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Continuity and Change in Nuclear Modernization: Ensuring an Effective Future Nuclear Deterrent

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Introduction

The United States is facing an unprecedented strategic challenge. Assumptions about the global environment that drove nuclear modernization decisions in 2010 have turned out to be overly optimistic. Risks and scenarios previously identified only as possibilities in prior *Nuclear Posture Revi*ews (NPRs) are now being realized. More than a dozen years later, the United States faces a very different—and deteriorating—strategic environment.

The 2022 NPR outlines a sobering description:

> …the international security environment has deteriorated in recent years…Our principal competitors continue to expand and diversify their nuclear capabilities… By the 2030s, the United States will, for the first time in its history, face two major nuclear powers as strategic competitors and potential adversaries.

The NPR notes these threats may require changes in our strategy and forces in the future but does not lay out a detailed prescription for what we need to do to ensure a timely response.

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Global events require U.S. decision makers to evaluate the sufficiency of the currently planned nuclear deterrent. This paper argues for evaluating now whether additional capabilities—beyond the programs underway—will be needed to ensure deterrence in the future. The United States also needs to consider strategic responses to the challenges and drive to its strengths—technology and innovation, incorporating advances from the non-nuclear community and private sector—to prepare to bolster U.S. deterrent capability.

2010 NPR

The current nuclear modernization programs were initiated by the Obama Administration in what was seen as a significantly more benign geo-political environment. In a 2009 speech, President Obama said "…the United States will take concrete steps towards a world without nuclear weapons…"[1] The 2010 NPR stated "fundamental changes in the international security environment…enable … lower levels and … reduced reliance on nuclear weapons…. Russia and the U.S. are no longer adversaries…"[2] New START Treaty (NST) ratification efforts were underway; the NPR stated that as the parties reduce under NST, the United States "will pursue negotiations for deeper reductions…"[3]

China's growing nuclear capabilities were also noted—China's "lack of transparency surrounding its nuclear programs…raises questions about China's future strategic intentions"[4] but were not identified as a driving concern.

The 2010 NPR noted that U.S. existing nuclear weapons systems were aging and required replacements in the 2030 timeframe. The current replacement programs, based on the 2010 environment, are underway across the three legs of the TRIAD "simultaneously"[5] and will deliver over the coming decade.

The Obama-proposed modernization programs did generate debate over the design of the new COLUMBIA ballistic missile submarine (SSBN). Each of the 12 new COLUMBIA SSBNs will be equipped with 16 missile tubes for D-5 SLBMs; currently, each of the 14 OHIO SSBNs has 20 missile tubes.[6]

Gen. Robert Kehler, then-Commander of U.S. Strategic Command (USSTRATCOM), testified to Congress that a sub design with "Sixteen [tubes] will meet STRATCOM's requirements."[7] He added, however, that "the capability differences between a 16 and 20 tube configuration would only be relevant in a *significantly deteriorated strategic environment*."[8] [Emphasis added.]

In other words, 16 missile tubes (on each of the 12 COLUMBIA submarines) was considered sufficient for the envisioned future environment. There was little discussion about what a "significantly deteriorated environment" might look like; however, it was acknowledged the United States might need additional nuclear capabilities if future threats evolved differently.[9]

The 2010 NPR announced retirement of one aging system, the nuclear Tomahawk sea-launched cruise missile (TLAM-N), with no replacement.

2018 Nuclear Posture Review

The Trump Administration NPR re-affirmed the Obama modernization programs.[10] It noted, however, a "rapid" and "dramatic" deterioration of the strategic environment and called for additional non-strategic and low yield nuclear capabilities which would "enhance deterrence by signaling to potential adversaries that their limited nuclear escalation offers no exploitable advantage" and to "provide additional diversity in platforms, range, and survivability, and a valuable hedge against future nuclear 'break out' scenarios." [11] It called for:

- A low-yield SLBM warhead (W76-2) to "ensure a prompt response option that is able to penetrate adversary defenses,"[12] and
- A new nuclear-armed sea-launched cruise missile (SLCM-N).

The 2018 NPR also focused heavily on "hedging," stating U.S. nuclear forces played a critical role in providing "capacity to hedge against an uncertain future." It identified different kinds of risks—geo-political, technological, operational, and programmatic; geo-political risk, for example, included the "expansion of adversary nuclear forces, [and] new alignments among adversaries…"[13]

On programmatic risk, the NPR noted that our legacy systems "may age-out…earlier or more precipitously than anticipated."[14] It also noted replacement programs may take longer to produce and deploy than expected and cited "a high degree of concurrency and synchronization" in the programs.[15] Accordingly, it stated that the hedging strategy "requires a framework to continually assess risks and threats, identify whether to accept or mitigate the risks, and guide development of appropriate and effective solutions." [16]

Finally, the 2018 NPR included a focus on the state of the DoE/National Nuclear Security Administration (NNSA) nuclear weapons complex, including the need to produce new plutonium pits to address aging of the current stockpile, stating that "The U.S. will pursue… the enduring capability and capacity to produce plutonium pits at a rate of no fewer than 80 pits per year by 2030…."[17]

2022 NPR

The unclassified 2022 NPR was released in Oct 2022 and notes the "deteriorated" global environment, with our principal competitors expanding and diversifying their nuclear capabilities. The NPR notes the changing nuclear threat includes "novel and destabilizing systems."[18]

It stated that China is now "the overall pacing challenge for US defense planning…[and] has embarked on an ambitious expansion, modernization, and diversification of its nuclear forces. The PRC likely intends to possess ***at least*** [emphasis added] 1,000 deliverable warheads by the end of the decade."[19]

The NPR makes it clear that the United States understands the "evolving" demands of deterrence and that we will "maintain a nuclear posture that is responsive to the threats we face."[20]

The 2022 NPR announced certain programmatic decisions. First, all of the on-going strategic modernization programs were supported, as was the need to sustain legacy systems and restore the NNSA weapons enterprise.

Second, this NPR cancelled one of the 2018 NPR non-strategic nuclear programs. While the review states that the W76-2 SLBM warhead "provides an important means to deter limited nuclear use"[21] and would be retained, the SLCM-N program was described as "no longer necessary given the deterrence contribution of the W-76-2, uncertainty regarding whether SLCM-N on its own would provide leverage to negotiate arms control limits on Russia's NSNW [non-strategic nuclear weapons], and the estimated cost of SLCM-N in light of other nuclear modernization programs and defense priorities."[22]

Cancellation of SLCM-N has raised controversy, with senior military leaders testifying to Congress that it was needed.[23] ADM Richard stated "a deterrence and assurance gap exists…"[24] Secretary of Defense Lloyd Austin, however, testified that "the marginal capability that [SLCM-N] provides is far outweighed by the cost" and that the United States has "the ability to provide options to the president with a number of means."[25]

Third, the 2022 NPR retired the B-83 nuclear gravity bomb, citing "increasing limitations on its capabilities and rising maintenance costs." It states, "in the near term, we will leverage existing capabilities to hold at risk hard and deeply buried targets…and…develop an enduring capability for improved defeat of such targets."[26]

Fourth, the NPR announced that NNSA will initiate a Production-based Resilience Program (PRP) to ensure the nuclear security enterprise is capable of full-scope production.

Finally, the 2022 NPR acknowledges that the emerging two-nuclear peer environment creates the need to evaluate geo-political risks and that new capabilities/adjustments may be necessary for effective deterrence in the future. One administration official stated that the environment "require[s] continued re-evaluation of the threat and re-evaluation of posture."[27] In a change from 2018, the 2022 NPR states "hedging against an uncertain future is no longer a stated role for our nuclear weapons."[28]

At the same time, however, the NPR establishes a new strategy to address risks similar to the previous hedging strategy:

> DoD and NNSA will develop and implement a "Nuclear Deterrent Risk Management Strategy" (NDRMS) to identify, prioritize, and recommend actions across the portfolio of nuclear programs and monitor the overall health of the nuclear deterrent... This strategy will be informed by ongoing assessment of the security environment and early identification of potential risks, with the goal of enhancing senior leader visibility and framing options for risk mitigation.[29]

2022 China Report to Congress

On Nov 29, 2022, DoD released the annual Report to Congress on Military and Security Developments Involving the People's Republic of China. This report adds to the NPR's characterization of China's nuclear buildup ("at least 1000 nuclear warheads by 2030"), noting they expect China will "likely field a stockpile of about 1500 warheads by…2035…" if they continue on the current pace. [30]

In addition, DoD indicates China "probably intends to develop new nuclear warheads and delivery platforms that at least equal the effectiveness, reliability, and/or survivability of some of warheads and delivery platforms currently under development by the United States and/or Russia."[31]

Recommendations

The Biden Administration's NPR leaves little room for disagreement that the strategic environment has deteriorated. The 2022 China Report helps clarify how much further it may deteriorate if China's buildup continues on its current trajectory.

The 2022 NPR also states that the administration will continue to evaluate whether changes in strategy or posture will be needed.

Given the just in time nature of, and concurrency in, the replacement programs and the time and cost to develop additional capabilities, if needed, it is critical to start the dialogue now on whether the deterioration in the environment will be significant enough to warrant additional capability or other adjustments."[32] Recommended steps along these lines follow:

1. Deliver the Baseline and Minimize Transition Risk

First, the United States needs to continue to prioritize the currently fielded strategic systems as well as the replacement acquisition programs. As the 2022 NPR notes,

> …While the US nuclear arsenal remains safe, secure, and effective, most nuclear deterrent systems are operating beyond their original design life. Replacement programs are on track…, but there is little or no margin between the end of effective life of existing systems and the fielding of their replacements.[33]

DoD needs to ensure the replacement programs deliver on time and on budget. This should include helping industry recruit and retain the highest quality workforce on these programs and apply effective management tools to ensure strong supply chains and timely information flow for emerging issues.

The new risk management strategy should include a sustained and effective senior-level forum to monitor the health of both sustainment and acquisition programs and to identify, develop, cost, and track implementable, time-phased risk mitigation options to give to leadership when issues arise (e.g., if an acquisition program schedule slips). [34]

Some schedule risk will likely be realized. For example, Rear Admiral Pappano has noted the limited schedule margin in the COLUMBIA program[35] and the possibility of needing limited life extensions for a small number of OHIO SSBNs.[36]

The inclusion of NNSA in the risk mitigation strategy is critical since risks in the weapons program also affect delivery of the modernized deterrent. NNSA Administrator Jill Hruby said recently "this is the most demanding moment in the history of our nation's nuclear enterprise since the Manhattan Project" and NNSA is "recapitalizing our physical infrastructure to enable the execution of five weapons modernization and life extension programs."[37]

For example, NNSA recently stated the goal of "50 plutonium pits per year by 2030" at the Savannah River Plutonium Processing Facility would not be achievable until sometime between 2032-2035 and that this may require DoD to reuse existing pits, or change the warhead delivery rates, and may have implications for our ability to respond to future changes in the threat.[38]

The risk mitigation strategy should also include the critical enabling capabilities needed for the deterrent (e.g., nuclear command, control, and communications (NC3) systems, non-nuclear components, refueling tankers, supporting infrastructure, etc.), and R&D to remain well ahead of threats.[39]

Finally, Congress needs to be an active partner in execution of this strategy so that they are prepared to support and fund any mitigation steps.

2. Assess Evolving Threat Risk

Given the increasing threat, we should begin the analysis now on whether additional capability will be needed, or put on a warm standby, to address the evolving future environment.

The complexities of these changes, and in particular of a two-peer nuclear environment, could have broad and significant implications for our national security and warrants a comprehensive re-look at our nuclear strategy and posture requirements. This should include modelling and simulation of the potential environments, sufficiency of the programs of record, requirements for non-strategic nuclear forces, and any adjustments that may strengthen deterrence.
This could lead to a need for force posture adjustments, new capabilities, increased quantities, and/or acceleration of schedules for programs already in the pipeline. It is possible this analysis will identify a requirement for a secure second strike response capability for two adversaries[40] and/or a need for larger numbers of deployed warheads.[41]

Pursuit of such options, however, could take time and be hampered by capacity constraints in the enterprise; in-depth evaluation of future requirements should therefore be undertaken now.

This needs to consider our broader national security strategy, technological advances which could affect these issues, and a willingness to revisit prior strategic lessons learned.[42]

Finally, these reviews should also consider next steps in arms control. While it is difficult to see a scenario anytime soon for agreement with Russia given events in Ukraine, the NPR states the U.S. is "placing renewed emphasis on arms control…" and is "ready to expeditiously negotiate a new arms control framework to replace NST when it expires in 2026, although negotiations require a willing partner operating in good faith."[43]

Even if a good faith partner materializes, it is not clear what objectives, if any, the United States should pursue with *only* Russia. The NPR recognizes that China's nuclear buildup—which could approach the NST 1,550 ceiling—"must factor…into our arms control and risk reduction approaches with Russia."[44]

Given the expiration of the New START Treaty in 2026, the United States should identify post-NST objectives now. This should include a net assessment of (1) how Russia (or the United States) could exploit the absence of NST-like limits when it expires; (2) if, and when, additional weapons might be needed (e.g., above NST 1550 limit?); (3) the implications of entering any

new agreement (even if just politically binding) that constrains the United States while China visibly builds to a force of ~1500 warheads; and (4) identification of measures that could strengthen strategic stability in light of adversary developments on new kinds of delivery systems.

3. Signal Strategic Commitment

The United States must make clear it will engage and prevail against the challenges from Russia and China and try to convince them to change course. The United States needs to show that, just as in the Cold War, it will invest and innovate as necessary to ensure that they will not prevail.

Some programmatic signals could include:

1. Strengthen NNSA weapons production complex commitments, including making Plutonium Pit Production a national priority.
2. Expand/strengthen submarine production and maintenance capability. This could reduce risk in COLUMBIA ("supply chain fragility") or allow completion of the 12-boat program early. It could also support attack submarine programs, possibly increasing other long-range strike capabilities.
3. Strengthen strategic missile production capacity (large solid rocket motors, radiation hardened micro-electronics, re-entry systems, cruise missiles), with a focus on modularity, adaptability, and R&D programs that could be incorporated as needed to outpace the threat.
4. Reinvigorate R&D on future kinds of strategic deterrent systems.
5. Prioritize long-range non-nuclear strike systems/capabilities, including hypersonics, that could have strategic affects, (hold the right targets at risk from distance in sufficient quantities to support the integrated deterrence calculation).

Conclusion

It is clear that we are being challenged by Russia and China with a focus on nuclear weapons. The United States needs to demonstrate a "national commitment" to meet this challenge, including fresh thinking on how to apply American strengths.

There are numerous technical, fiscal, and other issues that may make it difficult to accomplish what is proposed here. But to meet this challenge, we must change the bureaucratic "business as usual" mindset to one that focuses on the importance and urgency of the task at hand.

Finally, this has to be a bipartisan effort. The only way to convince our adversaries of U.S. seriousness is to maintain a strong bipartisan consensus on any force modifications, or arms control proposals—or both—which may be needed to ensure deterrence in the future.

[1] The White House, "Remarks By President Barack Obama In Prague As Delivered," April 5, 2009, available at https://obamawhitehouse.archives.gov/the-press-office/remarks-president-barack-obama-prague-delivered.

[2] Department of Defense, *Nuclear Posture Review Report*, April 2010, pp. iv-v, available at https://dod.defense.gov/Portals/1/features/defenseReviews/NPR/2010_Nuclear_Posture_Review_Report.pdf.

[3] Ibid., p. 12.

[4] Ibid., p. v.

[5] DoD Response to GAO Report 22-104061, *NUCLEAR ENTERPRISE: DOD and NNSA Could Further Enhance How They Manage Risk and Prioritize Efforts*, January 2022, p. 50, available at https://www.gao.gov/assets/gao-22-104061.pdf. The COLUMBIA-class ballistic missile submarine will replace the OHIO-class. The Sentinel program will replace the Minuteman III ICBM. The B-21 Raider will replace the B-2 bomber and the Long-Range Standoff (LRSO) weapon will replace the AGM-86 Air-Launched Cruise Missile (ALCM).

[6] See Frank Miller, "Don't Even Think About Redesigning the Columbia SSBN," *Real Clear Defense*, March 31, 2022, available at https://www.realcleardefense.com/articles/2022/03/31/dont_even_think_about_redesigning_the_columbia_ssbn_824714.html.

[7] Responses from Gen. Kehler at HASC Strategic Forces Subcommittee Hearing, March 2, 2011, p. 9, available at https://www.govinfo.gov/content/pkg/CHRG-112hhrg65112/html/CHRG-112hhrg65112.htm.

[8] Ibid., p. 25.

[9] Ibid. Gen. Kehler noted other "levers" (other than the number of SLBM missile tubes on each COLUMBIA) that could be pursued in such situations, including changes in the Air Force legs of the Triad or a future decision could be made to procure additional COLUMBIA SSBNs.

[10] 2018 NPR, op. cit., p. II.

[11] Ibid., p. VI.-XIII

[12] Ibid., p. XII.

[13] Ibid., p. 38.

[14] Ibid.

[15] 2018 NPR, op. cit., p. 37.

[16] Ibid., p. 24. "In Jan 2021, the Acting Secretary of Defense created the Secretary of Defense Nuclear Transition Review to institutionalize a process of quarterly briefings on the DoD Nuclear Enterprise." Government Accountability Office, *Nuclear Enterprise: DoD and NNSA Could Further Enhance How They Manage Risk and Prioritize Efforts,* January 2022, op. cit., p. 18.

[17] 2018 NPR, p. XV.

[18] 2022 NPR. pp. 2-4. On new systems, ADM Richard testified "The [Russian] Avangard HGV, Tsirkon hypersonic anti-ship and land-attack missile, and Kinzahl ALBM are operationally fielded now… work continues on the Skyfall nuclear-powered intercontinental cruise missile and the nuclear-armed Poseidon autonomous underwater vehicle." See ADM Charles Richard, Testimony to the House Appropriations Subcommittee on Defense, April 5, 2022, p. 14. DoD also indicates "The PRC is probably developing advanced nuclear delivery systems…On July 27th, 2021, the PRC conducted a test of an ICBM-range hypersonic glide vehicle that travelled 40,000 kilometers. The test likely demonstrated the PRC's technical ability to field a FOB system." *DoD Annual Report to Congress on Military and Security Developments Involving the People's Republic of China*, November 2022, p. 98.

[19] Ibid., p.4. A broader discussion of nuclear threats, including North Korea, is on pages 4-6.

[20] 2022 NPR, p. 25.

[21] Ibid., p. 20.

[22] Ibid.

[23] See Connor O'Brien, "Top Military Leaders Split with Biden Over Nuke Cruise Missile," *Politico Online*, April 5, 2022, available at https://www.politico.com/news/2022/04/05/nuke-cruise-missile-00023034.

[24] Joe Gould, "US Strategic Command Chief: Sea Missile Cancellation Opens 'Deterrence and Assurance Gap,' *Defense News Online*, April 5, 2022, available at https://www.defensenews.com/pentagon/2022/04/05/us-strategic-command-chief-sea-missile-cancellation-opens-deterrence-and-assurance-gap/.

[25] Connor O'Brien, op. cit.

[26] 2022 NPR, p. 20.

[27] Statement of HON John Plumb before the Senate Armed Services Committee (SASC), Subcommittee on Strategic Forces, May 4, 2022, available at https://www.armed-services.senate.gov/imo/media/doc/ASD%20Plumb%20SASC%20SF%20Missile%20Defense%20Written%20Statement%20-%20May,18%202022_FINAL.pdf.

[28] 2022 NPR, p. 7.

[29] Ibid., p. 23.

[30] *Report to Congress on Military and Security Developments Involving the People's Republic of China*, op. cit., p. IX. While there is likely nuance in what is "counted" here and how it relates to New START counting rules, which China is not a party to, it's worth noting that the U.S. and Russia are each limited to 1,550 deployed nuclear warheads under NST.

[31] Ibid., p. 96.

[32] ADM Richard spelled out the task: "it is clear what we have today is the absolute minimum, and we are going to have to ask ourselves what additional capability, capacity, and posture do we need…" Statement of ADM Charles Richard before the SASC, March 9, 2022, available at https://www.stratcom.mil/Media/Speeches/Article/2960836/usstratcom-and-usspacecom-sasc-testimony/.

[33] 2022 NPR, p.20.

[34] See GAO, op. cit., January 2022.

[35] See Exchange Monitor (online), "One Month of Margin Left on First Columbia Ballistic Missile Submarine, Navy Says," November 3, 2022.

[36] "RADM Pappano: Supply Chain Fragility is No. 1 Risk to COLUMBIA SSBN Program," *Seapower Magazine Online*, November 18, 2021, available at https://portal.ct.gov/OMA/In-the-News/2021-News/Rear-Adm-Pappano-Supply-Chain-Fragility-Is-No-1-Risk-To-Columbia-SSBN-Program#:~:text=%E2%80%94%20The%20admiral%20in%20charge%20of,2%2C%E2%80%9D%20said%20Rear%20Adm.

[37] "Amid geopolitical instability, NNSA looks to industry for new arms control verification tech," Breaking Defense, December 2, 2022, available at https://breakingdefense.com/2022/12/amid-geopolitical-instability-nnsa-looks-to-industry-for-new-arms-control-verification-tech/.

[38] National Nuclear Security Administration, Department of Energy, *Pit Production Contingency Plans, Report to Congress*, October 2021, p. i.

[39] ADM Charles Richard, Testimony to the House Appropriations Subcommittee on Defense, April 5, 2022, op. cit., p. 14.

[40] See Andrew Krepinevich, Jr. "The New Nuclear Age: How China's growing Nuclear Arsenal Threatens Deterrence," *Foreign Affairs*, May/June 2022.

[41] See Miller-Edelman testimony before the SASC, September 20, 2022, p. 8.

[42] See "The Art of the Arms Race: To avoid Disaster, The United States Must Relearn Crucial Cold War Lessons," *Foreign Policy*, July 1, 2022.

[43] 2022 NPR, p. 16.

[44] Ibid., p. 5.

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