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# The Future of the U.S. Intercontinental Ballistic Missile Force

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## Summary

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U.S. strategic nuclear forces may factor into a widening set of emerging security situations. Intercontinental ballistic missiles (ICBMs), in particular, may find new relevance in extending deterrence and assuring allies since they present a ready threat to newly emerged nuclear states that choose to base nuclear weapons and their means of delivery in the open or on alert. If these challenges demand more from the U.S. ICBM force than the Minuteman III (MM III) can deliver in a cost-effective way, a number of different classes of alternatives are worth consideration. The upcoming ICBM Analysis of Alternatives (AoA) will have to assess alternatives across a broad set of potential characteristics and situations weighed against the costs of those alternatives.

At the same time that the New Strategic Arms Reduction Treaty (New START) is pushing ICBM force levels to 420 or below, their lowest point in decades, the 2010 Nuclear Posture Review (NPR) identifies a variety of emerging situations in which strategic forces might play a role in deterring adversaries, stabilizing regions, and reassuring allies and partners. The United States' relationship with China is evolving, and with it our understanding of strategic nuclear stability. North Korea acts inconsistently with its assertions of intent to denuclearize the Korean peninsula, and Iran may be on the precipice of a realized nuclear weapon program. Meanwhile, the United States continues to support allies and partner nations with a "credible U.S. 'nuclear umbrella.'"<sup>1</sup> These situations are not independent, and how the United

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<sup>1</sup> Department of Defense (DoD), *Nuclear Posture Review Report*, executive summary, April 2010, p. 12.

States may choose to shape or respond to any one of them may impact other relationships. The drive in the United States to continue to reduce force sizes may compound the problem of balancing these increasingly complex interactions and relationships. The ICBM may have to evolve to support these future situations.

Although the ongoing DoD Service Life Extension Programs (SLEPs) hope to enable the Minuteman III force, which has been in service since the 1970s, to serve until approximately 2030, it is important to begin thinking now about the necessary research, development, and testing of a new missile, as it could easily take a decade or more to field a new system. Procurement and fielding of complete systems can take equally as long. As called for in the NPR, policymakers should already be considering and assessing alternatives for the next-generation ICBM, understanding that adjustments to the U.S. nuclear force posture should be a deliberate policy choice rather than a consequence of budgetary pressures or aging machinery. Meanwhile, any future U.S. ICBM force must meet the twin goals outlined in the NPR of “maintaining strategic deterrence and stability at reduced force levels” and “maintaining a safe, secure and effective nuclear arsenal.”

## The Challenge

Air Force Global Strike Command (AFGSC) will soon begin a formal AoA for the next-generation ICBM. In fiscal year (FY) 2011, AFGSC began pre-AoA analyses with a Capabilities-Based Assessment and an Initial Capabilities Document (ICD) that will help guide the AoA. AFGSC and the Strategic Deterrence and Nuclear Integration Office, Headquarters U.S. Air Force (AF/A10), asked RAND to support these efforts by independently developing operational, organizational, and technological concepts for the future ICBM force. Specifically, RAND was asked to examine and assess possible ICBM alternatives against the current Minuteman III system, including cost drivers and cost parameters, to focus the scope of the AoA. In addition, AF/A10 asked RAND to provide insights into the potential impact of further force reductions on critical nuclear expertise and career fields.

## Our Approach

To narrow the focus of the potentially large set of issues in play, we pursued three lines of research to shed light on the future of the U.S. ICBM:

- Using the current Minuteman III as a baseline, we developed a framework consisting of five categories—basing, propulsion, boost, reentry, and payload—to characterize alternative classes of ICBMs and assess the survivability and effectiveness of possible alternatives.
- Using existing cost analyses and cost data from historic ICBM programs, we derived likely cost bounds on alternative classes of ICBM systems.
- We developed force reduction scenarios and examined their impacts on several key nuclear specialty career fields to understand possible implications of reductions on the current organizational structure.

Our cost analysis is not meant to stand in for an AoA cost analysis. This is merely our attempt to make some broad characterizations about likely budget requirements for any ICBM follow-on.

While we did not identify or derive possible requirements—in fact, AFGSC specifically asked us not to do so—we were able to make some meaningful survivability and effects assessments of some ICBM alternatives. We examined several issues—survivable basing, range and overflight, and conventional strike—without holding to any specific number.

To examine the impact of force-size reductions on manpower, we compared sustainment and requirement profiles within the various reduction scenarios. This analysis should be most relevant to the Air Force because it highlights future organizational issues and decisions that need to be made if the ICBM force continues to shrink below New START levels.

## Results and Findings

### Options for ICBM Modernization

Our initial survey of options and costs suggests that incremental modernization and sustainment of the current Minuteman III force is a cost-effective alternative that should be considered within the AoA. The biggest hurdle currently standing in the way of continued SLEPs to sustain Minuteman III beyond 2030 is the declining number of missile bodies due to required test launches. If 420 Minuteman III missiles are retained for operations, the test inventory will be depleted by 2030. Maintaining a smaller force of 400 missiles would delay this milestone several years to 2035 by making more bodies available for tests; fielding even fewer missiles or reducing the number of annual test launches would proportionately extend the depletion date. Tests are critical to the longevity, readiness, and reliability of the system. While we did not explore whether the current testing requirements could be relaxed, caution should be exercised because reducing the number of tests could limit engineering-level assessments of the effects of aging and the effects of combining new parts with existing parts in any SLEP.

Sustaining Minuteman III through SLEPs and gradual upgrades is a relatively inexpensive way to retain current ICBM capabilities. The AoA should examine this option in more detail, to include expanding SLEPs to silos; nuclear command, control, and communications (NC3); and other support equipment. This report also outlines the operational and cost implications of future design options for ICBM basing, range, payload, and reentry vehicles. However, these options are only relevant if warfighting and deterrence demands push requirements for an ICBM system to beyond what an incrementally modernized Minuteman III can offer.

### Options for Survivable Basing

In assessing basing alternatives against current baseline threats and possible future excursions from that baseline, we find that silo basing will likely continue to be the most cost-effective option for the foreseeable future. Today, only Russia is capable of attacking U.S. ICBMs, and, even in this situation, an attack would require a substantial frac-

tion of Russian reentry vehicles (RVs) under the New START ceiling. Thus, the continuing vulnerability of U.S. ICBMs to a Russian preemptive strike may not be of nearly as much concern as it was during the Cold War, especially since the United States and Russia are no longer implacable enemies. Basing ICBMs in current silos is survivable against all other potential nuclear adversaries. In particular, China is now incapable of such an attack, and will likely remain so for the foreseeable future. The only thing that could move the United States away from its current silo basing is the future evolution of the threat in terms of either quality or quantity. Quantity, of course, has to do with the size of the potential attacking force relative to the total number of silos in the U.S. ICBM fields. Thus, unilateral reductions could affect the survivability of the residual U.S. ICBM force.

### **Options for Effectiveness and Lethality**

While ICBM propulsion will likely continue to be based on solid fuels, boost, reentry, and payload options can add capability to hold a potentially larger class of targets at risk. We find that if overflight of Russia and China remains a dominant issue for ICBMs, the most cost-effective mitigation may be to add launch options to Vandenberg and Cape Canaveral, although this may not completely eliminate the risk. Overflight from current wing locations can be addressed by launching south or changing planes, but both options add significantly to missile size requirements. Because of this, systems other than the ICBM may be more effective in situations where overflight is a critical planning consideration; the flight paths of bombers and submarine-launched ballistic missiles (SLBMs), for example, are not as constrained as those of ICBMs. For payload options, we find that a conventional ICBM only holds at risk a narrowly defined set of targets—those characterized by being relatively stationary and relatively unhardened. The upcoming AoA should therefore focus on the nuclear capabilities necessary to deter attacks from established nuclear powers and to provide an effective counterforce capability against hostile emerging nuclear states in dangerous situations. An AoA could, however, consider conventional payloads as an option for some ICBM designs should the need arise.

### **The Impact of Further Force Reductions**

Realistically, Congressional direction to significantly reduce the DoD budget over the next 12 years may make it difficult to significantly upgrade or replace the current silo-based Minuteman in the near term.<sup>2</sup> While budgetary constraints, along with other factors, could force further reductions of the current Minuteman force below the 400–420 level currently planned to meet the New START limit, only complete closure of an ICBM-only base would result in significant annual operation and support cost savings.

Moreover, of interest to Air Force personnel and career field managers, decreasing the force to or below 300 will impact key nuclear career fields. In the appendix, we show how, as the number of ICBMs decreases, mismatches within the 13S nuclear specialty career field will be exaggerated while mismatches in the 2M0 career field may arise if the Air Force continues current personnel policies. Air Force manpower policies will therefore need to adapt in the case of a decreasing force.

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<sup>2</sup> The Budget Control Act of 2011 contains automatic sequestrations if the Democrats and Republicans do not achieve other budget agreements.