The Cost of U.S. Nuclear Forces: From BCA to Bow Wave and Beyond

Todd Harrison and Evan Braden Montgomery
The Changing Nuclear Weapons Debate

• The Geopolitical Argument
  – But U.S. faces increasing competition with China and Russia

• The Nonproliferation Argument
  – But concerns about proliferation continue despite U.S. nuclear drawdown

• The Resource Argument
  – BCA defense spending caps
  – Overlapping modernization programs
Key Modernization Programs

• Ohio-Replacement Program
• Ground-Based Strategic Deterrent
• Long Range Strike-Bomber
• B61 Life Extension Program
• Long Range Standoff Missile
## Comparison of Cost Projections

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>TOTAL COST (IN THEN-YEAR DOLLARS)</th>
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<th>YEARS INCLUDED</th>
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<td>CBO’s <em>Projected Costs of U.S. Nuclear Forces</em> (January 2015)</td>
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<td>Stimson’s <em>Resolving Ambiguity: Costing Nuclear Weapons</em> (June 2012)</td>
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<td>CNS’s <em>The Trillion Dollar Nuclear Triad</em> (January 2014)</td>
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<td>DoD and DoE Estimates in GAO Report (July 2015)</td>
<td>$298B</td>
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<td>FY 2015 to 2024</td>
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</tbody>
</table>
• Includes nuclear-related costs of:
  – Airborne Delivery Systems
  – Sea-Based Delivery Systems
  – Land-Based Delivery Systems
  – Nuclear Weapons (Warheads and Bombs)
  – Command and Control Systems

• Does not include:
  – Cleanup and disposal of nuclear waste
  – Threat reduction and arms control
  – Missile defense or missile warning systems
Comparison of Methodologies

Capability / capacity of dual-use forces needed primarily for conventional forces

Conventional
Only Forces

Aerial Refueling

Dual-Use Forces

Protected SATCOM

Capability / capacity of dual-use forces needed for both nuclear and conventional forces

Nuclear Only Forces

SSBNs

Costs included in Stimson methodology

Costs Included in CSBA methodology
Airborne Delivery Systems

- **Bombers (B-52s, B-2s, and LRS-B)**
  - 25% of O&M and MILPERS
  - 50% of RDT&E for B-2 communications upgrades
  - 10% of Procurement and RDT&E for LRS-B acquisition

- **Air-Launched Cruise Missiles (AGM-86B and LRSO)**
  - 100% of costs (nuclear-only system)

- **Dual-Capable Fighters (F-16s, F-15Es, and F-35As)**
  - 10% of O&M and MILPERS for the entire fleet
  - 100% of DCA upgrades to F-35A
Nuclear-Related Costs for Airborne Systems
Sea-Based Delivery Systems

- **Ballistic Missile Submarines (Ohio-class and Ohio Replacement Program)**
  - 100% of all costs (O&M, MILPERS, RDT&E, Procurement, MILCON)
  - Proportionate share of DoE reactor sustainment / acquisition costs

- **Sub-Launched Ballistic Missiles (Trident II D5 and Follow-On)**
  - 100% of all missile-related costs, warhead costs are included in a separate category
  - Assumes follow-on missile program begins ~FY30 and does not start fielding until sometime after FY39
Nuclear-Related Costs of Sea-Based Systems

- Ohio Replacement
- Ohio-Class
- Trident II Missile Follow-On
- D5 Life Extension
Land-Based Delivery Systems

• ICBMs (Minuteman III and GBSD)
  – 100% of all costs (O&M, MILPERS, RDT&E, Procurement, MILCON)
  – Initial GBSD funding begins in FY16, assumes procurement begins in late 2020s

• Helicopter Support for ICBMs (UH-1N and Follow-On)
  – 100% of all costs (O&M, MILPERS, RDT&E, Procurement, MILCON)
  – Initial funding for UH-1N replacement begins in FY16, assumes procurement begins in early 2020s
Nuclear Weapons Programs

- B61-3
- B61-4
- B61-7
- B61-10
- B61-11
- B83
- W80
- W80-4 Life Extension Program
- W78
- W88-0
- W88 Alt 370
- W88-1
- W87
- W76
- W76-1
- B61-12 Life Extension Program
- Interoperable Warhead 1 (IW-1)
- Interoperable Warhead 2 (IW-2)
- Interoperable Warhead 3 (IW-3)
Costs of Nuclear Weapons Programs
Command and Control (C2) Systems

- Terrestrial Command and Control (MEECN, NMCS, SACC(S)
  - 100% of all costs

- Airborne Command and Control (E-4B, E-6B)
  - 50% of O&M, MILPERS, and RDT&E costs

- Satellite Communications (IPS, Milstar, EPS, AEHF, EPS Follow-On, and AEHF Follow-On)
  - 100% of polar-orbiting protected SATCOM
  - 50% of GEO protected SATCOM
Nuclear-Related Costs of C2 Systems
Summary of Nuclear-Related Costs
(in then-year dollars)
Summary of Nuclear-Related Costs
(in constant FY15 dollars)
Potential Cost Growth

Estimated Cost in Then-Year Dollars

- FY15
- FY16
- FY17
- FY18
- FY19
- FY20
- FY21
- FY22
- FY23
- FY24
- FY25
- FY26
- FY27
- FY28
- FY29
- FY30
- FY31
- FY32
- FY33
- FY34
- FY35
- FY36
- FY37
- FY38
- FY39

- Land-Based
- Sea-Based
- Airborne
- C3
- Weapons
Percentage of Total National Defense

Nuclear Forces as a Percentage of Total National Defense (050) Budget

- President's FY16 Request
- President's FY12 Request
- BCA Budget Caps
## Comparison to Other Estimates

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<tr>
<th>SOURCE</th>
<th>TOTAL COST (IN THEN-YEAR DOLLARS)</th>
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<th>CSBA ESTIMATE OVER SAME PERIOD (IN THEN-YEAR DOLLARS)</th>
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<td>DoD’s Major Force Program 1: Strategic Forces</td>
<td>$73B</td>
<td>FY16-20</td>
<td>$100B</td>
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<td>CBO’s <em>Projected Costs of U.S. Nuclear Forces</em></td>
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<td>FY15-24</td>
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<td>$352-392B</td>
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<td>CNS’s <em>The Trillion Dollar Nuclear Triad</em></td>
<td>$872-1,082B</td>
<td>FY14-43</td>
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<tr>
<td>Heavy Bombers</td>
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<tr>
<td>B-2 and B-52</td>
<td>$24.4B</td>
<td>$6.0B</td>
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<td>New Bomber</td>
<td>$33.1B</td>
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<td>B61-12 Tail Kit Assembly</td>
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<td>Cruise Missiles</td>
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<tr>
<td>Air-Launched Cruise Missile</td>
<td>$0.6B</td>
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<td>Long-Range Standoff Missile</td>
<td>$2.8B</td>
<td>$4.3B</td>
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<td>ICBMs*</td>
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<tr>
<td>Minuteman III</td>
<td>$11.6B</td>
<td>$13.2B</td>
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<td>Minuteman III Replacement</td>
<td>$6.0B</td>
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<td>ICBM Fuse Modernization</td>
<td>$1.4B</td>
<td>$1.3B</td>
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<td>Dual-Capable Aircraft**</td>
<td>$2.7B</td>
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<tr>
<td>Fleet Ballistic Missile Submarine (SSBN)</td>
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<td>Ohio-Class Submarine</td>
<td>$19.0B</td>
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<td>Ohio Replacement Submarine</td>
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<td>SSBN-X Reactor Design</td>
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<td>Trident II</td>
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<td>Nuclear Command and Control***</td>
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<td>DoE Nuclear Modernization</td>
<td>$100.1B</td>
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* DoD and CSBA costs shown here do not include the costs of UH-1N or replacement helicopters

** DoD’s estimate includes only the costs of dual-use fighters at bases with a nuclear mission, whereas CSBA’s estimate includes 10% of all dual-use fighter costs

*** DoD’s estimate includes missile warning systems, whereas CSBA’s estimate does not
## Example Savings

<table>
<thead>
<tr>
<th>LEG OF TRIAD</th>
<th>OPTION</th>
<th>NET SAVINGS FY15-19</th>
<th>NET SAVINGS FY20-29</th>
<th>NET SAVINGS FY30-39</th>
<th>TOTAL NET SAVINGS FY15-39</th>
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<tr>
<td>Airborne</td>
<td>Eliminate B61-12 and dual-capable aircraft</td>
<td>$6.3B</td>
<td>$11.4B</td>
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<td>$28.8B</td>
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<td>Eliminate nuclear-capable standoff weapons and delivery systems</td>
<td>$4.3B</td>
<td>$20.3B</td>
<td>$5.2B</td>
<td>$29.7B</td>
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<td>Sea-Based</td>
<td>Reduce SSBN fleet to 10 boats by FY20</td>
<td>$8.1B</td>
<td>$28.8B</td>
<td>-$9.3B</td>
<td>$27.6B</td>
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<td></td>
<td>Reduce SSBN fleet to 10 boats by FY30</td>
<td>$7.9B</td>
<td>$22.9B</td>
<td>-$9.4B</td>
<td>$21.4B</td>
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<tr>
<td></td>
<td>Reduce SSBN fleet to 10 boats by FY40</td>
<td>$0</td>
<td>$0</td>
<td>$16.5B</td>
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<td>Land-Based</td>
<td>Cut one wing of ICBMs and delay follow-on GBSD program by 5 years</td>
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<td>Reduce Minuteman III Test Rate and delay GBSD program by 5 years</td>
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<td><strong>Total</strong></td>
<td></td>
<td><strong>$19.7B</strong></td>
<td><strong>$76.8B</strong></td>
<td><strong>$20.6B</strong></td>
<td><strong>$117.0B</strong></td>
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Conclusions

• Much of the variation among cost estimates for nuclear forces is due to how dual-use systems are treated.

• In our estimate, the cost of U.S. nuclear forces is projected to peak at just under 5% of the total national defense budget.

• Nuclear modernization is affordable within current budget constraints if it remains a priority.

• The savings from potential reductions in nuclear forces and modernization programs accrue largely after the BCA budget caps are set to expire.
Questions?
Data Sources

• Prioritization of data sources used:
  – FY16 Budget Request (FY14-20)
  – Selected Acquisition Reports
  – DoD public statements and press releases
  – Prior studies and cost estimates (RAND, CBO, etc.)
  – Cost of analogous systems
  – Author estimates

• Overall assumptions:
  – Inflation: OMB’s GDP price index, long-term assumed to be 2.0%
  – O&M and MILPERS Growth: 3.0% (consistent with long-term trends)