending for procurement of new strategic systems in the 1980s under President Ronald Reagan.

Prior to sequestration, the Administration planned to replace current systems more rapidly. The new procurement schedule still entails significant programmatic risks and will likely result in even higher costs, lower capability, and slower deployments. This situation undermines the credibility of the US nuclear deterrent, and could, in a worst-case scenario, result in the loss of one or both of the Air Force legs of the triad.

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US policy makers are only now beginning to appreciate the full scope of these procurement costs. A variety of different actors, each with only partial responsibility for oversight of national priorities, are making decisions that will result in the piecemeal procurement of an entirely new nuclear triad, with far from certain results. Accordingly, *a national discussion is needed about the future of the nuclear triad and deterrent, one that should include both the strategic and financial implications of these*

*decisions.* Air Force Chief of Staff General Mark Welch recently said the cost of modernizing nuclear infrastructure will likely require a “very honest debate about where we can afford to invest.”<sup>1</sup>

The estimates in this report are the result of a year-long process to identify how much the United States will spend to maintain and replace the nation’s nuclear deterrent. As the United States seeks to maintain a credible deterrent for the next several decades, it will have to carefully manage its investments given the constrained budget environment. The fiscal and strategic reality today is much different from that of the 1980s, and it is an open question whether this level of investment can be sustained along with other national priorities.

<sup>1</sup>“Debating the Cost of the Nuclear Triad,” *Air Force Magazine*, November 14, 2013, <[www.airforcemag.com/DRArchive/Pages/2013/November%202013/November%2014%202013/Debating-the-Cost-of-the-Nuclear-Triad.aspx](http://www.airforcemag.com/DRArchive/Pages/2013/November%202013/November%2014%202013/Debating-the-Cost-of-the-Nuclear-Triad.aspx)>.

Within the Congress and the executive branch, these costs and challenges are not well understood in large part because there is no comprehensive estimate for the year-over-year or full life cycle costs of the new systems in development. The United States government does not know with any accuracy how much it spends annually on its nuclear deterrent, or how much it will cost to replace the current triad.<sup>2</sup> The longest-range estimates for the nuclear mission produced by the administration were in 2010 and contained about \$214 billion in spending over the Fiscal Year (FY) 2011-20 period, but the report omitted significant costs, and the estimate period ends just before the substantial procurement bills come due.<sup>3</sup>

*The United States Congress should require the Office of Management and Budget and Departments of Defense and Energy to annually produce an integrated nuclear deterrent budget...*

All estimates, of course, are imperfect.

The estimates collected in this report are intended to provide a rough road map of the scale and timeline for the various programs now being contemplated. We have not attempted to estimate the full costs of protecting the United States from a nuclear weapon attack or of maintain its nuclear arsenal. This report does not try to include each and every dollar that could be connected to the nuclear deterrent mission such as missile defense, nonproliferation efforts to secure or eliminate nuclear materials, or intelligence programs related to the nuclear mission. These are important programs with costs worthy of debate, but they lay outside the scope of this effort. Instead, this report consolidates estimates directly tied to sustaining the current deterrent while replacing each leg of the triad, relying primarily on official government cost projections. These projections also include directed stockpile work, life extension programs for existing nuclear weapons, and the costs of repairing and replacing major parts of the nuclear weapon infrastructure needed to maintain nuclear weapons.

The debate over the future of the triad has important political, strategic, and financial implications. The Washington policy debate on the appropriate size of the future strategic arsenal was heavily discussed during the approval of the New Strategic Arms Reduction Treaty (START). During that process, the president committed to maintain the nuclear triad under New START and to fund modernization efforts of the strategic arsenal. However, the lack of authoritative year-over-year and life-cycle costs presents a challenge for maintaining the US nuclear deterrent. Thus, the authors' sole recommendation in this report is that *the United States Congress should require the Office*

<sup>2</sup> See Government Accountability Office, "Military Transformation: Action Needed by DOD to More Clearly Identify New Triad Spending and Develop a Long-term Investment Approach," GAO-05-962R, August 4, 2005, <[www.gao.gov/assets/100/93509.pdf](http://www.gao.gov/assets/100/93509.pdf)>, and Stephen I. Schwartz, "Unaccountable: Exploring the Lack of Budgetary Transparency for U.S. Nuclear Security Spending," Nuclear Threat Initiative, January 5, 2012, <[www.nti.org/analysis/articles/transparency-us-nuclear-security-budget/](http://www.nti.org/analysis/articles/transparency-us-nuclear-security-budget/)>.

<sup>3</sup> November 2010 Update to the National Defense Authorization Act of FY2010 Section 1251 Report, <<http://nucleardiner.com/blogs/wp-content/uploads/2011/10/1251-1.pdf>>.

***of Management and Budget and Departments of Defense and Energy to annually produce an integrated nuclear deterrent budget*** that includes and details all major budget activities, including: development, procurement, operations and maintenance, all lifetime personnel costs (including healthcare and pensions), and project the costs of each system in the triad out for its expected lifetime.

## THE TRILLION DOLLAR NUCLEAR TRIAD

The United States is committed to maintaining “a credible deterrent, capable of convincing any potential adversary that the adverse consequences of attacking the United States or our allies and partners far outweigh any potential benefit they may seek to gain through an attack.”<sup>4</sup> Under the New Strategic Arms Reduction Treaty (New START), the United States will reduce its strategic nuclear weapons to a maximum of 1,550 deployed warheads on no more than 700 deployed intercontinental ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs), and heavy bombers by February 5, 2018.<sup>5</sup> Speaking in Berlin in June 2013, President Barack Obama announced his intention to seek a further one-third reduction in deployed strategic nuclear warheads with Russia. As of October 1, 2013, the United States had 1,688 strategic nuclear warheads on 809 deployed ICBMs, deployed SLBMs and heavy bombers, as well as hundreds of nonstrategic and thousands of nondeployed warheads not constrained by US-Russia arms control treaties.<sup>6</sup> The Obama administration, during the process of seeking Senate advice and consent to New START, also committed to request more than \$200 billion through 2020 to maintain and replace the nation’s nuclear force and nuclear weapon production complex. Although Congress has not fully funded the president’s budget requests, nuclear weapon expenditures have been largely protected from the current climate of fiscal austerity. The Continuing Resolution for FY2011, for example, contained an exception to increase funds available for the National Nuclear Security Administration (NNSA).<sup>7</sup> The Department of Defense (DOD) has also exempted nuclear forces from sequestration.<sup>8</sup>

*Refusing to make hard choices does not mean those choices can be avoided; it simply makes them less rational.*

It is unclear how long the nation’s nuclear weapon program can defy budgetary gravity. Deputy Secretary of Defense Ashton Carter has argued that the nation’s nuclear deterrent is a bargain at only \$12 billion per year—\$16 billion per year if one includes command-and-control costs.<sup>9</sup> Carter’s \$12 billion estimate is consistent with the DOD’s \$125 billion share of the administration’s \$214 billion dollar commitment cited in the report required under section 1251 of the National Defense Authorization Act of 2010, subsequently referred to as the “1251 Report.”<sup>10</sup>

<sup>4</sup> White House, “Fact Sheet: Nuclear Weapons Employment Strategy of the United States,” June 19, 2013, <[www.whitehouse.gov/the-press-office/2013/06/19/fact-sheet-nuclear-weapons-employment-strategy-united-states](http://www.whitehouse.gov/the-press-office/2013/06/19/fact-sheet-nuclear-weapons-employment-strategy-united-states)>.

<sup>5</sup> Under the terms of New START, each heavy bomber counts as one deployed strategic nuclear warhead, regardless of how many nuclear weapons it can or does carry.

<sup>6</sup> Department of State, Bureau of Arms Control, Verification and Compliance, “New START Treaty Aggregate Numbers of Strategic Offensive Arms,” October 1, 2013, <[www.state.gov/t/avc/rls/215000.htm](http://www.state.gov/t/avc/rls/215000.htm)>.

<sup>7</sup> Senate Committee on Appropriations, Energy and Water Development Subcommittee, FY2011 Continuing Resolution, <<http://appropriations.senate.gov/news.cfm?method=news.download&id=00ec20a3-ed78-4cb4-bfc8-65a048999b60>>.

<sup>8</sup> Department of Defense, “Remarks by Deputy Secretary of Defense Carter at the Aspen Security Forum at Aspen, Colorado,” July 18, 2013, <[www.defense.gov/transcripts/transcript.aspx?transcriptid=5277](http://www.defense.gov/transcripts/transcript.aspx?transcriptid=5277)>.

<sup>9</sup> Ibid.

<sup>10</sup> House Armed Services Committee, Subcommittee on Strategic Forces, “The Current Status and Future Direction for

While unintended, the 1251 Report is both incomplete and misleading; it was never intended to be a basis for planning investments to maintain and replace the deterrent. The United States needs, and does not have (and, indeed, never had) a single, best estimate of current and planned levels of investment for its nuclear deterrent, including both year-over-year and for the life cycle of proposed new systems. Congress and the administration lack the information to create a consensus to sustain

*Congress and the administration lack the information to create a consensus to sustain the planned modernization, possibly jeopardizing both the nation's deterrent and nuclear reduction plans as a result.*

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The 1251 Report was a ten-year cost estimate for projected nuclear weapon investments. Produced and updated in 2010, this report

estimated that the United States would spend about \$214 billion over 2011-20 to maintain and replace the nation's deterrent: \$125 billion on Department of Defense activities and \$88 billion for Department of Energy weapon-related activities. Although the full 1251 Report is classified, the administration released an unclassified summary and has provided a number of briefings and presentations on its contents.<sup>11</sup>

The 1251 Report has two major structural problems. First, it does not contain full cost estimates for either the follow-on ICBM or the follow-on bomber. These costs are omitted from the 1251 Report in part because the administration could not estimate them at the time with any certainty. Although the omission of hard-to-estimate costs is understandable, from a planning perspective we know that a follow-on ICBM and new bomber will cost more than the approximately \$20 million dollars and \$1.7 billion respectively contained in the 1251 estimate.

Second, the 1251 Report is a ten-year projection. The ten-year period from 2011-20 is an unfortunate time frame because the procurement "bow wave" for new submarines, bombers, and ballistic missiles will come just beyond the ten-year horizon in the 1251 Report. As best as can be determined, the DOD plans to purchase five strategic submarines, seventy-two long-range bombers, and 240 ICBMs

*DOD plans to purchase five strategic submarines, seventy-two long-range bombers, and 240 ICBMs in a six-year period between 2024-29....the average procurement expenditures during this period are comparable to those during the Ronald Reagan administration's defense buildup in the 1980s.*

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U.S. Nuclear Weapons Policy and Posture," 112th Congress, 1st session, November 2, 2011, <[www.gpo.gov/fdsys/pkg/CHRG-112hhrg71527/html/CHRG-112hhrg71527.htm](http://www.gpo.gov/fdsys/pkg/CHRG-112hhrg71527/html/CHRG-112hhrg71527.htm)>.

<sup>11</sup> White House, "Fact Sheet: An Enduring Commitment to the U.S. Nuclear Deterrent," November 17, 2010, <[www.whitehouse.gov/the-press-office/2010/11/17/fact-sheet-enduring-commitment-us-nuclear-deterrent](http://www.whitehouse.gov/the-press-office/2010/11/17/fact-sheet-enduring-commitment-us-nuclear-deterrent)>.

in a six-year period between 2024-29. As a percentage of overall defense spending, the average procurement expenditures during this period are comparable to those during the Ronald Reagan administration's defense buildup in the 1980s. This assumes a flat defense budget in current dollars. Because there is no stand-alone life cycle budget for these programs, the administration and Congress are only now beginning to recognize the full scale of the investments being contemplated and have not yet made a public case for this level of investment.

The result may well be budget chaos; this plans will likely result in reduced political support for modernization with shifting requirements, program delays, and significant cost growth. Navy and Air Force officials have already expressed concerns about the impact of these costs on other defense programs.

In the worst case, an attempt to simultaneously rebuild all three legs of the strategic triad may imperil either the ICBM force or the nuclear mission for the follow-on bomber. DOD officials have themselves highlighted the risk of an overly ambitious procurement timeline.<sup>12</sup> Any decision to eliminate a leg of the triad or the entire Air Force nuclear mission is one that must be taken only after careful and thorough strategic analysis and should not be the consequence of budgetary

*Chaotic and poorly planned reductions—disarmament by default—would undermine deterrence, as well as the prospects of further negotiated reductions with Russia.*

chaos. Chaotic and poorly planned reductions—disarmament by default—would undermine deterrence, as well as the prospects of further negotiated reductions with Russia. During the New START debate, further cuts to the size of America's nuclear arsenal were tied to modernizing the existing arsenal, meaning that future reductions may be harder to achieve if modernization plans falter or are delayed.

A better strategy is one in which we choose to align the nation's deterrent with current geopolitical and fiscal realities. This will almost certainly involve a managed reduction in the number of nuclear weapons as we replace delivery systems. The administration's current policy is to simply replace the force we have today despite the fact that it reflects choices made during a very different strategic and fiscal environment. Refusing to make hard choices does not mean those choices can be avoided; it simply makes them less rational. Current five- and ten-year projections are simply not adequate for the programs they are intended to support. Programs to maintain and replace the deterrent take more than a decade to go from design to deployment, and longer-range budget documents and political support are essential.

We are disappointed that this report is even necessary. The federal government, not nongovernmental organizations, outside experts, and educational institutions should be responsible for laying out the current and anticipated future costs of the nuclear arsenal, or providing strategic warning that

<sup>12</sup> House Armed Services Committee, Strategic Forces Subcommittee, "Fiscal Year 2014 Budget Request for Atomic Energy Defense Activities and Nuclear Forces Programs," May 9, 2013, <<http://armedservices.house.gov/index.cfm/2013/5/fiscal-year-2014-budget-request-for-atomic-energy-defense-activities-and-nuclear-forces-programs>>.

nuclear modernization plans are at risk. Reliable information is an essential component of an informed and productive policy debate over how best to maintain a nuclear deterrent. However, until Congress requires the executive branch to fully account for its projected costs, this report seeks to consolidate existing official estimates for the nuclear deterrent to promote a sensible debate on this important issue.

## **Methodology**

The general approach of this report is simple. The authors began by attempting to reverse engineer the administration's 1251 Report. Having identified significant gaps in the 1251 Report, the report presents existing estimates of what various replacements might cost until all replacement is complete—about thirty years from now.

This report relies on data from the annual budget process, supplemented by reports prepared by the Congressional Budget Office, the Government Accountability Office, and congressional testimony. In some cases, the estimates compiled are supplemented with historical cost data. In general, the report presents a range of costs, without seeking to estimate possible cost overruns or other factors that might result in cost growth.

Lastly, we have restricted our estimates to costs directly tied to nuclear weapons and their delivery systems. The thirty-year projected charts include our best estimates for how programs might be pursued year over year, but the precise spending in any given year will vary depending on procurement timing and budget allocations. We have not included related programs such as system dismantlement, nuclear material disposal or environmental remediation, intelligence expenditures related to nuclear missions and targeting, missile defense, and so on.

The purpose of this report is not to provide a definitive estimate but to demonstrate the government needs to produce a stand-alone budget for maintaining and modernizing the nuclear deterrent. The scope of the enterprise the country is contemplating requires the executive branch and Congress to start making less risky budget and program decisions before these programs are put further at risk.

## PROJECTIONS

Over the next thirty years, the United States plans to maintain its current triad of ICBMs, SLBMs, and bombers, and procure replacement systems. Although the 1251 Report documents approximately \$200 billion in funding over FY2011-20, decisions being taken now commit the United States to spend nearly \$1 trillion over the next three decades for these systems. Procurement of replacements will peak during a four to six year window between 2024 and 2029, when the DOD plans to purchase five strategic submarines, seventy-two long-range bombers and 240 ICBMs. The new systems will cost approximately 3 percent of the defense budget, comparable to Reagan-era spending for procurement of new strategic systems.

The projected costs of maintaining current systems—including nuclear warhead life extension programs—as well as replacing each leg of the triad totals \$872 billion to \$1.082 trillion over the next thirty years (see Table 1).

Table 1

### Average Annual Cost/30-Year Projected Strategic Triad Costs

Program/Element	Annual Cost (Billions)	30-Year Cost (Billions)
Current Triad	\$8-9	\$240-270
NNSA weapons activities	\$11.66	\$350
Command, control, and communications	\$4	\$120
Minuteman follow-on	N/A	\$20-120 <sup>13</sup>
Long Range Standoff missile	N/A	\$10-20
Ohio-class ballistic missile submarine	N/A	\$77-102
Long Range Strike Bomber	N/A	\$55-100 <sup>14</sup>
<b>TOTAL</b>		<b>\$872-1,082</b>

NOTES: Current triad costs are from the 1251 Report reconstruction, remarks by Deputy Secretary of Defense Carter, and other sources; NNSA costs are from the Weapons Activities account and the FY2014 Stockpile Stewardship and Management Plan; Command, control, and communications costs are from Deputy Secretary of Defense Carter; Minuteman follow-on costs are based on historical data for the MX/Peacekeeper and Small ICBM programs; LRSO costs are based on conversations with US government officials and includes costs for the dedicated warhead; SSBN(X) costs are a range of Navy, GAO, and Congressional Budget Office estimates; LRS-B costs are a range of Air Force, CBO, and Teal Group estimates.

Table 1 provides more information to US policy makers than is available from any single government publication. It excludes many components of military operations that could be legitimately applied to the costs of maintaining a deterrent, such as long-term health and pension benefits for military and civilian personnel, the costs of decommissioning and dismantlement, disposal of delivery vehicles, warheads and other special materials, and the environmental remediation of nuclear weapons production facilities and deployment sites.

Table 1 includes a projected cost of between \$8-9 billion per year for maintaining the triad. Our confidence in this number is less than complete, but it is consistent with the 1998 Congressional Budget Office (CBO) report and comments by Deputy Secretary of Defense Carter in July 2013 that the United States spent \$12 billion annually on its nuclear deterrent.<sup>13</sup> His number is consistent with the 1251 Report, which projects a quarter of this \$12 billion to be spent on follow-on systems. We can identify about \$8 billion in Navy and Air Force budget documents to maintain the current force. See Table 2 for a breakdown of these costs.

*Table 2*

### **Current Triad Costs**

Category	FY 2014 Navy & Air Force Requests (Billions of dollars)
<b>NAVY</b>	
RTD&E - (Research, Development, Testing & Evaluation)	\$0.258
Procurement	\$1.444
O&S* - (Operations & Support)	\$1.193
<b>AIR FORCE</b>	
RTD&E - (Research, Development, Testing & Evaluation)	\$0.922
Procurement	\$0.245
O&S - (Operations & Support)	\$4.00
<b>TOTAL</b>	<b>\$8.06</b>

NOTE: Data for FY2014 requests are taken from FY2014 Air Force and Navy budget documents, submitted in April 2013, and available at <[www.saffm.hq.af.mil/budget/](http://www.saffm.hq.af.mil/budget/) and <https://www.ncca.navy.mil/FMB/PB/BOOKS.htm>>. Sequestration and Continuing Resolutions obscure actual appropriations. O&S costs possibly do not include Navy military personnel (not provided), nor funding within NNSA Naval Reactors account. Air Force O&S costs are taken from the Nuclear Deterrence Operations graph of the FY2014 Air Force budget overview.

<sup>13</sup> Congressional Budget Office, “Estimated Budgetary Impacts of Alternative Levels of Strategic Forces,” March 18, 1998, [www.cbo.gov/sites/default/files/cbofiles/ftpdocs/3xx/doc392/altforce.pdf](http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/3xx/doc392/altforce.pdf); Department of Defense, “Remarks by Deputy Secretary of Defense Carter at the Aspen Security Forum at Aspen, Colorado.”

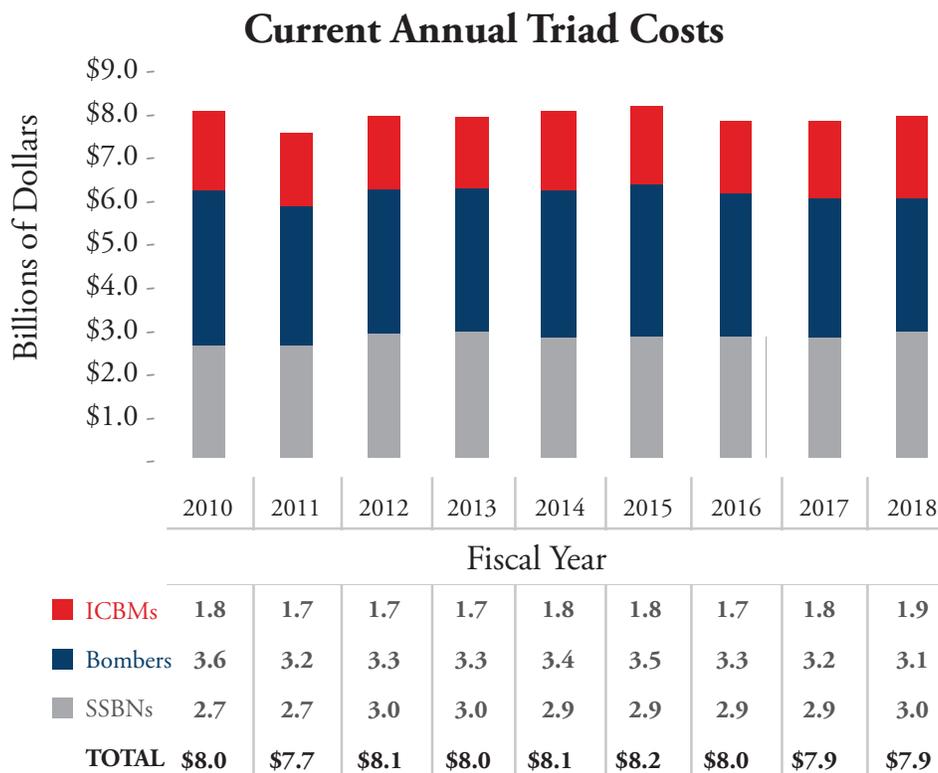
This compilation of estimates, however, does help make clear the unknowns associated with costing out the budget for the nuclear deterrent in the United States and reinforces the central recommendation of this report: ***Congress should require the Office of Management and Budget and Departments of Defense and Energy to annually produce an integrated and stand-alone nuclear deterrent budget*** that includes all major budget activities, including: development, procurement, operations and maintenance, all lifetime personnel costs (including pensions), and project the costs of each system in the triad out for their expected lifetimes.

The government does not provide adequate transparency and cost estimates for the maintenance of these programs. In turn, this lack of transparency precludes the conduct of a meaningful and informed policy discussion *within the government itself* (as well as between government officials and the public) about the costs and benefits of maintaining the nuclear arsenal.

## The Triad

Each leg of the nuclear triad consists of a current force and a projected replacement force. The numbers for the current force include—to the greatest extent possible—operations, maintenance, and life extension programs. The projections are the best level of data, based on multiple official and unclassified budget documents, and supplemented with proven nongovernmental documents (see Figure 1).

Figure 1



## *Submarines*

The United States maintains a force of fourteen Ohio-class SSBNs, each with twenty-four launch tubes capable of launching a Trident II D5 SLBM. Each SLBM, in turn, carries either W76 or W88 warheads.<sup>14</sup> These submarines are based at Bangor, Washington, and Kings Bay, Georgia.

To comply with New START, the United States plans to maintain all fourteen Ohio-class SSBNs with up to 240 deployed SLBMs, while converting or eliminating four launchers on each submarine.<sup>15</sup>

The annual cost of maintaining this force for the duration of the Future Years Defense Program (FYDP) ranges from \$2.9 to \$3.0 billion, for a total of \$14.6 billion (see Figure 2). This cost includes maintaining the submarines and missiles, but does not include personnel costs, long-term costs associated with boat and reactor decommissioning, or pensions and healthcare costs for retired personnel.

Ohio-class SSBNs are scheduled to begin retiring in 2027 at an approximate rate of one per year through 2042.<sup>16</sup> The Navy plans to replace the existing SSBNs with twelve SSBN(X)s. Current funding for the SSBN(X) is allocated to technology development, including the common missile compartment and an electric-drive propulsion system.<sup>17</sup>

Procurement of the first SSBN(X) has been delayed from 2019 to 2021 for cost and other reasons. As a result, the Navy now plans to operate fewer than twelve boats for more than a decade from 2029-41, dropping to ten deployed boats for the majority of that period.<sup>18</sup>

The full replacement costs of the SSBN(X) are estimated at \$77-\$102 billion with the per boat cost reaching as much as \$7.2 billion.<sup>19</sup> The Navy projects the annual operation and support cost of each SSBN(X) to be \$124 million, or nearly \$1.5 billion for twelve boats.<sup>20</sup> The Navy still hopes to reduce

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<sup>14</sup> Hans M. Kristensen and Robert S. Norris, "US nuclear forces, 2013," *Bulletin of the Atomic Scientists* 69 (March/April 2013), pp. 77-86.

<sup>15</sup> Amy F. Woolf, "U.S. Strategic Nuclear Forces: Background, Developments, and Issues," Congressional Research Service, October 22, 2013, p. 8, <[www.fas.org/sgp/crs/nuke/RL33640.pdf](http://www.fas.org/sgp/crs/nuke/RL33640.pdf)>.

<sup>16</sup> Ronald O'Rourke, "Navy Ohio Replacement (SSBN[X]) Ballistic Missile Submarine Program: Background and Issues for Congress," Congressional Research Service, October 22, 2013, p. 12, <[www.fas.org/sgp/crs/weapons/R41129.pdf](http://www.fas.org/sgp/crs/weapons/R41129.pdf)>.

<sup>17</sup> Government Accountability Office, "Defense Acquisitions: Assessments of Selected Weapons Programs," GAO-13-294SP, March 28, 2013, p. 145, <[www.gao.gov/products/GAO-13-294SP](http://www.gao.gov/products/GAO-13-294SP)>.

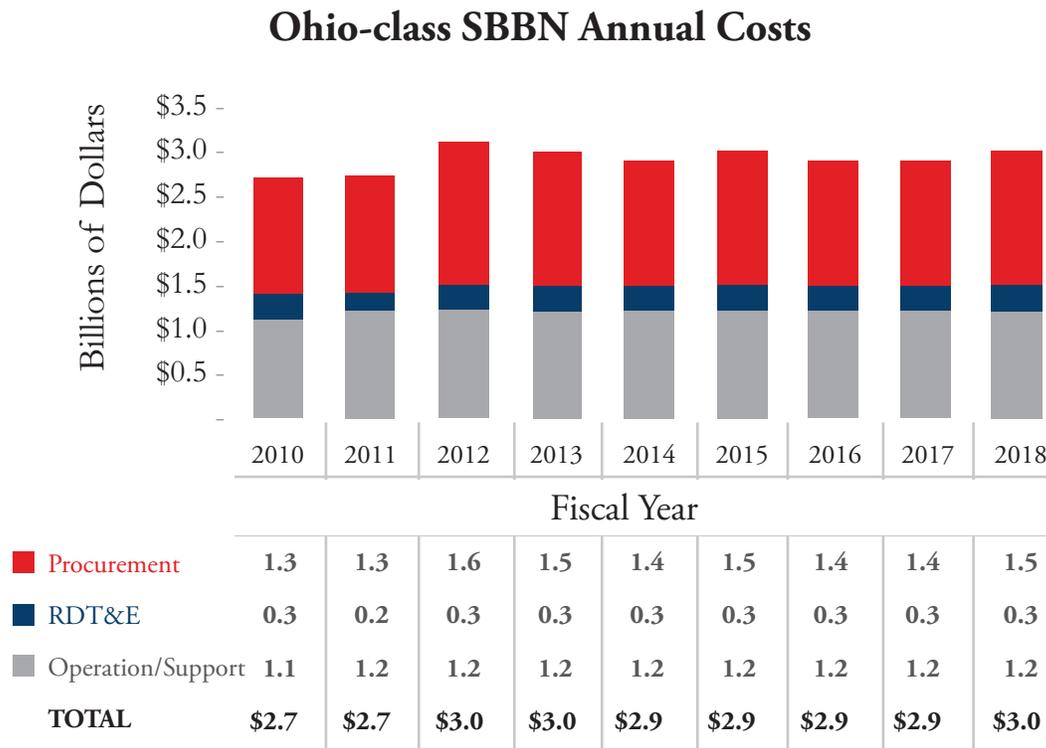
<sup>18</sup> O'Rourke, "Navy Ohio Replacement (SSBN[X]) Ballistic Missile Submarine Program," Summary.

<sup>19</sup> The Navy projects the cost of 12 boats to be \$77 billion, the GAO projects \$93 billion, and the Congressional Budget Office provides a high-end of \$102 billion. Government Accountability Office, "Defense Acquisitions: Assessments of Selected Weapons Programs," p. 145; Congressional Budget Office, "An Analysis of the Navy's Fiscal Year 2014 Shipbuilding Plan," October 2013, p. 24, <[www.cbo.gov/sites/default/files/cbofiles/attachments/44655-Shipbuilding.pdf](http://www.cbo.gov/sites/default/files/cbofiles/attachments/44655-Shipbuilding.pdf)>.

<sup>20</sup> O'Rourke, "Navy Ohio Replacement (SSBN[X]) Ballistic Missile Submarine Program," p. 15.

both the per boat and operation and support costs.<sup>21</sup> The FYDP calls for \$6 billion in research and development, as well as \$1.6 billion for advance procurement.

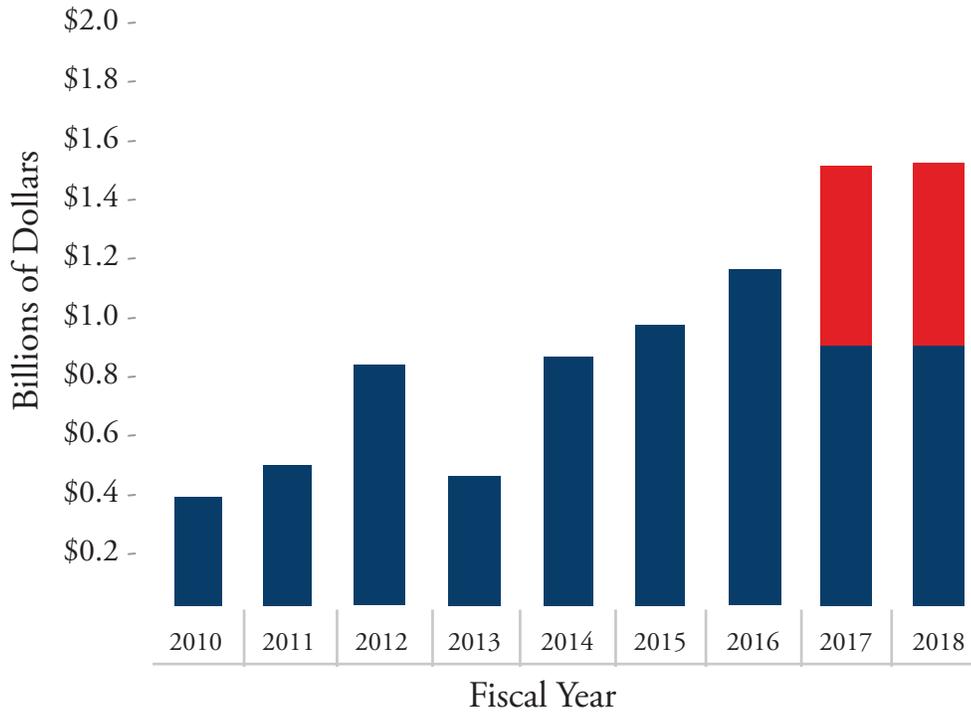
Figure 2



<sup>21</sup> Ibid.

Figure 3

### SSNB(X) Annual Costs

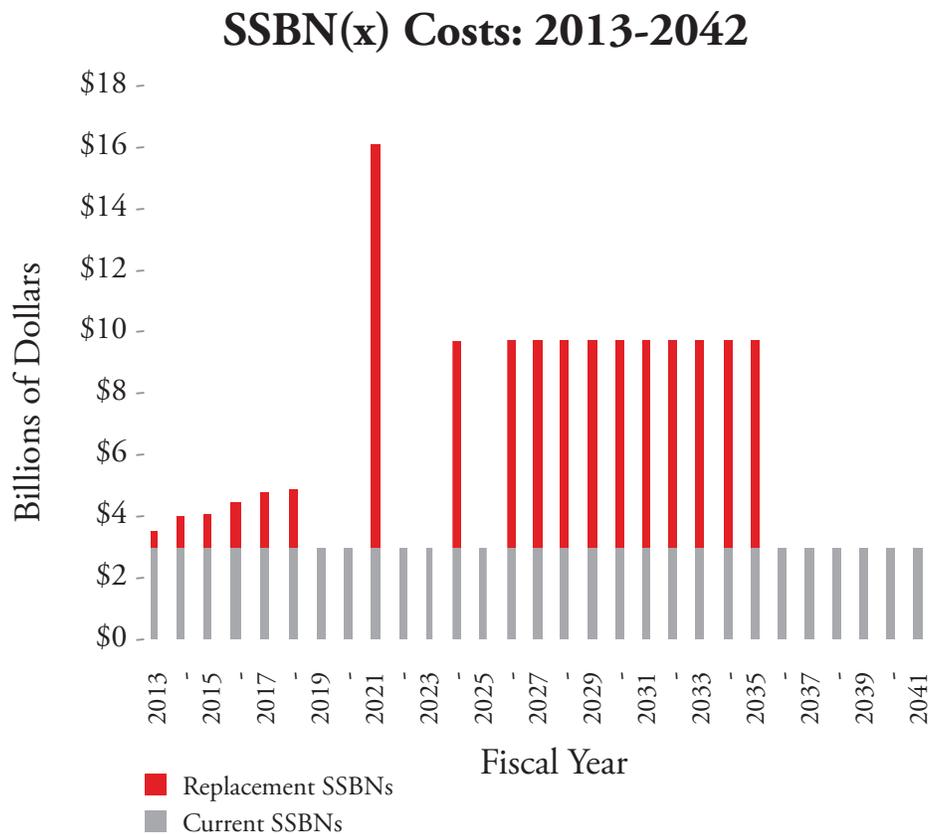


■ Procurement

■ RDT&E

**TOTAL**

Figure 4



Current cost projections do not include the costs of replacing the D5 SLBMs. Those missiles are expected to reach the end of their service lives in 2042, meaning that research, development, testing, and evaluation on a new system could begin as early as 2030. While there is no existing cost projection for this follow-on system, current budget documents indicate annual requests of about \$1.2 billion per year across the FYDP to purchase twenty-four D5 missiles per year.<sup>22</sup> This expense can be used as a rough estimate for the costs of the future system and are included in Figure 2 under SSBN procurement.

Recently, Navy officials have begun alluding to the possibility that the high cost of the SSBN(X) and the inflexibility of its replacement schedule will have significant adverse funding effects on other critical shipbuilding programs.<sup>23</sup> In September 2013, reports indicated that the Navy planned to request a special supplemental appropriation to fund the procurement of the Trident replacement submarine.<sup>24</sup>

<sup>22</sup> Department of the Navy, “Fiscal Year (FY) 2014 President’s Budget Submission: Weapons Procurement, Navy,” April 2013, p. 1, <[www.ncca.navy.mil/FMB/14pres/WPN\\_BOOK.PDF](http://www.ncca.navy.mil/FMB/14pres/WPN_BOOK.PDF)>

<sup>23</sup> Admiral William Burke, “Navy Perspectives on Trident Strategic Modernization,” Presentation at National Defense Industrial Association/Reserve Officers Association Capitol Hill Forum, April 30 2013, <<http://secure.afa.org/HBS/transcripts/2013/April%2030%20-%20Burke.pdf>>.

<sup>24</sup> Grace Jean, “USN needs supplemental funding to procure ballistic missile submarine replacement,” Jane’s Defence,

## *Strategic Bombers*

The United States maintains ninety-four heavy bombers that can be equipped with nuclear weapons. This includes seventy-six B-52Hs and eighteen B-2As. Under New START, the United States intends to maintain up to sixty nuclear-capable bombers.<sup>25</sup> B-52s are deployed at Barksdale Air Force Base (AFB), Louisiana, and Minot AFB, North Dakota.<sup>26</sup> B-2As are deployed at Whiteman AFB, Missouri.<sup>27</sup> While both systems are integrated into the nuclear war plan and are accountable under US-Russian arms control agreements, none of these aircraft are routinely equipped or deployed with nuclear weapons on a day-to-day basis.

The annual cost of maintaining this fleet of aircraft ranges from \$3.1-3.5 billion across the FYDP (2014-18) for a total of \$16.5 billion. Operations and support comprises the majority of the cost (see Figure 5). The Air Force intends to maintain the B-52H and B-2A at least through 2040 and 2050, respectively.<sup>28</sup>

The Air Force currently plans to augment or replace the entire fleet of long-range nuclear-capable bombers with the Long Range Strike-Bomber (LRS-B).<sup>29</sup> It is unclear how far along the LRS-B is in the development process because some details of the program are classified; however, the Air Force budget calls for \$10 billion in spending over the next five years (see Figure 6).<sup>30</sup> The 2012 DOD 30-year “Annual Aviation Inventory and Funding Plan” caps procurement at \$55 billion, and the Air Force hopes to buy eighty to 100 new bombers.<sup>31</sup> This estimate does not factor in R&D.<sup>32</sup> Outside analysts estimate R&D costs between \$20 billion and \$45 billion.<sup>33</sup> This is consistent with a 2006 Congressional Budget Office study that provided an estimate for a long-range subsonic bomber of

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September 26, 2013, [www.janes.com/article/27584/usn-needs-supplemental-funding-to-procure-ballistic-missile-submarine-replacement](http://www.janes.com/article/27584/usn-needs-supplemental-funding-to-procure-ballistic-missile-submarine-replacement); “Statement of Rear Admiral Richard P. Breckenridge, Director Undersea Warfare (N97) and Rear Admiral David C. Johnson, Program Executive Office Submarines, on Undersea Warfare,” House Armed Services Committee, Subcommittee on Seapower and Projection Forces, September 12, 2013, <<http://armedservices.house.gov/index.cfm/2013/9/undersea-warfare-capabilities-and-challenges>>.

<sup>25</sup> Woolf, “U.S. Strategic Nuclear Forces,” p. 8.

<sup>26</sup> “2013 USAF Almanac,” *Air Force Magazine*, May 2013, p. 57, <[www.airforcemag.com/MagazineArchive/Magazine/2013/0513fullissue.pdf](http://www.airforcemag.com/MagazineArchive/Magazine/2013/0513fullissue.pdf)>.

<sup>27</sup> Ibid.

<sup>28</sup> “Statement of General C.R. Kehler, Commander, U.S. Strategic Command,” before the House Armed Services Committee, March 5, 2013, <[www.stratcom.mil/files/2013-03-05-posture.pdf](http://www.stratcom.mil/files/2013-03-05-posture.pdf)>.

<sup>29</sup> Department of Defense, “Aircraft Procurement Plan, Fiscal Years 2012-2041,” March 2011 <[www.airforcemag.com/SiteCollectionDocuments/Reports/2011/May%202011/Day25/AircraftProctPlan2012-2041\\_052511.pdf](http://www.airforcemag.com/SiteCollectionDocuments/Reports/2011/May%202011/Day25/AircraftProctPlan2012-2041_052511.pdf)>.

<sup>30</sup> This number includes about \$1 billion for LRSO research and development. Department of the Air Force, “Fiscal Year (FY) 2014 President’s Budget Submission: Research, Development, Test & Evaluation, Air Force, Vol. II,” April 2013, p. 209 and 727, <[www.saffm.hq.af.mil/shared/media/document/AFD-130408-066.pdf](http://www.saffm.hq.af.mil/shared/media/document/AFD-130408-066.pdf)>

<sup>31</sup> The DOD Aviation Inventory provides an “average procurement unit cost goal of approximately \$550 million,” giving a high-end of \$55 billion for 100 aircraft. In referencing guidance by former Secretary of Defense Robert Gates, Air Force Chief of Staff General Norton Schwartz stated that if the price exceeds the cap, “we don’t get a program.” See Schogol, “Schwartz Defends Cost of USAF’s Next-Gen Bomber.”

<sup>32</sup> Department of Defense, “Annual Aviation Inventory and Funding Plan,” p. 22.

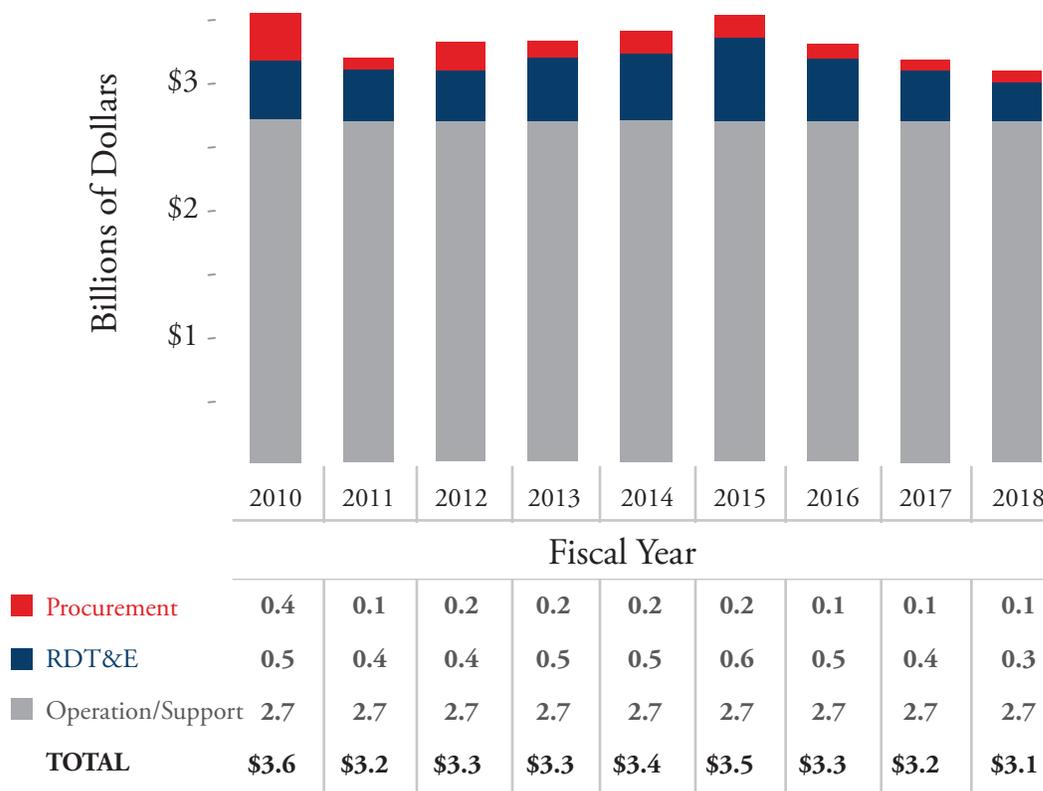
<sup>33</sup> Magnuson, “Budget Pressures Seen as Biggest Risk to Long Range Bomber Program.”

\$93 billion in total acquisition costs, with \$61 billion for procurement and \$31 billion for R&D.<sup>34</sup>

The primary rationale for the LRS-B is to ensure the United States maintains a conventionally-armed long-range strike aircraft. This report includes the full cost of this program as part of the nuclear deterrent, however, because the requirement for a manned bomber is directly tied to the nuclear mission. If a decision were made not to maintain an air-breathing leg of the nuclear triad, the design and specifications for the LRS-B might be very different, and less expensive.

Figure 5

### B2 and B-52 Bomber Annual Costs



<sup>34</sup> See “Alternative 4,” Table A-5 in Congressional Budget Office, “Alternatives for Long Range Ground Attack Systems,” March 2006, p. 44, <[www.cbo.gov/sites/default/files/cbofiles/ftpdocs/71xx/doc7112/03-31-strikeforce.pdf](http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/71xx/doc7112/03-31-strikeforce.pdf)>.

Figure 6

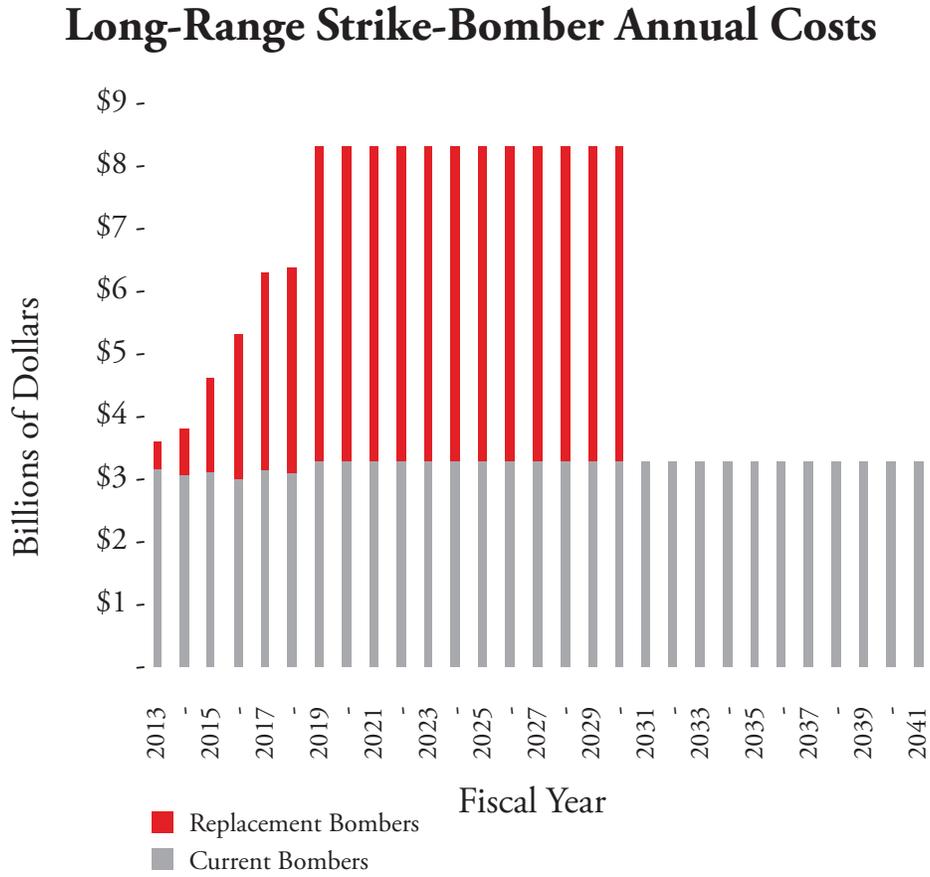
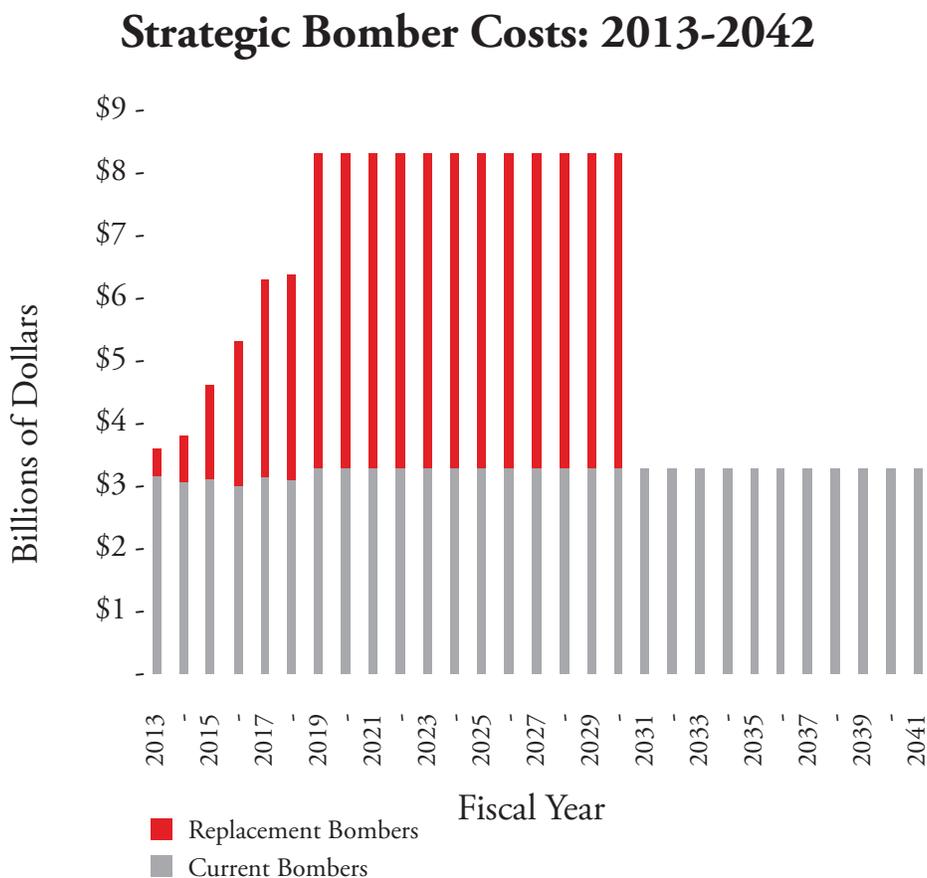


Figure 7



### *Follow-on Intercontinental Ballistic Missile*

The United States maintains a force of 450 deployed Minuteman III ICBMs.<sup>35</sup> The Minuteman IIIs are deployed in silos in three 150-missile wings at F.E. Warren AFB, Wyoming, Minot AFB, North Dakota, and Malmstrom AFB, Montana.<sup>36</sup> Under New START, the United States plans to retain up to 420 deployed ICBMs.<sup>37</sup>

The annual cost of maintaining this force ranges from \$1.7-1.9 billion across the FYDP (see Figure 8) for a total of \$8.9 billion. The bulk of the costs result from operations and support expenditures. The Air Force plans to maintain the Minuteman III through 2030 and recently completed a major life extension program.<sup>38</sup>

<sup>35</sup> Woolf, “U.S. Strategic Nuclear Forces,” p. 8.

<sup>36</sup> “2013 Air Force Almanac,” p. 57.

<sup>37</sup> Woolf, “U.S. Strategic Nuclear Forces,” p. 8.

<sup>38</sup> “Statement of General C.R. Kehler, Commander, U.S. Strategic Command,” p. 13.

The Air Force launched an Analysis of Alternatives (AoA) study in late 2013 for the follow-on to the Minuteman III; accordingly, it has not yet defined a plan to replace the ICBM force.<sup>39</sup> Such a decision will follow the completion of the AoA, now estimated to be finished in 2014.<sup>40</sup>

There are no cost estimates for a follow-on to the Minuteman III at this time. The 1251 Report contains no funds beyond \$20 million to conduct the AoA (see Figure 9). The last time the United States initiated new ICBM procurement programs was in the 1980s with the MX/Peacekeeper and the Small ICBM (“Midgetman”). Based on actual cost of the Peacekeeper and the projected costs of the Small ICBM deployed in silos, a force of 400 follow-on ICBMs would cost between \$20-70 billion, excluding basing modes.<sup>41</sup> If a decision is made to pursue a new ICBM, the costs for procurement would likely begin to be expended in 2016-17 and are reflected in the associated graphs.

This estimate is consistent with the Air Force’s recent experience with the Evolved Expendable Launch Vehicle, which involved the purchase of 150 space launch vehicles based on existing technologies. Originally slated to cost \$30 billion, program costs now exceed \$70 billion.<sup>42</sup>

The 2012 announcement for the follow-on ICBM program included both tunnel and mobile basing, and the GAO’s most recent report in September 2013 states that the Air Force is concentrating on mobile missiles along with two of the other five original options.<sup>43</sup> Mobility and other survivable basing options were major cost factors in the Peacekeeper and Small ICBM estimates.

Deploying the new ICBM in silos would be the least expensive mode of deployment, costing perhaps several billion dollars. More exotic basing modes, such as a system of tunnel-like shelters or a fleet of mobile launchers, could add \$50 billion to the total cost.<sup>44</sup>

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<sup>39</sup> In August 2012, the Joint Requirements Oversight Council approved the Air Force’s initial capabilities document. Government Accountability Office, “ICBM Modernization: Approaches to Basing Options and Interoperable Warhead Designs Need Better Planning and Synchronization,” GAO-13-831, September 20, 2013, p. 2, <[www.gao.gov/products/GAO-13-831](http://www.gao.gov/products/GAO-13-831)>. The announcement of the beginning of the AoA occurred in October 2013. “OSD Approves Start of Analysis of Alternatives on Minuteman III’s Future,” Inside Defense, October 4, 2013, <<http://insidedefense.com/Inside-the-Air-Force/Inside-the-Air-Force-10/04/2013/osd-approves-start-of-analysis-of-alternatives-on-minuteman-iiis-future/menu-id-82.html>>.

<sup>40</sup> Government Accountability Office, “ICBM Modernization.”

<sup>41</sup> Ibid. Estimates based on General Accounting Office figures.

<sup>42</sup> Mike Gruss, “Report: U.S. Air Force to Extend EELV Program,” Space News, May 24, 2013, <[www.spacenews.com/article/military-space/35475report-us-air-force-to-extend-eelv-program](http://www.spacenews.com/article/military-space/35475report-us-air-force-to-extend-eelv-program)>.

<sup>43</sup> Federal Business Opportunities, “Broad Agency Announcement—Ground-Based Strategic Deterrence,” BAA-AFNWC-XZ-13-001Rev2, March 29, 2013, <<https://www.fbo.gov/spg/USAF/AFMC/377CONSKOC/BAA-AFNWC-XZ-13-001/listing.html>>; Government Accountability Office, “ICBM Modernization,” p. 10.

<sup>44</sup> Op Cit, Authors’ estimates based on General Accounting Office figures.

Figure 8

### Minuteman III ICBM Annual Costs

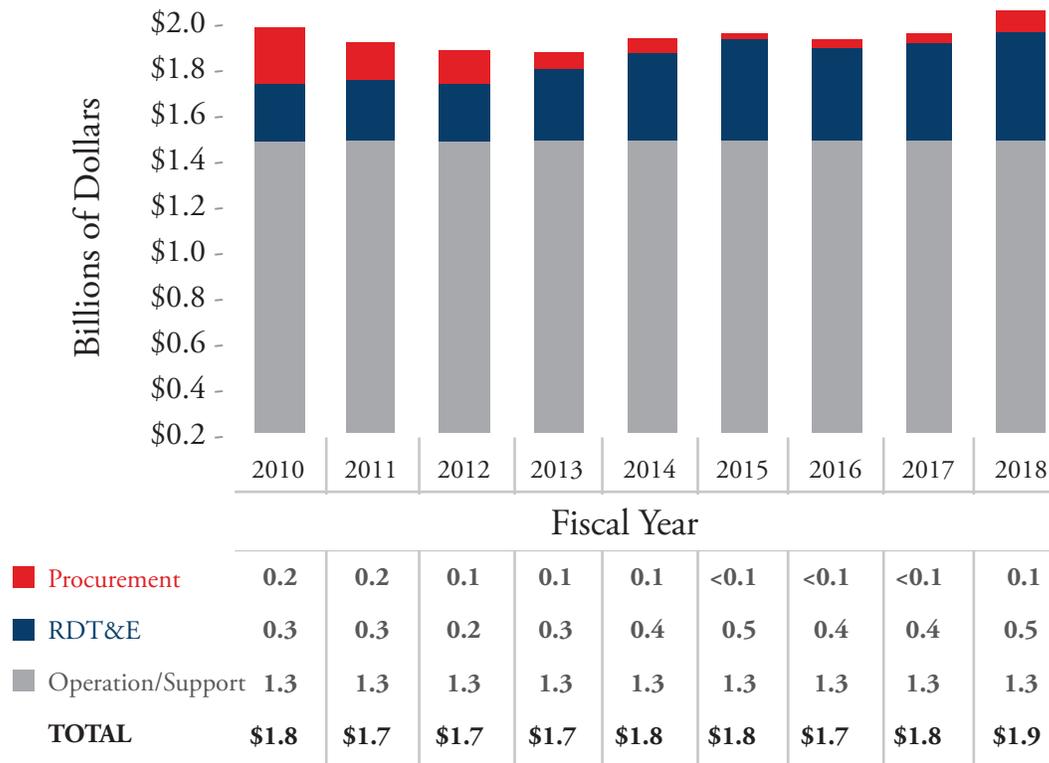
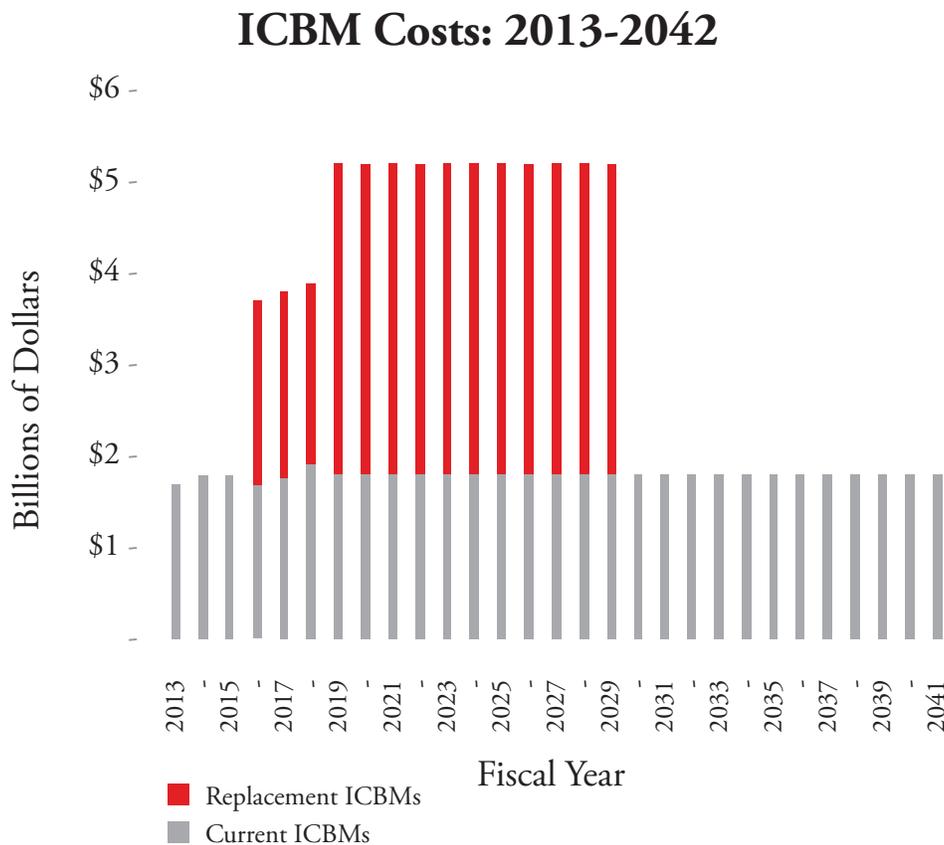


Figure 9



Figure 10



### *National Nuclear Security Administration*

Maintaining and modernizing the current generation of US nuclear weapons is at the heart of a complex, widespread, and capital-intensive effort by the National Nuclear Security Administration—a semi-autonomous agency of the Department of Energy. This work is roughly divided into three categories: to modernize and maintain the reliability of the current arsenal of warheads and bombs, as well as to eliminate weapons designated as no longer needed; to maintain, modernize, and replace the infrastructure needed to perform the first mission of weapon maintenance, modernization, and dismantlement; and the broad array of scientific and technical work needed to recruit, retain, and exercise the skilled personnel needed to operationalize the nation’s deterrent. Taken together, this mission is currently estimated to cost \$350 billion over the next thirty years.<sup>45</sup> This cost estimate comes from NNSA and assumes no cost overruns or inflation.

All of the work being undertaken to monitor and maintain the nation’s nuclear weapons is ongoing at the same time and presents a series of tremendously complex engineering, logistical, and

<sup>45</sup> Department of Energy, “Fiscal Year 2014 Stockpile Stewardship and Management Plan,” June 2013, Chapter 8, p. 10-18, <[http://nnsa.energy.gov/sites/default/files/nnsa/06-13-inlinefiles/FY14SSMP\\_2.pdf](http://nnsa.energy.gov/sites/default/files/nnsa/06-13-inlinefiles/FY14SSMP_2.pdf)>.

management challenges. In fact, the thirty-year estimate for the NNSA mission is predicted to be more expensive and prone to complicating factors than any other element of the nuclear mission over the next few decades.

Of particular importance for cost estimates are the life extension programs (LEP) and new facilities being pursued or considered by the NNSA. Warhead LEPs are step-by-step projects to upgrade or replace critical elements of existing nuclear weapons to either improve safety or ensure the operation of these systems beyond their currently planned life expectancies. Over the next thirty years, NNSA currently estimates that LEP work will cost \$70-80 billion.

The most recent NNSA Stockpile Stewardship and Management Plan (SSMP) for FY2014 provides new details about the costs of warhead LEPs. Current plans suggest a “3+2” strategy where ballistic missiles would use any of three interoperable warheads, and air-delivered weapons would use one of two interoperable warheads. The NNSA estimates that three of these interoperable warheads would cost between \$12-14 billion each over the 2014-38 timeframe. In addition, the B61-12, an air-dropped nuclear bomb to be assigned missions on board both nuclear-armed bombers and tactical delivery aircraft, is now projected to cost \$13 billion through 2038.<sup>46</sup> Lastly, an as-yet-defined warhead is being contemplated for use in the still-to-be developed LRSO weapon to be deployed on the next generation bomber. The LRSO is planned to use a new cruise missile warhead, projected to cost about \$12 billion through 2038.

These budget projections are taken directly from the Department of Energy’s 2014 “Stockpile Stewardship Management Plan,” which looks out twenty-five years. The plan extends until 2038, and for the purposes of this report, we have flat-lined the final four years to match the other timelines in this thirty-year projection. While the final official estimates increase year-over-year, this report simply extends the final budget year until 2042 (see Figure 11).

Just as we identify a significant risk associated with the DOD seeking to simultaneously procure a large number of aircraft and submarines in the late 2020s, we are similarly concerned about what appears to be an extremely ambitious plan by the NNSA to perform multiple life extension programs and development studies. This peak in LEP activities appears to take place during the same time as the DOD “modernization mountain” also peaks. The General Accounting Office recently found that NNSA’s budget estimates “may not represent total funding needed and therefore do not fully align with aspects of these plans.”<sup>47</sup>

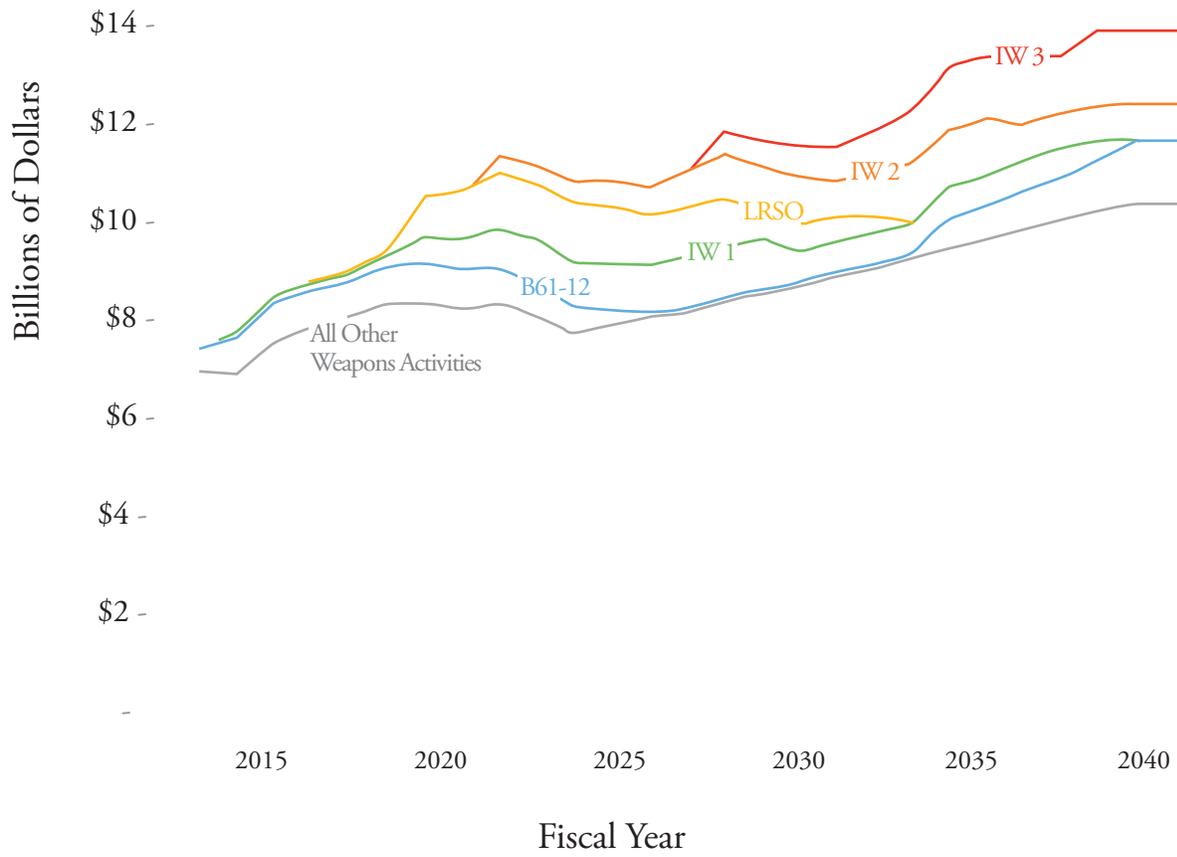
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<sup>46</sup> Ibid, SSMP.

<sup>47</sup> General Accountability Office, “Modernizing the Nuclear Security Enterprise: NNSA’s Budget Estimates Do Not Fully Align with Plans” GAO-14-45, December 2013, p. 18 <[www.gao.gov/assets/660/659610.pdf](http://www.gao.gov/assets/660/659610.pdf)>.

Figure 11

### NNSA Current and Future Warhead & Weapon Work Cost by Year



## CONCLUSION

The United States is on course to spend approximately \$1 trillion dollars over the next thirty years to maintain its current nuclear arsenal and procure a new generation of nuclear-armed or nuclear-capable bombers, submarines, SLBMs, and ICBMs. While to some these costs may seem large, previous efforts to build the triad have been similarly expensive. In almost all cases, we have chosen to leave out categories of costs that could not be accurately identified, but that clearly exist and are part of the nuclear deterrent. In addition, the estimates above do not include cost increases over the current projections provided by the DOD or DOE, Congressional Budget Office, or Government Accountability Office, even though military procurement programs often experience budget increases—sometimes significant increases over 50 percent of the original estimated cost. Most significantly, the estimate omits “legacy” costs associated with dismantling retired weapon systems, and supporting retired workers and veterans—including long-term pension and healthcare costs—because these costs are not readily identifiable in budget documents.

Thomas Jefferson said that “[I]f a nation expects to be ignorant and free, in a state of civilization, it expects what never was and never will be. The functionaries of every government have propensities to command at will the liberty and property of their constituents. There is no safe deposit for these but with the people themselves; nor can they be safe with them without information.”<sup>48</sup> As with other critical government programs, when it comes to making crucial and costly decisions about the future size and composition of our nuclear stockpile, a healthy democratic system cannot do so without a full understanding of the facts and figures and their implications—data which should be made available for internal as well as public debate and discussion.

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<sup>48</sup> Thomas Jefferson, *The Works*, Vol. 11 (Correspondence and Papers 1808-1816) [1905], <[http://oll.libertyfund.org/?option=com\\_staticxt&staticfile=show.php%3Ftitle=807&chapter=88152&layout=html&Itemid=27](http://oll.libertyfund.org/?option=com_staticxt&staticfile=show.php%3Ftitle=807&chapter=88152&layout=html&Itemid=27)>.

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