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Tailored Deterrence and Low-Cost Nuclear Weapons Upload

Mark B. Schneider
Keith B. Payne



NATIONAL INSTITUTE FOR PUBLIC POLICY

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**Mark B. Schneider
Keith B. Payne**

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Executive Summary

Introduction

Before the end of its tenure, the Biden Administration pointed publicly to the Russian, Chinese and North Korean nuclear force buildups and the potential need to strengthen U.S. nuclear capabilities in response to these threats. These assessments came in the context of Russia's ongoing horrific campaign against Ukraine and Chinese President Xi Jinping's order that China be prepared to invade Taiwan by 2027.

Particularly troubling, the United States may have significantly underestimated Russian and Chinese nuclear capabilities. For example, the extent to which Russia may have uploaded its strategic nuclear forces is uncertain. Moscow had been in violation of the New START Treaty for two years when it illegally "suspended" the entire Treaty. Russia has had sufficient time to upload its strategic force since the last inspection in March 2020.

Contemporary U.S. plans for the modernization of nuclear forces are an approximately 15-year-old legacy of the Obama Administration and they are moving slowly. They were established at a time when many U.S. officials believed that U.S. relations with Russia and China were relatively benign and would remain so, or improve further. Now, there is an emerging Sino-Russian entente, a Russo-North Korean alliance, and extensive Russo-Iranian-North Korean cooperation in a major war against Ukraine, a Western partner. These marriages of convenience are organizing around the clear common intent to overthrow the post-World War II liberal international order.

History has proceeded in a decidedly different direction than expected. There is potential for multiple, simultaneous geopolitical crises and conflicts, and the prospect for deterrence failure is very real. Prudence now demands

strengthening U.S. deterrence and extended deterrence strategies.

Given the diversity of U.S. opponents and related variability in their decision making, the need to “tailor” U.S. deterrence strategies to diverse opponents has become a well-accepted principle of U.S. deterrence policy. This mandates deterrence strategies adapted to the range of threat requirements needed for multiple opponents and contexts—which, in turn, demands deterrence force flexibility and diversity.

While the basic U.S. approach to nuclear deterrence has not significantly changed for decades, Washington’s ability to implement it has drastically declined due to the combination of deep U.S. nuclear weapons reductions and the expansion of opponents’ nuclear and other military forces. The prospect for opportunistic or coordinated Russian, Chinese, and North Korean aggression makes this a particularly urgent concern. Given the looming threats posed by the unprecedentedly dangerous contemporary geopolitical context, and the associated expansion of Russian, Chinese, and North Korean nuclear capabilities, the United States must now consider how to strengthen its nuclear capabilities to preserve deterrence.

Today, the United States reportedly has ~1,660 deployed strategic nuclear weapons. With this level of capability, even with planned U.S. force modernization, the United States likely cannot fully hold at risk Russian and Chinese targets related to deterrence, particularly given Beijing’s new nuclear force expansion and construction of underground facilities.

Nuclear force upload is an advantageous and timely option for deterrence purposes. It is a particularly important option to sustain deterrence in the near term. The potential upload, even under the limits of New START, would provide ~2,200 warheads. The Trident SLBM force reportedly could be uploaded in months and the

Minuteman ICBM force in about three to four years. The follow-on systems can extend the upload of these legacy systems. *Upload is not a substitute for the modernization program* as the existing Triad is aging out rapidly, but it may be critical for deterrence in the near term.

The New START Treaty and Upload

Significant U.S. upload now requires prompt U.S. withdrawal from the expiring (in February 2026) New START Treaty. Russia has ceased observing New START, violated its verification provisions, and may be in violation of its warhead limits. Consequently, the United States certainly has the legal right to terminate the Treaty and the strategic need to do so.

Upload is largely limited by the available number of delivery vehicles, i.e., missiles and bombers. The 2002 Moscow Treaty intentionally did not limit delivery vehicles in order to facilitate a prompt U.S. response to negative security developments. The 2001 *Nuclear Posture Review* (NPR) similarly emphasized retaining upload potential (called the “responsive force”) as a hedge against an uncertain future, and stated that U.S. forces could be uploaded in “weeks, months and years.” Unfortunately, the 2010 New START Treaty did the opposite. Given New START’s limit on *accountable*, deployed warheads (1,550), the United States can upload its strategic missile force by only 131 warheads. The ~2,200 potential upload under New START is possible because of the Treaty’s very lenient counting rules that apply to bomber weapons.

If the United States continues observation of New START limits despite Russian violations (and China’s dramatic nuclear buildup), the only way to substantially increase the number of deployed U.S. nuclear weapons would be to procure many more nuclear-capable bombers and cruise missiles. Yet, more cruise missiles are not feasible

until the Long-Range Stand-Off (LRSO) missile is operational (2030). Until then, a small number of B-21 bombers (with a probable *nuclear-capable* IOC in the late 2020s) can likely carry eight nuclear bombs each, based upon the reported size and payload of the B-21 bomber.

The Scope of Possible U.S. Warhead Upload

If not constrained by New START, with uploading, the Trident SLBM force reportedly could increase from ~960 to ~1,626 deployed warheads and the Minuteman ICBM force could increase from about 400 to ~1,000 deployed warheads, for a deployed strategic ballistic missile force of ~2,626 warheads. The number of warheads could be somewhat higher or lower than these estimates depending upon decisions related to necessary missile range and the required number of single warhead missiles. Additionally, there will be several hundred bomber weapons which could be somewhat increased via uploading.

In the past, the bomber force could be uploaded in a matter of weeks. However, a 2007 decision eliminated all but 528 nuclear ALCMs (now reduced by almost 20 years of testing) and all Advanced Cruise Missiles, thereby eliminating much of what otherwise would be the *most rapid* U.S. upload potential. Nevertheless, the bomber upload, with or without New START, would likely now permit ~716-~784 bomber warheads.

Table 1 below compares routine strategic force loading with the upload potential at low cost. Table 2 summarizes the potential U.S. upload, also at low cost, with and without New START. (See Appendix A for Tables 1 and 2 references.). The number of warheads could be higher or lower than these estimates depending upon decisions related to necessary missile range, targeting flexibility, and warhead footprint considerations.

Table 1: Routine Strategic Force Loading and Upload Potential at Low Cost

Routine Force Loading Under New START				Potential Uploading		
Delivery Vehicle	Number of Delivery Vehicles	Weapons Per Delivery Vehicle	Total Weapons	Weapons Capacity Per Delivery Vehicle	Total Weapons Capacity	Potential Warhead Increase Beyond Current Routine
Trident D5 SLBM	240	~4 W76 or W88	~960	8 W76 or W88	1,920 (~1,626) ^(e)	960 (658) ^(e)
Minuteman III ICBM	400	1 W78 or W87	400	1 W87 or 3 W78	~1,000 ^(b)	~600 ^(d)
B-52H Bomber	44	20 ALCM w/ W80 ^(a)	0 (~300) ^(a)	20 ALCM w/ W80	528 (~460) ^(c)	528 (~460)
B-2 Bomber	19 (16) ^(a)	16 B61 or B83 ^(a)		16 B61 or B83	256	256
Total Weapons	~1,360 warheads + ~300 Bombs and ALCMs = ~1,660 total				~3,342 to ~3,704	~1,974 to ~2,344

Notes

- (a) Sixteen B-2 bombers are combat coded which means they are maintained in a combat ready status for nuclear and conventional strikes. On a day-to-day basis, deployed bombers are not loaded with nuclear gravity bombs or cruise missiles, although these weapons are kept in storage facilities in or near bomber air bases. Reportedly, there are ~300 nuclear weapons deployed at the three nuclear-capable bomber bases. There are no bombers maintained exclusively for the nuclear mission. In light of the conventional role of the B-2s, diverting all combat coded B-2s to the nuclear deterrence mission is unlikely.
- (b) Three hundred Minuteman III ICBMs could carry up to three W-78/Mark 12A warheads each. Each remaining missile can carry only a single W87/Mark 21 warhead.
- (c) Each B-52H can carry up to 20 nuclear ALCMs. A 2007 decision resulted in the retention of 528 ALCMs but these have been reduced as a result of 18 years of testing. The number will continue to decline until LR5Os are deployed in the early 2030s. To deploy 460 nuclear ALCMs would require about 24 B-52s. This leaves 20 combat coded B-52s for conventional missions.
- (d) In addition to the 400 deployed Minuteman III silos and their deployed missiles, 50 silos will be retained in a non-deployed but "warm" status, with their non-deployed missiles kept in storage. If the missiles were returned to the silos, and each missile was armed with one warhead, the upload potential of the Minuteman III force would increase by 50 weapons.
- (e) The maximum upload capability is 1920; 1,626 assumes that the number of W88/Mark 5 warheads is reduced to give missiles with both warhead configurations about the same range.

Table 2: Prompt and Low-Cost Upload Potential of the Deployed U.S. Strategic Nuclear Force With and Without New START Constraints

	Routine Force Loading Under New START			Uploading		
Delivery Vehicle	Number of Delivery Vehicles	Weapons Per Delivery Vehicle	Total Weapons	Weapons Per Delivery Vehicle	Upload With New START	Upload Without New START
Trident D5 SLBM	240	~4 W76 or W88	~960	8 W76 or W88	~1,086 ^(b)	~1,920 (~1,626) ^(d)
Minuteman III ICBM	400	1 W78 or W87	400	1 W87 or 3 W78	400 ^(b)	~1,000 ^(e)
B-52H Bomber	44	20 ALCM w/ W80 ^(a)	0 (~300) ^(a)	20 ALCM w/ W80	528 (~460) ^(c)	528 (~460)
B-2 Bomber	19 (16) ^(a)	16 B61 or B83 ^(a)		16 B61 or B83	256	256
Total Weapons	~1,360 warheads + ~300 Bombs and ALCMs = ~1,660 total				~2,202	~3,342 to ~3,704

Notes

- (a) Sixteen B-2 bombers are combat coded which means they are maintained in a combat ready status for nuclear and conventional strikes. On a day-to-day basis, deployed bombers are not loaded with nuclear gravity bombs or cruise missiles, although these weapons are kept in storage facilities in or near bomber air bases. Reportedly, there are ~300 nuclear weapons deployed at the three nuclear-capable bomber bases. Bombs at bomber bases can be uploaded in days. There are no bombers maintained exclusively for the nuclear mission. In light of the conventional role of the B-2s, diverting all combat coded B-2s to the nuclear deterrence mission is unlikely.
- (b) Assumes all uploaded warheads are added to Trident SLBMs because this is faster, cheaper and more survivable.
- (c) Each B-52H can carry up to 20 nuclear ALCMs. A 2007 decision resulted in the retention of 528 ALCMs but these have been reduced as a result of 18 years of testing. The number will continue to decline until LR5Os are deployed in the early 2030s.
- (d) The maximum upload capability is 1920. The number 1,626 assumes that the number of W88/Mark 5 warheads is reduced to give missiles with both warhead configurations about the same range.
- (e) In addition to the 400 deployed Minuteman III silos and their deployed missiles, 50 silos will be retained in a non-deployed but "warm" status, with their non-deployed missiles kept in storage. If the missiles were returned to the silos, and each missile was armed with one warhead, the upload potential of the Minuteman III force would increase by 50 weapons.

These numbers are not necessarily the largest possible loadings, but they are reasonable maximums when the necessary range and the impact of range reduction on submarine survivability are taken into account. For example, while each Trident missile reportedly can carry 14 warheads, this may not be the case in practice because of the possible decrease in missile range.

The Costs of Upload

The cost of upload would be quite modest—largely transportation and warhead installation. An August 2020 report of the Congressional Budget Office (CBO) concluded that: 1) expanding nuclear forces to the Moscow Treaty limit (2,200) warheads “would not increase the Department of Defense’s (DoD’s) costs relative to its current plans....”; and 2) “Increasing warhead loadings to reach the START II limits [3,500 warheads] would incur about \$100 million in onetime costs for DoD.” Moreover, the \$100 million would be spent over a period of several years. The CBO indicated there were some long-term sustainment costs, but they would be in the 2040s. It should be noted that during the Biden Administration there was high inflation that was not anticipated in the 2020 cost estimates.

The U.S. Nuclear Modernization Program and Upload

U.S. strategic nuclear forces could be fully uploaded before the first element of the planned modernization program becomes operational, which is not being pursued with urgency. With limited exceptions, that program will not provide significant new capabilities; rather it will largely provide more of the same. The planned 12 Columbia-class submarines will carry fewer missiles and are “...the absolute minimum required to meet [the] strategic guidance.” As General Anthony Cotton observed, the modernization program is the product of the Obama Administration’s 2010 *Nuclear Posture Review Report* (NPR) which assumed, as did previous NPRs, benign great power relations.

Bomber Weapons

To preserve deterrence credibility, the 2018 *Nuclear Posture Review* directed the Defense Department “to prioritize its nuclear hedge planning” to (among other things) retain “the ability to penetrate adversary defenses...” To do so at relatively low cost, and in near term pending the fielding of LRSO and SLCM-N, the United States must explore mating an existing cruise missile frame with an existing nuclear weapon. To support deterrence now, placing a portion of the bombers on alert also is important to increase U.S. force survivability and resilience, i.e., a portion of U.S. bombers must be put on a sustainable alert.

In this context, it may be important to note that near-term ICBM and SLBM upload would provide expanded missile capabilities to suppress opponents’ air/missile defenses, and thereby help mitigate opponents’ questions about the U.S. capability to deliver weapons against advanced defenses-questions that could otherwise undermine deterrence.

Hard and Deeply Buried Targets (HDBTs)

The nuclear-armed authoritarian leaders depend upon Hard and Deeply Buried Targets (HDBTs) to assure their survival. China, for example, has thousands of advanced underground facilities (UGFs) and constructs more each year. According to the Pentagon, these UGFs are central to China’s counter intervention and power projection efforts, enabling the PLA to protect valuable assets from the threat of missile strikes and conceal military operations.

Increasing the U.S. capacity to hold UGFs at risk in the near term is another reason upload can contribute to deterrence. HDBTs are important targets to hold at risk in this regard because they may protect what some adversaries value most. Any expectation that they can serve as reliable

sanctuaries is very likely to degrade the effectiveness of U.S. deterrence strategies. The weapons that may have held HDBTs at risk during the Cold War—the Peacekeeper ICBM, the Advanced Cruise Missile and the multi-megaton B53—are no longer available to upload. Nevertheless, Minuteman and subsequently Sentinel uploading can provide expanded coverage against the number of UGFs that can be held at risk via attack by one or more weapons.

Yield Diversity

To deter adversaries that are increasingly deploying nuclear forces geared for warfighting, the United States needs diverse capabilities, including variable yield systems. A variety of yields enhances flexibility and adaptability, thereby facilitating the potential for tailoring deterrence. Variable yields can also reduce collateral damage—potentially strengthening the credibility of U.S. deterrence strategies.

Upload can increase yield diversity somewhat by permitting more low-yield Trident warheads. It is critical for increasing U.S. low-yield capabilities in a timely way. Retention of the B83 and W88 would help. More significant would be, at low cost, to give the new W93 and the W87-1 warheads variable yields, but they are likely a decade or more away. The new nuclear sea-launched cruise missile (SLCM-N) will provide much-needed low-yield nuclear capability. However, the new SLCM-N may not be deployed until 2034. While only a small number of low-yield W76-2s were produced, with termination of New START, upload could rapidly increase severalfold the number of survivable low-yield weapons: more W76-2s could be produced and modified W76-1s could become low-yield weapons.

High Delivery Accuracy

High delivery accuracy also increases deterrence strategy adaptability and targeting flexibility. Enhancing the accuracy of the ballistic missile force would likely strengthen the U.S. nuclear deterrent by increasing damage expectancy against many types of hard targets; in combination with lower-yield weapons, it could also increase the credibility of U.S. deterrence strategies by reducing collateral damage. The B61-12 and B61-13 are now the only U.S. precision nuclear weapons. The new Sentinel ICBM and warhead package reportedly will be considerably more accurate than the 1970-vintage Minuteman III; if so, Sentinel uploading would provide additional weapons with greater accuracy. Uploading ICBM and SLBMs would expand U.S. capabilities with accuracy and additional numbers could help compensate for inadequate accuracy via two-on-one targeting in some scenarios.

Dealing with the Non-Strategic Nuclear Threat

Russia has a “vast arsenal of non-strategic nuclear weapons.” Most estimates range from 2,000 (the official number) to 10,000 – 10 to 50 times the reported U.S. number. In February 2024, General Cotton said China “...has approximately 1,000 medium- and intermediate-range dual-capable...ballistic missiles....” China may also possess nuclear-capable cruise missiles, short-range ballistic missiles, and gravity bombs. These capabilities would allow Russia and/or China to launch many types of attacks against U.S. allies – to which Washington would likely not be able to respond promptly or effectively with non-strategic systems. That reality poses a threat to deterrence, particularly extended deterrence, given the likely need for

low-yield, regional U.S. nuclear options for credible deterrence in regional contingencies.

Given Russian, Chinese and North Korean theater nuclear escalation options, the United States needs more non-strategic nuclear capability for credible extended deterrence purposes. The nuclear SLCM-N program may be accelerated if the existing TLAM Block 5 SLCM is given a nuclear capability. This is a very important possible step, as is providing a stealthy stand-off nuclear capability for NATO's Dual-Capable Aircraft (DCA). However, strategic force upload may be a helpful, near-term – albeit partial – means to strengthen extended deterrence. That is, uploading Trident could provide additional low-yield targeting capabilities much more quickly than other possible options. Doing so would likely contribute significantly to extended deterrence credibility as future U.S. regional options mature.

Extended Deterrence in the Indo-Pacific

There are no U.S. nuclear weapons deployed in the Indo-Pacific region and there is a serious question of whether the United States has *any real* capability for *timely* deployment of capabilities to the theater. This gives Russia, China and North Korea dangerous coercive leverage as they expand, diversify and improve their nuclear capabilities. The Congressional Strategic Posture Commission rightly concluded that there is an “urgent need” for U.S. theater nuclear forces to be “deployed or based in the Asia-Pacific theater.”

None of the U.S. INF-range ballistic, cruise or hypersonic missile programs are nuclear capable. The way the United States is doing business today, there is likely no possibility of giving any of them nuclear capability by the possible 2027 timeline for a Chinese invasion of Taiwan, and the current strategic modernization program is unlikely to

provide any new capability in 2027 other than the new versions of the B61 bomb.

In the near term, inexpensive warhead upload may be the only available option to help sustain nuclear deterrence in this theater. If the United States starts soon, all of the Trident force and almost half of the Minuteman force likely could be uploaded by mid-2027. While not sufficient, this could help to enhance extended deterrence in the near term and reduce the prospect of nuclear proliferation by desperate allies.

Conclusion

A prudent deterrence response to an unprecedented threat context involving the potential for opportunistic or coordinated aggression and the long-standing Russian and Chinese nuclear buildups includes nuclear weapons upload of legacy and future forces. This is a near-term option to redress the looming nuclear imbalance and threats to deterrence. It likely is impossible, for example, to hold at risk the increasingly large number of Chinese and Russian deterrence-related assets, including nuclear weapons and facilities, with a New START Treaty-limited force. The United States must proceed with the planned nuclear modernization program. But, it likely will be too slow and ultimately too limited for confident deterrence in a rapidly worsening threat environment. At this point, nuclear upload is likely the only way America can adequately enhance the force size and flexibility needed to tailor deterrence in the near term for the prevention of great power conflict, including major aggression against U.S. allies. And, absent upload, the United States will realize only about half of the potential benefit from the planned modernization program in terms of warhead numbers.

Introduction

Before the end of its tenure, the Biden Administration pointed publicly to Russian, Chinese and North Korean nuclear force buildups and the potential need to strengthen U.S. nuclear capabilities in response. In 2024, for example, Pranay Vaddi, then-Special Assistant to then-President Biden, stated that, “Russia, the PRC and North Korea are all expanding and diversifying their nuclear arsenals at a breakneck pace—showing little or no interest in arms control.”¹ In August 2024, Acting Assistant Secretary of Defense for Space Policy Vipin Narang observed that, “We have begun exploring options to increase future launcher capacity or additional deployed warheads—on the land, sea, and air legs—that could offer national leadership increased flexibility if executed.”² The November 2024 Biden Administration nuclear weapons employment guidance report stated “...it may be necessary to adapt current U.S. force capability, posture, composition, or size in order to be able to fulfill the three stated roles of nuclear weapons.”³ These assessments came in the context of Russia’s on going horrific campaign against Ukraine and

¹ Pranay Vaddi, “Adapting the U.S. Approach to Arms Control and Nonproliferation to a New Era,” Arms Control Association, June 7, 2024, available at <https://www.armscontrol.org/2024AnnualMeeting/Pranay-Vaddi-remarks>.

² “Nuclear Threats and the Role of Allies’: Remarks by Acting Assistant Secretary of Defense for Space Policy Dr. Vipin Narang at CSIS,” August 1, 2024, available at <https://www.defense.gov/News/Speeches/Speech/Article/3858311/nuclear-threats-and-the-role-of-allies-remarks-by-acting-assistant-secretary-of/>.

³ U.S. Department of Defense, “Report on the Nuclear Employment Strategy of the United States,” November 2024, p. 4, available at <https://media.defense.gov/2024/Nov/15/2003584623/-1/-1/1/REPORT-ON-THE-NUCLEAR-EMPLOYMENT-STRATEGY-OF-THE-UNITED-STATES.PDF>.

China's President Xi Jinping's order that China be prepared to invade Taiwan by 2027.⁴ Nevertheless, the Biden Administration left taking actions in this regard to the Trump Administration.⁵

As ominous as these assessments are, the United States may significantly underestimate Russian and Chinese nuclear capabilities. There is precedent for underestimation: at the end of the Cold War, when Russia revealed the size of the Soviet nuclear arsenal, it became clear that Washington had underestimated it by 17,000 warheads.⁶ Today, Russia and China may each have twice as many nuclear warheads as reported by the Department of Defense (DoD) and the Federation of American Scientists, respectively.⁷ Russia is well ahead of the United States in nuclear weapons and China is rapidly closing the gap.⁸ The DoD's estimate of 600+ Chinese nuclear weapons in mid-

⁴ Olivia Victoria Gazis, "CIA Director William Burns: 'I wouldn't underestimate' Xi's ambitions for Taiwan," *CBS News*, February 23, 2023, available at <https://www.cbsnews.com/news/cia-director-william-burns-i-wouldnt-underestimate-xis-ambitions-for-taiwan/>.

⁵ Michael R. Gordon, "U.S. Must Be Prepared to Expand Nuclear-Weapons Force, Biden Officials Say," *The Wall Street Journal*, November 15, 2024, available at <https://www.wsj.com/politics/national-security/u-s-must-be-prepared-to-expand-nuclear-weapons-force-biden-officials-say-3f317fc9>.

⁶ Houston T. Hawkins, *Rethinking the Unthinkable* (Los Alamos, NM: Los Alamos National Laboratory, July 23, 2014), p. 8, available at <https://www.osti.gov/biblio/1148302>.

⁷ Mark B. Schneider, "The Chinese Nuclear Arsenal: More DoD Nuclear Threat Minimization," *RealClearDefense*, March 1, 2025, available at https://www.realcleardefense.com/articles/2025/03/01/the_chinese_nuclear_arsenal_more_dod_nuclear_threat_minimization_1094753.html; and Mark B. Schneider, *How Many Nuclear Weapons Does Russia Have? The Size and Characteristics of the Russian Nuclear Stockpile* (Fairfax, VA: National Institute Press, 2023), available at <https://nipp.org/wp-content/uploads/2023/09/Vol.-3-No.-8.pdf>.

⁸ *Ibid.*

2024 is already a year out of date.⁹ A straight-line projection of its estimates of Chinese nuclear warheads growth over the last several years (~100 a year) would result in 900+ Chinese nuclear warheads in mid-2027. Since the United States cannot commit all of its nuclear weapons to deterring China only, this is a dangerous development.

More concerning still, the extent to which Russia may have uploaded its strategic nuclear forces is uncertain. Russia had been in violation of the New START Treaty for two years when it illegally “suspended” the entire Treaty,¹⁰ including on-site inspections which actually ended in March 2020.¹¹ This has created a large uncertainty concerning the number of deployed Russian nuclear warheads. This reality is a reflection of the fact that Russian arms control violations have been all too common. The 2023 bipartisan Congressional Strategic Posture Commission report summarized this: “Over the past 20 years, Russia has either violated or has failed to comply with nearly every

⁹ U.S. Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China*, December 2024, p. IX, available at <https://media.defense.gov/2024/Dec/18/2003615520/-1/-1/0/MILITARY-AND-SECURITY-DEVELOPMENTS-INVOLVING-THE-PEOPLES-REPUBLIC-OF-CHINA-2024.PDF>.

¹⁰ U.S. Department of State, Office of the Spokesperson, “Russian Noncompliance with and Invalid Suspension of the New START Treaty,” Fact Sheet, June 1, 2023, available at <https://2021-2025.state.gov/russian-noncompliance-with-and-invalid-suspension-of-the-new-start-treaty/>.

¹¹ U.S. Department of State, “Report to Congress on Implementation of the New START Treaty Pursuant to paragraph (a)(10) of the Senate’s Resolution of Advice and Consent to Ratification of the New START Treaty (Treaty Doc. 111-5) NEW START TREATY ANNUAL IMPLEMENTATION REPORT,” January 20, 2023, p. 8, available at <https://www.state.gov/wp-content/uploads/2023/01/2022-New-START-Implementation-Report.pdf>.

major arms control treaty or agreement to which the United States is or was a party.”¹²

The Biden State Department argued that the United States could adequately monitor the number of deployed Russian warheads without on-site inspections and that Russia was complying with the deployed warhead limit. This claim began to unravel openly in November 2024 when a Defense Intelligence Agency (DIA) report stated that Russia “...maintains about 1,550 deployed strategic nuclear warheads on ICBMs and submarine-launched ballistic missiles (SLBMs), as well as a force of heavy bombers which are capable of carrying long-range air-launched cruise missiles (ALCMs).”¹³ Since 1,550 is the New START limit on all accountable deployed weapons, the DIA’s assessment indicates Russia is violating the Treaty limit. In early 2025, TASS revealed that Russia had operational SS-19 ICBMs,¹⁴ which would put Russia further above the Treaty limit.

In January 2025, the Biden State Department, apparently in anticipation of the Trump Administration, issued a report that grudgingly acknowledged that Russia “...may have exceeded the deployed warhead limit by a small number

¹² Madelyn Creedon and Jon Kyl, et al., Congressional Commission on the Strategic Posture of the United States, *America’s Strategic Posture, The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Alexandria, VA: Institute for Defense Analysis, 2023), p. 84, available at <https://www.ida.org/-/media/feature/publications/a/am/americas-strategic-posture/strategic-posture-commission-report.ashx>.

¹³ Defense Intelligence Agency, “Nuclear Challenges – The Growing Capabilities of Strategic Competitors and Regional Rivals,” November 2024, p. IX, available at https://www.dia.mil/Portals/110/Images/News/Military_Powers_Publications/Nuclear_Challenges_2024.pdf.

¹⁴ Pavel Podvig, “Old UR-100NUTTH may still be in service,” *Russian Forces.org*, February 6, 2025, available at https://russianforces.org/blog/2025/02/old_ur-100nutth_may_still_be_i.shtml.

during portions of 2024....”¹⁵ Yet, it also stated that, “The United States assesses with high confidence that Russia did not engage in any large-scale activity above the Treaty limits in 2024....” That “high confidence” claim is not credible given the collapse of the New START Treaty’s verification regime – which, even when in effect, left room for uncertainty. In 2010, then-Senator Christopher Bond (R-MO) stated that, “As the vice chairman of this committee [the Senate Select Committee on Intelligence], I have reviewed the key intelligence on our ability to monitor this treaty [New START] and heard from our intelligence professionals. There is no doubt in my mind that the United States cannot reliably verify the treaty’s 1,550 limit on deployed warheads.”¹⁶ In 2020, former Under Secretary of State and chief New START Treaty negotiator Rose Gottemoeller said “...we discarded the counting rules in favor of confirming declared warheads on the front of missiles through reciprocal inspections; in fact, we did not need telemetry measures to confirm compliance with the warhead limits in the new treaty.”¹⁷ Gottemoeller estimated Russia could otherwise covertly add several hundred to 1,000 warheads through upload.¹⁸ Substantially higher

¹⁵ U.S. Department of State, “2024 Report to Congress on Implementation of the New START Treaty,” January 17, 2025, available at <https://2021-2025.state.gov/2024-report-to-congress-on-implementation-of-the-new-start-treaty/>.

¹⁶ Christopher Bond, “The New START Treaty,” *The Congressional Record*, November 18, 2010, available at <https://www.congress.gov/111/crec/2010/11/18/CREC-2010-11-18-pt1-PgS8093.pdf>.

¹⁷ Rose Gottemoeller, “The New START Verification Regime: How Good Is It?,” *Bulletin of the Atomic Scientists*, May 21, 2020, available at <https://thebulletin.org/2020/05/the-new-startverification-regime-how-good-is-it/>.

¹⁸ Rose Gottemoeller, U.S. Congress, *The Importance of the New START Treaty* (Washington, D.C.: House Committee on Foreign Affairs, December 4, 2019), p. 61, available at

numbers actually appear possible.¹⁹ With no New START Treaty on-site inspections since March 2020, Russia could have uploaded much of its strategic nuclear force.²⁰

Contemporary U.S. plans for the modernization of nuclear forces are an approximately 15-year-old legacy of the Obama Administration and are moving slowly. They were established at a time when many U.S. officials believed that U.S. relations with Russia and China were relatively benign and would remain so, or improve further. However, in contrast to the United States, Moscow and Beijing have been expanding their nuclear arsenals for over a decade and appear to view nuclear weapons as coercive tools for expansion.²¹ China appears intent on taking Taiwan by force, if necessary.²² Moscow frequently issues audacious nuclear threats and Russia's doctrinal statements emphasize a steady lowering of the threshold for nuclear employment.²³ This will likely also be true with regard to

<https://www.congress.gov/116/meeting/house/110302/documents/CHRG-116hrg38543.pdf>.

¹⁹ Schneider, *How Many Nuclear Weapons Does Russia Have?*, op. cit., pp. xiii, 86, 91, 132, 133, 135-147.

²⁰ Mark B. Schneider, "Red Flag: State Department Report on Russian New START Treaty Compliance," *RealClearDefense*, February 3, 2025, available at https://www.realcleardefense.com/articles/2025/02/04/red_flag_state_department_report_on_russian_new_start_treaty_compliance_1089158.html.

²¹ See the discussion in Keith B. Payne and David Trachtenberg, *Deterrence in the Emerging Threat Environment: What is New and What is Different*, Occasional Paper, Vol. 2, No. 8, (Fairfax, VA: National Institute Press, August 2022) available at <https://nipp.org/papers/deterrence-in-the-emerging-threat-environment-what-is-different-and-why-it-matters/>.

²² "Xi says no one can stop China's 'reunification' with Taiwan," *Reuters*, December 31, 2024, available at <https://www.reuters.com/world/china/xi-says-no-one-can-stop-chinas-reunification-with-taiwan-2024-12-31/>.

²³ Mark B. Schneider, "The Implications of Russia's New Nuclear Doctrine," *Information Series*, No. 615 (Fairfax, VA: National Institute

China if there is a crisis/conflict over Taiwan. There is an emerging Sino-Russian entente, a Russo-North Korean alliance, and extensive Russo-Iranian-North Korean cooperation in a major war against Ukraine, a Western partner. These marriages of convenience are organizing around the clear common intent to overthrow the post-World War II liberal international order.²⁴ As two former Biden senior national security officials have recently concluded, “The United States now faces a Category 5 hurricane of nuclear threats.”²⁵

Because history has proceeded decidedly differently than expected, U.S. deterrence strategies are now problematic and the prospect for significant failure is very real. There is potential for multiple, simultaneous geopolitical crises and conflicts; prudence now demands strengthening U.S. deterrence and extended deterrence strategies. Prior to departure, the Biden Administration essentially reached the same conclusion.²⁶

Press, February 5, 2025), available at https://nipp.org/information_series/mark-b-schneider-the-implications-of-russias-new-nuclear-doctrine-no-615-february-5-2025/.

²⁴ See Keith B. Payne, “Deterrence and Arms Control: Ending the Deceptive ‘Holiday from History,’” *Information Series*, No. 616 (Fairfax, VA: National Institute Press, February 10, 2025), available at https://nipp.org/information_series/keith-b-payne-deterrence-and-arms-control-ending-the-deceptive-holiday-from-history-no-616-february-10-2025/.

²⁵ Vipin Narang and Pranay Vaddi, “How to Survive the New Nuclear Age,” *Foreign Affairs* (July/August 2025), available at <https://www.foreignaffairs.com/united-states/how-survive-new-nuclear-age-narang-vaddi>.

²⁶ See, Department of Defense, “Report on the Nuclear Employment Strategy of the United States,” November 2024, op. cit., p. 4. “In an evolving security environment with multiple adversaries who are making nuclear weapons more central to their national security strategies, it may be necessary to adapt current U.S. force capability, posture, composition, or size in order to be able to fulfill the three stated roles of nuclear weapons.”

Expanding Nuclear Deterrence Requirements

The basic U.S. approach to nuclear deterrence has not significantly changed for decades.²⁷ In 2012, former STRATCOM Commander Admiral Richard Mies (Ret.), wrote that U.S. targeting doctrine was "...designed to hold at risk our potential adversaries' military forces, war-supporting industry, command and control capabilities, and military and while minimizing to the maximum extent collateral damage to population and civilian infrastructure."²⁸ In 2013, the Obama Administration's nuclear weapons employment policy stated, "The new guidance requires the United States to maintain significant counterforce capabilities against potential adversaries."²⁹ The 2024 Biden Administration's nuclear employment guidance said, "The Guidance continues to emphasize the need to, first and foremost, hold at risk what adversaries value most. It also reiterates the need to maintain counterforce capabilities to reduce potential adversaries' ability to employ nuclear weapons against the United States and its allies and partners, and does not rely on a counter-value or minimum-deterrence approach."³⁰

While this basic U.S. approach to deterrence has not changed much over many years, Washington's ability to

²⁷ See the excellent review in, Franklin Miller, "Counterforce and Countervalue in U.S. targeting: A Historical Review," in, *Counterforce in Contemporary U.S. Nuclear Strategy*, Brad Roberts, ed. (Livermore, CA: Lawrence Livermore National Laboratory, 2025), pp. 21-37.

²⁸ Admiral Richard Mies, USN (Ret.), "Strategic Deterrence in the 21st Century," *Undersea Warfare*, Spring 2012, p. 15, available at https://issuu.com/julianne.m.johnson/docs/usw_spring_2012.

²⁹ U.S. Department of Defense, "Report on the Nuclear Employment Strategy of the United States Specified in Section 491 of 10 U.S.C.," 2013, p. 4, available at <https://man.fas.org/eprint/employ.pdf>.

³⁰ Department of Defense, "Report on the Nuclear Employment Strategy of the United States," November 2024, op. cit., p. 3.

implement it has drastically declined due to the combination of deep U.S. nuclear weapons reductions and the expansion of opponents' nuclear and other military forces. A 2012 report concluded that the United States needed approximately 2,700-3,000 deployed strategic nuclear warheads because of the requirement to hold at risk adversary "hardened and mobile targets with high confidence...."³¹ This assessment, if even only approximately correct at the time, undercounts contemporary requirements as it occurred well before contemporary geopolitical hostilities, the Sino-Russian entente, and the large Chinese nuclear buildup—and the new deterrence requirements they generate.

For example, it may be impossible for U.S. strategic nuclear forces, if they are modernized on a replacement basis, to cover these new targets in a timely way. The existing Minuteman force likely was fully committed for decades before the new Chinese silos were discovered. Even when the Minuteman is entirely replaced by Sentinel (well into the 2030s), it would likely have to be uploaded (i.e., MIRVed) to cover the numerous new Chinese ICBMs and some of the underground facilities. Four hundred single warhead Sentinels would have a higher damage expectancy against up to 400 targets, but without upload they could not threaten 401 targets much less another 370 Chinese silos and other underground facilities that may be considerably hardened.

Given the looming threats posed by the unprecedented contemporary geopolitical context, and the associated expansion of Russian, Chinese, and North Korean nuclear capabilities, the United States must now consider how to strengthen its nuclear capabilities to preserve deterrence.

³¹ Rebecca Heinrichs and Baker Spring, "Deterrence and Nuclear Targeting in the 21st Century," (Washington, D.C.: The Heritage Foundation, November 30, 2012), available at <https://www.heritage.org/node/12067/print-display>.

Thomas Schelling's classic principle that deterrence can be based on a "threat that leaves something to chance,"³² i.e., that deterrence threats need *not* be logically credible to be effective, has been reflected in U.S. extended deterrence strategies for decades. However, when powerful opponents are cooperating, driven by the common goal of reordering the global order, and willing to use force despite the risks, deterrence likely needs to be more credible than a "threat that leaves something to chance."

The bipartisan Strategic Posture Commission's 2023 report rightly concluded that the existing 15-year-old modernization program of record is "necessary but not sufficient,"³³ and that the United States needs both to upload its strategic nuclear missiles and enhance its nuclear modernization program. It recommended:

First, the Commission recommends that the Air Force and Navy exercise uploading ICBM and SLBM warheads [and], Prepare to upload some or all of the nation's hedge warheads.

The current modernization program should be supplemented to ensure U.S. nuclear strategy remains effective in a two-nuclear-peer environment.

To avoid additional risk and meet emerging challenges, the United States must act now to pursue additional measures and programs. Additional measures beyond the planned modernization of strategic delivery vehicles and warheads may include either or both qualitative and

³² See, Thomas Schelling, *The Strategy of Conflict* (Cambridge, MA: Harvard University Press, 1960), pp. 187-188.

³³ Creedon and Kyl, et al., Congressional Commission on the Strategic Posture of the United States, *America's Strategic Posture, The Final Report of the Congressional Commission on the Strategic Posture of the United States*, op. cit., p. 84.

quantitative adjustments in the U.S. strategic posture.

The U.S. strategic nuclear force posture should be modified to: Address the larger number of targets due to the growing Chinese nuclear threat.

[T]he current POR [Program of Record] is not a like-for-like transition in capacity, and may demand more SSBNs [nuclear ballistic missile submarines] if the United States chooses to deploy additional missiles and nuclear warheads.

Increase the planned production of Columbia SSBNs and their Trident ballistic missile systems, and accelerate development and deployment of D5LE2 [Trident D-5 Life Extension Program II].

Increase the planned number of B-21 bombers [beyond the program number of 100] and the tankers an expanded force would require.

Initiate planning and preparations for a portion of the future bomber fleet to be on continuous alert status, in time for the B-21 Full Operational Capability (FOC) date.

Plan to deploy the Sentinel ICBM in a MIRVed configuration.

Increase the planned number of deployed Long-Range Standoff Weapons [LRSOs].

Address the need for U.S. theater nuclear forces deployed or based in the Asia-Pacific theater.

Finally, the U.S. theater nuclear force posture should be modified in order to provide the President a range of militarily effective response options to

deter or counter Russian or Chinese limited nuclear use in theater.³⁴

U.S. Strategic Command Commander General Anthony Cotton favors 145 B-21s, more LRSO nuclear cruise missiles, deploying the B-52J faster and more Columbia-class nuclear missile submarines.³⁵ He noted that the number of LRSOs was set in 2010 before China embarked on an aggressive campaign of building strategic weapons and developing new hypersonic missiles. Some of these recommendations, including those in the Congressional Strategic Posture Commission report, might be reduced or complemented by warhead upload, particularly if they are based on an assumption of existing New START constraints which force more expensive and slower options than upload.

Tailoring Deterrence and Its Requirements

Given the diversity of U.S. opponents and related variability in their decision making, the need to “tailor” U.S. deterrence strategies to diverse opponents has become a well-accepted principle of U.S. deterrence policy on a bipartisan basis.³⁶ Recent tabletop exercises confirm the criticality of tailoring deterrence to different opponents and different contexts.³⁷

³⁴ Ibid., pp. viii, 34, 35, 43, 45, 46, 48.

³⁵ John A. Tirpak, “STRATCOM Chief: Air Force Needs 145 B-21s and More New Strategic Systems,” *Air and Space Forces.com*, March 18, 2025, available at <https://www.airandspaceforces.com/stratcom-chief-b-21s-lrso-strategic-systems/>.

³⁶ See for example, Creedon and Kyl, et al., *The Final Report of the Congressional Commission on the Strategic Posture of the United States*, op. cit., pp. 27, 33.

³⁷ Markus Garlauskas, Lauren Gilbert, and Kyoko Imal, *A rising nuclear double-threat in east Asia : Insights from our Guardian Tiger I and II tabletop exercises*, Atlantic Council, May 2025, available at <https://www.atlanticcouncil.org/wp-content/uploads/2025/05/A->

Tailoring deterrence mandates strategies that can adapt to the range of threat requirements needed for multiple opponents and contexts—which, in turn, demands deterrence force flexibility and diversity.³⁸ The Biden Administration rightly concluded that, “The requirement to develop and maintain a tailored deterrence strategy in support of both deliberate and adaptive nuclear planning in a dynamic security environment requires nuclear capabilities that are highly flexible and that can support a wide range of employment options.”³⁹ Enhancing force flexibility and planning adaptability to support tailored deterrence against multiple opponents, in turn, demands diverse forces with resilience, accuracy, and various yields; these capabilities are critically dependent on the planned modernization. However, that modernization program will not bear much fruit until the early-to-mid 2030s—well past, for example, the 2027 date China’s President Xi Jinping’s has identified for absorbing Taiwan.⁴⁰

rising-nuclear-double-threat-in-East-Asia-Insights-from-our-Guardian-Tiger-I-and-II-tabletop-exercises.pdf.

³⁸ For the initial post-Cold War discussions of the need for “tailoring deterrence” and its requirements, see, Keith B. Payne, “Deterring Emerging Nuclear Actors?,” Presentation at the Strategic Options Assessment Conference, sponsored by U.S. Strategic Command, Dougherty Conference Center, Offutt Air Force Base, July 7, 1993; and Keith B. Payne, *Deterrence in the Second Nuclear Age* (Lexington, KY: University Press of Kentucky, 1996), pp. 123-129. See also, Department of Defense, *Deterrence Operations: Joint Operating Concept* (DO JOC), Version 2.0 (August 2006), p. 3, available at https://www.jcs.mil/Portals/36/Documents/Doctrine/concepts/joc_deterrence.pdf. For a later discussion see, M. Elain Bunn, “Can Deterrence be Tailored?,” *Strategic Forum*, National Defense University, No. 225 (January 2007), pp. 1-8.

³⁹ Department of Defense, “Report on the Nuclear Employment Strategy of the United States,” November 2024, op. cit., p. 4.

⁴⁰ Gazis, “CIA Director William Burns: ‘I wouldn’t underestimate’ Xi’s ambitions for Taiwan,” op. cit.

The United States reportedly has ~1,660 deployed strategic nuclear weapons (~1,360 missile warheads and ~300 bomber weapons.)⁴¹ As concluded by the Strategic Posture Commission, one avenue to help increase needed U.S. deterrence capabilities in the near term is uploading existing and follow-on missiles and bombers. Upload is limited in this regard: two of the most capable Cold War counterforce capable missiles—the Peacekeeper ICBM and the Advanced Cruise Missile—were eliminated and are now unavailable for upload.

Nevertheless, upload is an advantageous and timely option. For example, it can considerably enhance U.S. targeting capabilities against China and Russia (including the 370 new Chinese ICBM silos⁴² and some portion of the thousands of new underground facilities) well before realization of significant nuclear improvements from the modernization program. Indeed, the U.S. upload potential can serve multiple purposes associated with sustaining an effective U.S. deterrence strategy. It can help to: 1) hedge against the possible breakout of Russian and Chinese forces and related extant or future intelligence failures; 2) increase the U.S. capability and flexibility to hold diverse targets at risk for deterrence purposes; 3) increase the survivability and resilience of nuclear weapons; 4) increase damage expectancy against diverse target sets; 5) enhance counterforce capability, particularly against hard and deeply buried targets (HDBTs); 6) enhance defense

⁴¹ See Table 1 below. See also Hans M. Kristensen, Matt Korda, Eliana Johns and Mackenzie Knight, “United States nuclear weapons 2025,” *Bulletin of the Atomic Scientists*, March 2025, Vol. 81, No. 1, p. 53, available at <https://doi.org/10.1080/00963402.2024.2441624>.

⁴² U.S. Department of Defense, *Military and Security Developments Involving the People’s Republic of China*, 2024, p. 101, available at <https://media.defense.gov/2024/Dec/18/2003615520/-1/-1/0/MILITARY-AND-SECURITY-DEVELOPMENTS-INVOLVING-THE-PEOPLES-REPUBLIC-OF-CHINA-2024.PDF>.

suppression potential; and 7) help preserve the credibility of U.S. extended deterrence commitments.⁴³

What upload cannot do is change the nature of the U.S. strategic forces, modernize them or make them more diverse to deal with the spectrum of new threats. Upload is not a substitute for modernization. But, it is a near-term avenue to increase U.S. nuclear deterrence capabilities relatively quickly and at modest cost. Other recommendations tend to be longer term and more expensive than upload.

The New START Treaty and Upload

Upload is largely limited by the available number of delivery vehicles, i.e., missiles and bombers. The 2002 Moscow Treaty did not limit delivery vehicles, facilitating the potential for a prompt U.S. response to negative security developments.⁴⁴ In line with the Moscow Treaty, the 2001 *Nuclear Posture Review* (NPR) cut by two-thirds U.S. deployed strategic nuclear weapons, but emphasized retaining upload potential (called the “responsive force”) as a hedge against an uncertain future, and stated that U.S. forces could be uploaded in “weeks, months and years.”⁴⁵

⁴³ Mark B. Schneider, “The October 2023 Strategic Commission Report and U.S. Nuclear Weapons Requirements,” *Information Series*, No. 568 (Fairfax, VA: National Institute Press, December 1, 2023), available at https://nipp.org/information_series/mark-b-schneider-the-october-2023-strategic-commission-report-and-u-s-nuclear-weapons-requirements-no-568-december-1-2023/.

⁴⁴ U.S. Department of State, “Comparison of the START Treaty, Moscow Treaty, and New START Treaty,” Fact Sheet. Bureau of Verification, Compliance, and Implementation, April 8, 2010, available at <https://2009-2017.state.gov/t/avc/rls/139901.htm>.

⁴⁵ Donald H. Rumsfeld, *Annual Report to the President and the Congress* (Washington, D.C.: Department of Defense, 2002), p. 90, available at https://history.defense.gov/Portals/70/Documents/annual_reports/2002_DoD_AR.pdf?ver=2014-06-24-153732-117.

Unfortunately, the New START Treaty did the opposite, reducing the potential U.S. “responsive force.” The only reductions in *operational* forces that existed when New START entered into force in 2011 were made solely by the United States. This included four launchers on each Trident missile submarine. Russia already was below the New START Treaty limit on accountable, deployed weapons (1,550) and deployed delivery vehicle limits (700) when the Treaty entered into force.⁴⁶ All Russia had to eliminate were 65 non-deployed weapons that already were inoperable. This, sadly, was considered a negotiating success by much of Washington’s establishment.

Significant U.S. upload now requires prompt withdrawal from the expiring (in February 2026) New START Treaty, which, as noted above, Russia has ceased observing, has violated its verification provisions, and may be in violation of its weapons limits—giving the United States the clear legal right to terminate it. Based on the last available official data concerning the number of U.S. deployed strategic nuclear warheads (from 2023),⁴⁷ the United States can upload its strategic missile force by only 131 warheads given New START’s limit on accountable, deployed weapons (1,550). If the United States were to continue observation of New START limits despite Russian violations (and China’s dramatic nuclear buildup), the only way to substantially increase the number of deployed U.S.

⁴⁶ U.S. Department of State, “New START Treaty Aggregate Numbers of Strategic Offensive Arms,” Fact Sheet, Bureau of Arms Control, Verification, and Compliance, June 1, 2011, available at <https://2009-2017.state.gov/t/avc/rls/164722.htm>.

⁴⁷ U.S. Department of State, “Report to Congress on Implementation of the New START Treaty Pursuant to paragraph (a)(10) of the Senate’s Resolution of Advice and Consent to Ratification of the New START Treaty (Treaty Doc. 111-5) NEW START TREATY ANNUAL IMPLEMENTATION REPORT,” January 31, 2024. p. 4, available at <https://www.state.gov/wp-content/uploads/2024/01/2023-New-START-Treaty-Implementation-Report.pdf>.

nuclear weapons would be to procure many more nuclear-capable bombers and cruise missiles. However, it appears that more cruise missiles are not feasible until the LRSO is operational (2030).⁴⁸ Until then, a small number of B-21 bombers (with a probable *nuclear-capable* IOC in the late 2020s) can likely carry eight nuclear bombs each, based upon the reported size and payload of the B-21 bomber.⁴⁹

The modernization program is critical to preserving the long-term viability of the U.S. deterrent, which, at this point, is rapidly aging out, but it provides little near-term increased capability—a problem that upload can help address at modest cost.

The Scope of Possible U.S. Warhead Upload

If not constrained by New START, with uploading, the Trident SLBM force reportedly could increase from ~968 to ~1,626 deployed warheads and the Minuteman ICBM force could increase from about 400 to ~1,000 deployed warheads, for a deployed strategic ballistic missile force of ~2,626 warheads.⁵⁰ The Trident force reportedly could be

⁴⁸ General Anthony J. Cotton, Testimony before the Subcommittee on Strategic Forces, Senate Armed Services Committee, March 26, 2025, p. 13, available at https://www.armed-services.senate.gov/imo/media/doc/testimony_of_general_anthony_j_cotton2.pdf.

⁴⁹ Christian Orr, “B-21 Raider: Why the Air Force Needs This 6th-Gen Bomber Now,” *1945.com*, December 17, 2024, available at <https://www.19fortyfive.com/2024/12/b-21-raider-why-the-air-force-needs-this-6th-gen-bomber-now/>.

⁵⁰ Keith B. Payne and Mark B. Schneider, “U.S. Nuclear Deterrence: What Went Wrong and What Can Be Done?,” *Information Series*, No. 601 (Fairfax, VA: National Institute Press, October 7, 2024), available at https://nipp.org/information_series/keith-b-payne-and-mark-b-schneider-u-s-nuclear-deterrence-what-went-wrong-and-what-can-be-done-no-601-october-7-2024/.

uploaded in months and the Minuteman force in about three to four years.⁵¹ It is important to emphasize that the number of warheads could be higher or lower than these estimates depending upon decisions related to necessary missile range, targeting flexibility, and warhead footprint considerations, and the required number of single warhead missiles. Additionally, there will be several hundred bomber weapons which could be somewhat increased via uploading.

It is possible to reconstitute some U.S. nuclear capability (e.g., Trident missile launchers), eliminated under the New START Treaty. The reconciliation version of the House and Senate Armed Services Committee's FY2026 authorization bill provides "\$62,000,000 to convert Ohio-class submarine tubes to accept additional missiles."⁵² This would add 56 deployed Trident missiles, when available, with ~448 warheads to the ~2,606 mentioned above.

These calculations are based upon unclassified, agreed START and START II Treaty missile warhead accountability numbers. The numbers are not necessarily the largest possible loadings, but they are reasonable maximums when the necessary range and the impact of range reduction on submarine survivability are taken into account. For example, while each Trident missile reportedly can carry 14 warheads,⁵³ this may not be the case in practice because of the possible decrease in missile range. Another driving

⁵¹ As reported in, Peter Huessy, "Arms Control Challenges: Past & Present," *Warrior Maven*, June 8, 2023, available at <https://warriormaven.com/global-security/arms-control-nuclear-deterrence>.

⁵² "Amendment in the Nature of a Substitute to the Committee Print Offered by Mr. Rogers of Alabama," 2025, p. 28, available at https://armedservices.house.gov/UploadedFiles/Bill_Text.pdf.

⁵³ Brett Tingley, "First Improved W88 Nuclear Warhead For Navy's Trident Missiles Rolls Off The Assembly Line," *The War Zone*, July 14, 2021, available at <https://www.twz.com/41531/first-improved-w88-nuclear-warhead-for-navys-trident-missiles-rolls-off-the-assembly-line>.

factor in the above-referenced analysis was limitation of additional costs.

In the past, the bomber force could be uploaded in a matter of weeks.⁵⁴ However, a 2007 decision eliminated all but 528 nuclear ALCMs (now reduced by almost 20 years of testing) and all Advanced Cruise Missiles, eliminating much of what otherwise would be the *most rapid* U.S. upload potential.⁵⁵ Moreover, only a part of the bomber force likely can be devoted to the nuclear mission because of its important conventional role. The prompt and inexpensive upload for the strategic bomber force, with or without New START, would likely provide ~716~784 bomber weapons.

The current bomber modernization program involves 100 planned B-21s (replacing the B-1s and B-2s) and the 46 nuclear-capable B-52Js. The B-52H and the future B-52J modification can carry 20 nuclear cruise missiles. As noted above, each B-21 probably can carry eight nuclear bombs. The Air Force reportedly plans to make only 20 percent of the 100 planned B-21s immediately nuclear capable.⁵⁶ More

⁵⁴ "Gen. John A. Gordon, USAF (Ret.), Administrator, National Nuclear Security Administration, written response for the record, in Senate Armed Services Committee, Department of Defense Authorization for Appropriations for Fiscal Year 2003, Part 1, S. Hrg. 107-696, Pt. 1, 107th Cong., 2nd session," (Washington, D.C.: GPO, 2003), p. 378; and J.D. Crouch II, Assistant Secretary of Defense for International Security Policy, "Challenges of a New Capability-Based Defense Strategy: 'Transforming US Strategic Forces,'" briefing, National Defense Industrial Association 2003 Science & Engineering Technology Conference, March 5, 2003, slide 21, available at <http://www.dtic.mil/ndia/2003science/crouch.pdf>.

⁵⁵ Senate Armed Services Committee, Statement of Major General Roger Burg, March 28, 2007. p. 8, available at <https://www.airandspaceforces.com/PDF/testimony/Documents/2007/March%202007/032807Burg.pdf>.

⁵⁶ Peter Huessy, *ICBM EAR Christmas and New Year's Edition*, Week of December 27th, 2024, *ICBM Ear*, December 27, 2024, available at <https://geostrategicanalysis.substack.com/p/icbm-ear-report-week-of-december>.

B-21s probably will have to be made nuclear capable at relatively modest costs. The nuclear capability of another 30 B-52s eliminated under New START reportedly can be restored.⁵⁷

In 2023, the Biden Administration revealed that the U.S. nuclear stockpile, defined as “active” and “inactive” weapons, was 3,748.⁵⁸ The report states, “Active warheads include strategic and non-strategic weapons maintained in an operational, ready-for-use configuration, warheads that must be ready for possible deployment within a short timeframe, and logistics spares. They have tritium bottles and other Limited Life Components installed. Inactive warheads are maintained at a depot in a non-operational status and have their tritium bottles removed.” This represents a *de facto* limit on *rapid and inexpensive* U.S. upload. (Some of the 2,000 U.S. nuclear weapons awaiting dismantlement may be usable but this would require technical analysis of the state of the weapons.)

Table 1 below compares routine strategic force loading with the upload potential at low cost. Table 2 illustrates the potential U.S. upload, also at low cost, with and without New START. (See Appendix A for Tables 1 and 2 references.) The number of warheads could be higher or lower than these estimates depending upon decisions related to necessary missile range, targeting flexibility, and warhead footprint considerations.

⁵⁷ Bryant Harris and Stephen Losey, “Congress wants to restore nukes on conventional B-52 bombers,” *Defense News*, June 18, 2024, available at <https://www.defensenews.com/air/2024/06/18/congress-wants-to-restore-nukes-on-conventional-b-52-bombers/>.

⁵⁸ National Nuclear Security Administration, “Transparency in the U.S. Nuclear Weapons Stockpile,” July 2024, available at <https://www.energy.gov/nnsa/transparency-us-nuclear-weapons-stockpile>.

Table 1: Routine Strategic Force Loading and Upload Potential at Low Cost

Routine Force Loading Under New START				Potential Uploading		
Delivery Vehicle	Number of Delivery Vehicles	Weapons Per Delivery Vehicle	Total Weapons	Weapons Capacity Per Delivery Vehicle	Total Weapons Capacity	Potential Warhead Increase Beyond Current Routine
Trident D5 SLBM	240	~4 W76 or W88	~960	8 W76 or W88	1,920 (~1,626) ^(e)	960 (658) ^(e)
Minuteman III ICBM	400	1 W78 or W87	400	1 W87 or 3 W78	~1,000 ^(b)	~600 ^(d)
B-52H Bomber	44	20 ALCM w/ W80 ^(a)	0 (~300) ^(a)	20 ALCM w/ W80	528 (~460) ^(c)	528 (~460)
B-2 Bomber	19 (16) ^(a)	16 B61 or B83 ^(a)		16 B61 or B83	256	256
Total Weapons	~1,360 warheads + ~300 Bombs and ALCMs = ~1,660 total				~3,342 to ~3,704	~1,974 to ~2,344

Notes

- (a) Sixteen B-2 bombers are combat coded which means they are maintained in a combat ready status for nuclear and conventional strikes. On a day-to-day basis, deployed bombers are not loaded with nuclear gravity bombs or cruise missiles, although these weapons are kept in storage facilities in or near bomber air bases. Reportedly, there are ~300 nuclear weapons deployed at the three nuclear-capable bomber bases. There are no bombers maintained exclusively for the nuclear mission. In light of the conventional role of the B-2s, diverting all combat coded B-2s to the nuclear deterrence mission is unlikely.
- (b) Three hundred Minuteman III ICBMs could carry up to three W-78/Mark 12A warheads each. Each remaining missile can carry only a single W87/Mark 21 warhead.
- (c) Each B-52H can carry up to 20 nuclear ALCMs. A 2007 decision resulted in the retention of 528 ALCMs but these have been reduced as a result of 18 years of testing. The number will continue to decline until LRSOs are deployed in the early 2030s. To deploy 460 nuclear ALCMs would require about 24 B-52s. This leaves 20 combat coded B-52s for conventional missions.
- (d) In addition to the 400 deployed Minuteman III silos and their deployed missiles, 50 silos will be retained in a non-deployed but 'warm' status, with their non-deployed missiles kept in storage. If the missiles were returned to the silos, and each missile was armed with one warhead, the upload potential of the Minuteman III force would increase by 50 weapons.
- (e) The maximum upload capability is 1920; 1,626 assumes that the number of W88/Mark 5 warheads is reduced to give missiles with both warhead configurations about the same range.

Table 2: Prompt and Low-Cost Upload Potential of the Deployed U.S. Strategic Nuclear Force With and Without New START Constraints

	Routine Force Loading Under New START			Uploading		
Delivery Vehicle	Number of Delivery Vehicles	Weapons Per Delivery Vehicle	Total Weapons	Weapons Per Delivery Vehicle	Upload With New START	Upload Without New START
Trident D5 SLBM	240	~4 W76 or W88	~960	8 W76 or W88	~1,086 ^(b)	~1,920 (~1,626) ^(d)
Minuteman III ICBM	400	1 W78 or W87	400	1 W87 or 3 W78	400 ^(b)	~1,000 ^(e)
B-52H Bomber	44	20 ALCM w/ W80 ^(a)	0 (~300) ^(a)	20 ALCM w/ W80	528 (~460) ^(c)	528 (~460)
B-2 Bomber	19 (16) ^(a)	16 B61 or B83 ^(a)		16 B61 or B83	256	256
Total Weapons	~1,360 warheads + ~300 Bombs and ALCMs = ~1,660 total				~2,202	~3,342 to ~3,704

Notes

- (a) Sixteen B-2 bombers are combat coded which means they are maintained in a combat ready status for nuclear and conventional strikes. On a day-to-day basis, deployed bombers are not loaded with nuclear gravity bombs or cruise missiles, although these weapons are kept in storage facilities in or near bomber air bases. Reportedly, there are ~300 nuclear weapons deployed at the three nuclear-capable bomber bases. Bombs at bomber bases can be uploaded in days. There are no bombers maintained exclusively for the nuclear mission. In light of the conventional role of the B-2s, diverting all combat coded B-2s to the nuclear deterrence mission is unlikely.
- (b) Assumes all uploaded warheads are added to Trident SLBMs because this is faster, cheaper and more survivable.
- (c) Each B-52H can carry up to 20 nuclear ALCMs. A 2007 decision resulted in the retention of 528 ALCMs but these have been reduced as a result of 18 years of testing. The number will continue to decline until LRSOs are deployed in the early 2030s.
- (d) The maximum upload capability is 1920. The number 1,626 assumes that the number of W88/Mark 5 warheads is reduced to give missiles with both warhead configurations about the same range.
- (e) In addition to the 400 deployed Minuteman III silos and their deployed missiles, 50 silos will be retained in a non-deployed but "warm" status, with their non-deployed missiles kept in storage. If the missiles were returned to the silos, and each missile was armed with one warhead, the upload potential of the Minuteman III force would increase by 50 weapons.

To restore a U.S. strategic nuclear force with more than about 3,500 warheads, more Columbia-class missile submarines, LRSOs and nuclear bombs must be produced and/or the B83 bombs must be retained and eventually life extended.

The ability to sustain upload indefinitely depends on a number of factors, including the number of warheads that are life extended or newly produced for Minuteman and the Sentinel ICBM which will replace it. To achieve a *full* upload of Minuteman and subsequently Sentinel, the

United States must increase pit (the fissile material component of a nuclear weapon) production or further life extend the W78. The current plan to restore a capability (currently near zero) to produce 80 pits a year by the early 2030s is inadequate.⁵⁹

During the Cold War, the United States produced thousands a year and Russia has increased its production capability to thousands a year.⁶⁰ The Sentinel will carry the W87 and the modified W87-1 which requires a new pit, as does the W93. (The W93 reportedly will replace both Trident warheads).⁶¹ Ironically, the more new pits that are required, the smaller the U.S. arsenal will become, given the state of U.S. pit production. There may be some work-arounds including going to two or three shift day production, but more production capability is essential.

The Costs of Upload

The cost of uploading the legacy strategic forces to over 3,000 weapons, according to an earlier estimate, would be quite modest at approximately \$100 million—largely for transportation and warhead installation. An August 2020 report of the Congressional Budget Office (CBO) concluded

⁵⁹ See the interview of Tom Scheber in, “Interviews,” *Journal of Policy & Strategy*, Vol. 5, No. 2 (Fairfax, VA: National Institute Press, 2025), available at <https://nipp.org/wp-content/uploads/2025/06/Interviews-5.2.pdf>.

⁶⁰ Lt. Gen. Robert P. Ashley, Jr., “Russian and Chinese Nuclear Modernization Trends,” (Washington, D.C.: Defense Intelligence Agency, May 29, 2019), available at <https://www.dia.mil/Articles/Speeches-and-Testimonies/Article/1859890/russian-and-chinese-nuclear-modernization-trends/>.

⁶¹ Kris Osborn, “Pentagon Engineers New W-93 Nuclear Warhead for Trident II D5 Missile,” *Warrior Maven*, April 24, 2025, available at <https://warriormaven.com/air/pentagon-engineers-new-w-93-nuclear-warhead-for-trident-ii-d5-missile>.

that: 1) expanding nuclear forces to the Moscow Treaty limit (2,200) warheads “would not increase the Department of Defense’s (DoD’s) costs relative to its current plans....”; and 2) “Increasing warhead loadings to reach the START II limits [3,500 warheads] would incur about \$100 million in onetime costs for DoD.”⁶² Moreover, the \$100 million would be spent over a period of several years. The CBO indicated there were some long-term sustainment costs, but they would be in the 2040s. It should be noted that the high inflation during the Biden Administration was not anticipated in the CBO’s 2020 cost estimates.

The CBO estimated that the cost of going to the START Treaty limit (6,000 weapons) would be \$88 to \$149 billion. This represents force expansion rather than upload because it about doubles U.S. delivery vehicles to 1,600. The 6,000 number is for accountable weapons. The *de facto* START Treaty deployed weapons limit is about 10,000 if the United States produced more nuclear weapons and cruise missiles and made all B-21s nuclear capable. To assess options for increasing the number of deployed nuclear delivery vehicles, the 2023 Congressional Strategic Posture Commission report provides a more up-to-date and comprehensive analysis than the CBO study.

The U.S. Nuclear Modernization Program and Upload

The following looks at potential changes to the modernization program which in combination with upload could enhance the U.S. capacity to tailor effective deterrence strategies, e.g., via force flexibility and adaptability. The focus here is on low-cost options.

⁶² Congressional Budget Office, “The Potential Costs of Expanding U.S. Strategic Nuclear Forces If the New START Treaty Expires,” August 2020, available at <https://www.cbo.gov/system/files/2020-08/56475-START.pdf>.

U.S. strategic nuclear forces could be fully uploaded before the first element of the planned modernization program becomes operational, which is not yet being pursued with urgency. With limited exceptions, that program will not provide significant new capabilities; rather it will largely provide more of the same. For example, it will *not* provide hypersonic (or apparently even supersonic) nuclear-capable missiles or a new submarine-launched ballistic missile (SLBM).

The United States pursues cycles of nuclear force modernization, which have been separated by decades. This is in contrast to Russian and Chinese practice, which typically involves continuous modernization and two or three different systems for each leg of their nuclear Triads.⁶³ The cyclical nature of U.S. modernization programs now makes upload more important for Washington.

General Cotton observed that the modernization program is the product of the Obama Administration's 2010 *Nuclear Posture Review Report* (NPR) which assumed, as did the previous NPRs, benign great power relations.⁶⁴ As late as the Trump Administration's 2018 NPR, China was assessed to have only 200 nuclear weapons.⁶⁵ Few at the time expressed any expectation that China planned a large nuclear expansion. General Cotton has linked the Chinese nuclear buildup to President Xi Jinping's order that China be ready to invade Taiwan in 2027.⁶⁶

⁶³ *Nuclear Challenges*, op. cit., pp. VII, 1-18.

⁶⁴ See the discussion in, Keith B. Payne and John S. Foster, Jr., *A New Nuclear Review for a New Age* (Fairfax, VA: National Institute Press, 2017), p. 22, available at <https://nipp.org/wp-content/uploads/2021/03/A-New-Nuclear-Review-final.pdf>.

⁶⁵ *Nuclear Challenges*, op. cit., p. IX.

⁶⁶ Senate Armed Services Committee, "Statement of General Anthony J. Cotton," March 26, 2025, p. 3, available at https://www.armed-services.senate.gov/imo/media/doc/testimony_of_general_anthony_j_cotton2.pdf.

The 2010 NPR wisely preserved the nuclear Triad but, nevertheless, allowed it to erode. It directed no nuclear testing, minimum changes in the life-extended warheads and no “new nuclear warheads.”⁶⁷ U.S. nuclear adversaries clearly have not observed these constraints. The prohibition on nuclear testing continues despite the fact that both the Trump and Biden Administrations concluded that Russia was conducting yield-producing nuclear tests and there are official concerns about Chinese testing.⁶⁸

Bomber Weapons

To preserve deterrence credibility, the 2018 *Nuclear Posture Review* directed the Defense Department “to prioritize its nuclear hedge planning” to (among other things) retain “the ability to penetrate adversary defenses....”⁶⁹ Holding at risk heavily defended targets independently via bomber weapons demands stand-off capabilities, speed, and stealth. To do so at relatively low cost, and in near term pending the fielding of LRSO and SLCM-N, the United States should explore mating an existing cruise missile frame with an existing nuclear weapon.

⁶⁷ U.S. Department of Defense, *Nuclear Posture Review Report*, 2010, p. vi, xiv, available at https://nuke.fas.org/guide/usa/2010_npr_report.pdf.

⁶⁸ U.S. Department of State, *Adherence and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements*, 2020, pp. 46-52, available at <https://www.state.gov/wp-content/uploads/2022/04/2022-Adherence-to-and-Compliance-with-Arms-Control-Nonproliferation-and-Disarmament-Agreements-and-Commitments-1.pdf>; and, U.S. Department of State, *Adherence and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements*, 2022, pp. 29-30, available at <https://www.state.gov/wp-content/uploads/2022/04/2022-Adherence-to-and-Compliance-with-Arms-Control-Nonproliferation-and-Disarmament-Agreements-and-Commitments-1.pdf>.

⁶⁹ U.S. Department of Defense, *Nuclear Posture Review*, 2018, p. 40, available at <https://media.defense.gov/2018/Feb/02/2001872886/-1/-1/1/2018-NUCLEAR-POSTURE-REVIEW-FINAL-REPORT.PDF>.

To support deterrence now, placing a portion of the bombers on alert also is important to increase U.S. force survivability and resilience, i.e., a portion of U.S. bombers must be put on a sustainable alert. This could include, for example, 20 B-52s armed with 20 ALCMs each. Unfortunately, the U.S. bomber capability has eroded to the point that the United States cannot now sustain a nuclear alert for more than a short time. A sustained alert would likely require additional crews, security, maintainers, spare parts, tankers (e.g., on alert), and infrastructure improvements.⁷⁰ These requirements must be addressed urgently.

The Biden Administration program of record for bombers nearly zeroed funding for research and development on the nuclear-capable B-2 and the non-nuclear B-1, and cut R&D funding by about 50 percent for the nuclear-capable B-52.⁷¹ The possible implication of this is that, as opponent air defenses improve, U.S. bomber capability could decline until significant numbers of nuclear-capable B-21s become operational.

In this context, it may be important to note that near-term ICBM and SLBM upload could provide expanded missile capabilities to suppress opponents' air/missile defenses, and thereby help mitigate opponents' questions about the U.S. capability to deliver weapons against advanced defenses—questions that otherwise could undermine deterrence.

⁷⁰ Oriana Pawlyk, "Putting Nuclear Bombers Back on 24-Hour Alert Would Exhaust the Force, General Says," *Military Com*, April 22, 2021, available at <https://www.military.com/daily-news/2021/04/22/putting-nuclear-bombers-back-24-hour-alert-would-exhaust-force-general-says.html>.

⁷¹ Lieutenant Colonel Ross Hobbs, "Risking America's Long-Range Strike Capability," *Air and Space Forces Magazine*, April 4, 2025, available at <https://www.airandspaceforces.com/article/risking-americas-long-range-strike-capability/>.

Hard and Deeply Buried Targets (HDBTs)

All U.S. adversaries have hard and deeply buried facilities. In 2005, the National Academies of Sciences reported there were 10,000 HDBTs worldwide, 20 percent had a strategic function and strategic HDBTs were increasing at about 10 percent per year.⁷² The nuclear-armed authoritarian leaders depend upon HDBTs to assure their survival. Any expectation that they can serve as reliable sanctuaries is very likely to degrade the effectiveness of U.S. deterrence strategies. According to the National Academies' report, "Nuclear weapons are the only weapons that can destroy targets deep underground or in tunnels."⁷³ It noted that, "With the current U.S. nuclear arsenal, a number of the more important strategic HDBTs cannot be held at risk of physical destruction of the functional area."⁷⁴ There are some very deep facilities that cannot be held at risk with even a few nuclear weapons.⁷⁵

The Pentagon's 2024 China military report stated that, "The PLA maintains a robust and technologically advanced underground facility (UGF) program to conceal and protect all aspects of its military forces, including C2, weapons of mass destruction, logistics, and modernized missile, ground, air, and naval forces. The PRC has thousands of UGFs and constructs more each year. These UGFs are central to the PRC's counter intervention and power projection efforts, enabling the PLA to protect valuable

⁷² National Research Council, *Effects of Nuclear Earth-Penetrator and Other Weapons* (Washington, D.C.: National Academies Press, 2005) Chapter 4, available at <https://doi.org/10.17226/11282>.

⁷³ *Ibid.*, Chapter 6.

⁷⁴ *Ibid.*, Chapter 4.

⁷⁵ *Ibid.*, Summary, Chapter/2.

assets from the effects of missile strikes and conceal military operations from adversaries.”⁷⁶

Increasing the U.S. capacity to hold UGFs at risk in the near term is another reason upload can contribute to deterrence. HDBTs are important targets to hold at risk in this regard because they may protect what some adversaries value most. Any expectation that they can serve as reliable sanctuaries is very likely to degrade the effectiveness of U.S. deterrence strategies. As former Defense Secretary Harold Brown observed in 1983: “It is important for U.S. forces to be able to threaten retaliation against the assets that the Soviet leaders appear to prize, which are not only their urban industrial facilities but their nuclear and conventional forces and the hardened shelters that protect their political and military control centers, as well as their own lives.”⁷⁷ The same principle certainly seems to apply to contemporary authoritarian leaderships.

The weapons available for upload may lack the yield and accuracy necessary to be effective against *very deep* HDBTs. Without earth/rock penetration capability, 5.8 megatons of yield are required to destroy an HDBT buried to 400 meters (and this is *not* the deepest HDBT).⁷⁸ This is over 10 times higher than the reported yields of current U.S.

⁷⁶ U.S. Department of Defense, *Military and Security Developments Involving the People’s Republic of China*, 2024, p. 111, available at <https://media.defense.gov/2024/Dec/18/2003615520/-1/-1/0/MILITARY-AND-SECURITY-DEVELOPMENTS-INVOLVING-THE-PEOPLES-REPUBLIC-OF-CHINA-2024.PDF>.

⁷⁷ See, the testimony of Harold Brown in, U.S. Senate, Committee on Armed Services, *MX Missile Basing System and Related Issues*, Hearings, 98th Congress, 1st Session (Washington, D.C.: USGPO, 1983), p. 7. See also, *Report of the President’s Commission on Strategic Forces* (Washington, D.C.: The White House, April 1983), p. 7.

⁷⁸ *Effects of Nuclear Earth-Penetrator and Other Weapons*, op. cit., Chapter 4.

ballistic missile nuclear weapons.⁷⁹ The weapons that may have held HDBTs at risk during the Cold War with a single or multiple strikes—the Peacekeeper ICBM, the Advanced Cruise Missile and the multi-megaton B53—are no longer available to upload. Nevertheless, Minuteman and subsequently Sentinel uploading can provide expanded coverage against the number of UGFs that can be held at risk via attack by one or more weapons.

Yield Diversity

As former commander of STRATCOM Admiral Charles Richard (Ret.), former senior NSC and Pentagon official Frank Miller, and Senior Research Fellow at the Heritage Foundation Robert Peters have noted, to deter adversaries that are increasingly deploying nuclear forces geared for warfighting, the United States needs diverse capabilities, including “variable yield systems; and systems that can be generated from within theater on air, ground, and sea-launched platforms.”⁸⁰ A variety of yields enhances flexibility and adaptability, thereby facilitating the potential for tailoring deterrence. Variable yields can also help reduce collateral damage—potentially strengthening the credibility of U.S. deterrence strategies.⁸¹ The reduction of

⁷⁹ “Complete List of All U.S. Nuclear Weapons,” *Atomic Archive*, March 30, 2023, available at <https://nuclearweaponarchive.org/Usa/Weapons/Allbombs.html>.

⁸⁰ Admiral Charles Richard, USN (Ret.), Hon. Franklin C. Miller, and Robert Peters, “Nuclear Deterrence vs Nuclear Warfighting: Is There a Difference and Does it Matter?,” *Information Series*, No. 623 (Fairfax, VA: National Institute Press, April 15, 2025), available at https://nipp.org/information_series/admiral-charles-richard-usn-ret-hon-franklin-c-miller-and-robert-peters-nuclear-deterrence-vs-nuclear-warfighting-is-there-a-difference-and-does-it-matter-no-623-april-15-2025/.

⁸¹ Keith B. Payne and John S. Foster, Jr., et al., *Nuclear Force Adaptability for Deterrence and Assurance: A Prudent Alternative to Minimum Deterrence*

weapons types reduces available yields, including the highest and some of the lowest. (For example, reportedly the B83 has yields ranging from the low kiloton range to 1.2 megatons.)⁸²

Upload can increase yield diversity somewhat by permitting more low-yield Trident warheads. Retention of the W83 and W88 would help. More significant would be, at low cost, to give the new W93 and the W87-1 warheads variable yields, but they are likely a decade or more away.

According to General Cotton, the new nuclear sea-launched cruise missile (SLCM-N) "...will provide much-needed low-yield, non-ballistic, survivable, and persistent nuclear capability without visible generation...."⁸³ However, the new SLCM-N may not be deployed until 2034.⁸⁴ Upload may be critical for increasing U.S. low-yield capabilities in a timely way. Only a small number of low-yield W76-2s were produced—probably because more could not fit into a New START-limited nuclear force.⁸⁵ With termination of New START, upload could rapidly increase severalfold the number of survivable low-yield

(Fairfax, VA: National Institute Press, 2014), pp. xv, xvii, xix, 16, 21-22, 35, 44, available at <https://nipp.org/wp-content/uploads/2021/05/MD-II-for-web.pdf>.

⁸² "Complete List of All U.S. Nuclear Weapons," op. cit.

⁸³ "Statement of General Anthony J. Cotton," 2025, op. cit., p. 11.

⁸⁴ Sydney J. Freedberg, Jr., "Sub-launched nuclear cruise missile will need 'an entirely new industrial base,' warns Navy admiral," *Breaking Defense*, November 15, 2024, available at <https://breakingdefense.com/2024/11/sub-launched-nuclear-cruise-missile-will-need-an-entirely-new-industrial-base-warns-navy-admiral/>.

⁸⁵ U.S. Department of Defense, "Statement on the Fielding of the W76-2 Low-Yield Submarine Launched Ballistic Missile Warhead," February 4, 2020, available at <https://www.defense.gov/News/Releases/Release/Article/2073532/statement-on-the-fielding-of-the-w76-2-low-yield-submarine-launched-ballistic-m/>.

weapons. More W76-2s could be produced and modified W76-1s could become low-yield weapons.

In the longer run, it may be possible to speed up the nuclear SLCM program and design the W93 and the W87 to have variable yields. The Trident precision accuracy upgrade discussed above could expand *survivable* U.S. low-yield options to include precision low-kiloton or even sub-kiloton weapons.

High Delivery Accuracy

High delivery accuracy also increases deterrence strategy adaptability and targeting flexibility. Enhancing the accuracy of the ballistic missile force would likely strengthen the U.S. nuclear deterrent by increasing damage expectancy against many types of hard targets; in combination with lower-yield weapons, it could also increase the credibility of U.S. deterrence strategies by reducing collateral damage. The B61-12 and B61-13 are now the only U.S. precision nuclear weapons. The new Sentinel ICBM and warhead package reportedly will be considerably more accurate than the 1970-vintage Minuteman III.⁸⁶ If so, Sentinel uploading, would provide additional weapons with greater accuracy. It is unclear whether the second Trident II life extension program will enhance accuracy beyond the improvement provided by the W93/Mark 7 reentry vehicle in 2040.

⁸⁶ "Lockheed Martin chosen to design and build reentry vehicle for future Sentinel nuclear ballistic missile," *MilitaryAerospace.com*, November 9, 2023, available at <https://www.militaryaerospace.com/senso.s/article/14301230/lockheed-martin-nuclear-ballistic-missile-reentry-vehicle>; and, Northrop Grumman, "Building Upon the Minuteman Legacy," no date, available at <https://www.northropgrumman.com/space/sentinel/about-sentinel>.

A *portion* of the Trident W76 force could be given precision accuracy at modest cost. Tests of W76/Mark 4 reentry vehicles in 2003 and 2005 demonstrated that they “...could steer toward a target and strike with improved accuracy” and could “...slow down and control the impact conditions....”⁸⁷ Controlling impact conditions could enhance capabilities against some HDBTs with a specialized penetrator warhead. Trident could carry either the low- or high-yield W76s. An abortive program for a conventional Trident 20 years ago was estimated to achieve a 10 meter accuracy within two to four years at a cost of about \$500 million.⁸⁸ Uploading ICBM and SLBMs would expand U.S. capabilities with accuracy and the additional numbers could help compensate for inadequate accuracy via two-on-one targeting in some scenarios.

Dealing with the Non-Strategic Nuclear Threat

Russia has a “vast arsenal of non-strategic nuclear weapons.”⁸⁹ Most estimates range from 2,000 (the official number) to 10,000—10 to 50 times the reported U.S.

⁸⁷ Captain Terry Benedict, “A New Role for the Trident Fleet,” *Proceedings*, June 2006, available at <https://www.usni.org/magazines/proceedings/2006/june/new-role-trident-fleet>.

⁸⁸ Amy F. Woolf, “Conventional Warheads for Long Range Ballistic Missiles: Background and Issues” (Washington, D.C.: Congressional Research Service, January 2009), pp. 7, 9, available at <https://sgp.fas.org/crs/nuke/RL33067.pdf>.

⁸⁹ Office of Director of National Intelligence, *Annual Threat Assessment of the U.S. Intelligence Community*, March 2025, p. 20, available at <https://www.dni.gov/files/ODNI/documents/assessments/ATA-2025-Unclassified-Report.pdf>.

number.⁹⁰ In addition, China may already have exceeded the U.S. non-strategic nuclear force.⁹¹

Even the low estimates of Russian non-strategic nuclear weapons would allow Russia to launch many types of attacks against U.S. allies – to which Washington may not be able to respond promptly or effectively with non-strategic systems. That reality poses a threat to deterrence, particularly extended deterrence, given the likely need for low-yield, regional U.S. nuclear options for credible deterrence in regional contingencies.⁹² In the Indo-Pacific, this deterrence credibility problem may be exacerbated by the problem of U.S. aircraft vulnerability in the face of thousands of Chinese missiles. Reportedly, “...the U.S. military has built just 22 such [fighter aircraft] shelters in the Indo-Pacific region.”⁹³ Hence, unless on nuclear alert, nuclear-capable fighters may well be vulnerable to pre-emptive attack.

The following NATO figure illustrates the enormous disparity that exists in these types of nuclear weapons.

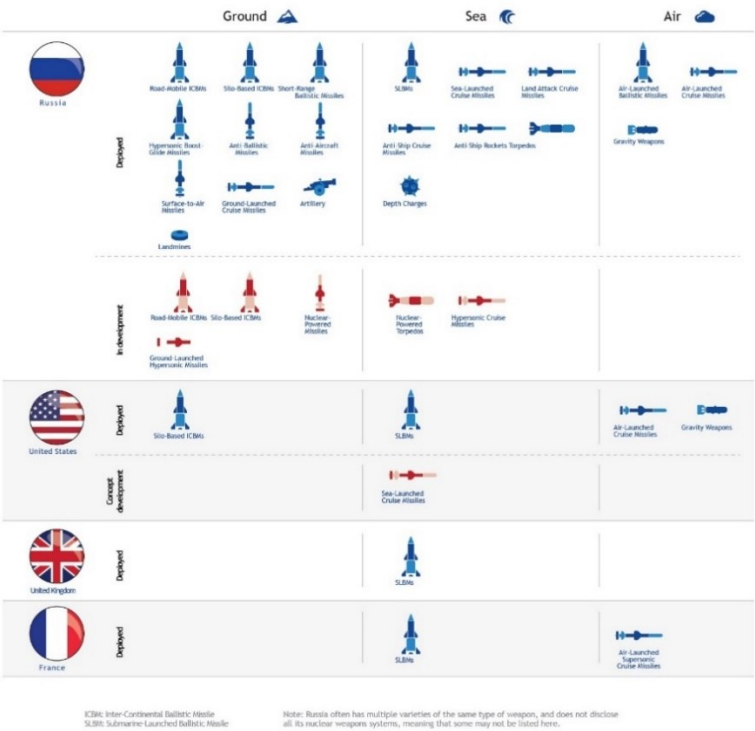
⁹⁰ Schneider, *How Many Nuclear Weapons Does Russia Have?*, op. cit., pp. 189-190.

⁹¹ House Committee on Oversight and Accountability, “Congressional Testimony of James E. Fanell, CAPT USN (Retired),” June 26, 2024, p. 6, available at <https://oversight.house.gov/wp-content/uploads/2024/06/Fanell-Testimony.pdf>.

⁹² See, for example, the discussion in, Joe Gould, “Strategic Command chief: sea missile cancellation opens ‘deterrence and assurance gap,’” *DefenseNews.com*, 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/>.

⁹³ Bill Gertz, “Lawmakers urge more hardened U.S. aircraft shelters in Asia as China bulks up,” *The Washington Times*, May 9, 2024, available at <https://www.washingtontimes.com/news/2024/may/9/lawmakers-urge-more-hardened-us-aircraft-shelters-/>.

Figure 1: Comparing Non-Strategic Nuclear Weapons Arsenals



Source: Jens Stoltenberg, *The Secretary General's Annual Report*, 2020

The Defense Department apparently has consistently underestimated Chinese nuclear capabilities.⁹⁴ Even so, China is assessed as having nuclear-capable, air-launched ballistic missiles, hypersonic glide vehicles, intermediate-range ballistic missiles and medium-range ballistic missiles,⁹⁵ all of which the United States lacks. In February 2024,

⁹⁴ Tom Cotton, *Seven Things You Can't Say About China* (New York: Broadside Books, 2025), p. 52.

⁹⁵ *Nuclear Challenges*, op. cit., p. vi.

General Cotton said China "...has approximately 1,000 medium- and intermediate-range dual-capable...ballistic missiles...."⁹⁶ Other sources credit China with nuclear-capable cruise missiles, short-range ballistic missiles, and gravity bombs.⁹⁷

Given Russian, Chinese and North Korean theater nuclear escalation options, the United States needs more non-strategic nuclear capability for credible extended deterrence purposes. The nuclear SLCM-N program may be accelerated if the existing TLAM Block 5 SLCM is given a nuclear capability.⁹⁸ This is a very important possible step. Similarly, it is critical to maintain the effectiveness of the airborne non-strategic nuclear deterrent (e.g., NATO's DCA). To do so, it is necessary to provide the F-35 with a stealthy stand-off capability and strike range extension. Two prime low cost candidates exist: 1) a nuclear-armed version of the AGM-154 Joint Standoff Weapon modified to carry a propulsion system which can be carried in the F-35 bomb bay; and, 2) a nuclear-armed version of the longer range AGM-158 Joint Air-to-Surface Standoff Missile Extended Range which must be carried externally reducing stealth. In the long run, it may be necessary to provide a

⁹⁶ Senate Armed Services Committee, "Statement of General Anthony J. Cotton," March 9, 2023, p. 6, available at <https://www.armed-services.senate.gov/imo/media/doc/2023%20USSTRATCOM%20Congressional%20Posture%20Statement%20-%20SASC.pdf>.

⁹⁷ Mark B. Schneider, "The Chinese Nuclear Threat," *Information Series*, No. 599 (Fairfax, VA: National Institute Press, September 26, 2024), available at https://nipp.org/information_series/mark-b-schneider-the-chinese-nuclear-threat-no-599-september-26-2024/.

⁹⁸ See the suggestion by Rob Soofer in, Sydney J. Freedberg, Jr., "Sub-launched nuclear cruise missile will need 'an entirely new industrial base,' warns Navy admiral," *Breaking Defense*, November 15, 2024, available at <https://breakingdefense.com/2024/11/sub-launched-nuclear-cruise-missile-will-need-an-entirely-new-industrial-base-warns-navy-admiral/>.

small nuclear-capable hypersonic missile to deal with very advanced defenses.

There are additional potential options to increase the U.S. non-strategic nuclear capability at modest cost. The nuclear SLCM could be deployed on a ground-based launcher. To help deter potential Russian, Chinese and North Korean use of battlefield nuclear weapons, any of the U.S. conventional ground-launched missiles could be given dual-capability at modest cost. For example, the W82 nuclear artillery round could be recreated. Nothing new would have to be developed. It is small and light enough to be carried by virtually any delivery vehicle. The way the United States currently does business under stockpile stewardship, it would likely take a decade to do this. This should be changed.

Strategic force upload may be a helpful, near-term—albeit partial—means to strengthen extended deterrence. That is, uploading Trident could provide additional low-yield targeting capabilities much more quickly than other options. Doing so would likely contribute significantly to extended deterrence credibility as longer-term U.S. regional options mature. Recent tabletop exercises have highlighted the importance of low-yield options for credible U.S. extended deterrence.⁹⁹

Extended Deterrence in the Indo-Pacific

There are no U.S. nuclear weapons deployed in the Indo-Pacific region, giving Russia, China and North Korea dangerous coercive leverage as they expand, diversify and improve their nuclear capabilities.¹⁰⁰ The Congressional

⁹⁹ Markus Garlauskas, Lauren Gilbert, and Kyoko Imal, *A rising nuclear double-threat in east Asia : Insights from our Guardian Tiger I and II tabletop exercises*, op. cit.

¹⁰⁰ “Conversations on National Security: Major General Michael J. Lutton,” *Information Series*, No. 487 (Fairfax, VA: National Institute

Strategic Posture Commission concluded that there is an “urgent need” for U.S. theater nuclear forces to be “deployed or based in the Asia-Pacific theater.”¹⁰¹

The 2010 NPR argued that the U.S. ability to forward deploy “...bombers with either bombs or cruise missiles and forward-deployment of dual-capable fighters....” was then adequate for extended deterrence.¹⁰² However, that claim was made well before the outlines of the unprecedented, current threat context were recognized. There is a serious question of whether the United States has *any real* capability for *timely* deployment of these capabilities. This necessitates sufficient deployable nuclear-certified aircraft, crews, maintainers, refueling tankers and security forces. These are in short supply. Forward deployed bombers have the same issues. Without the ability to maintain nuclear alert, forward deployed bombers would be more vulnerable.

None of the U.S. INF-range ballistic, cruise or hypersonic missile programs is nuclear capable. The way the United States is doing business today, there is likely no possibility of giving any of them nuclear capability by 2027. The current strategic modernization program is unlikely to provide any new capability by 2027 other than the new versions of the B61 bomb. Even the B-21 “Nuclear qualification will also take two years or so after IOC [probably in 2029].”¹⁰³ The rest of the modernization program is 2030 or beyond.

Press, April 27, 2021), available at https://nipp.org/information_series/conversations-on-national-security-major-general-michael-j-lutton-no-487-april-27-2021/.

¹⁰¹ Creedon and Kyl, et al., *The Final Report of the Congressional Commission on the Strategic Posture of the United States*, op. cit., p. viii.

¹⁰² *Nuclear Posture Review Report*, 2010, op. cit., p. 28.

¹⁰³ Congressional Research Service, “Air Force B-21 Raider Long-Range Strike Bomber,” September 22, 2021, p. 4, available at <https://www.congress.gov/crs-product/R44463>.

Acceleration of the nuclear SLCM program is necessary but unlikely to be fully adequate. Giving dual capability to at least one U.S. hypersonic and other INF-range missiles would allow Asia-Pacific deployment of significant nuclear capability, enhancing extended deterrence and reducing the prospect of nuclear proliferation by threatened allies. In the near term, inexpensive warhead upload may be the only available option to enhance nuclear deterrence of a possible 2027 timeline for a Chinese invasion of Taiwan. To help in this regard, if the United States starts soon, all of the Trident force and almost half of the Minuteman force likely could be uploaded by mid-2027. Doing so, while insufficient under looming threat conditions, could both enhance deterrence in the near term and reduce the prospect of proliferation by desperate allies.¹⁰⁴

Conclusion

The contemporary threat environment is unprecedented. For example, in addition to numerous explicit Russian nuclear threats, Putin's "suspended" and violated New START Treaty fans considerable uncertainty about the extent of possible Russian nuclear uploading. There is increasing evidence that Russia is above the deployed warhead limit. The Biden State Department's assertion that it had "high confidence" that Russia was not much above the New START deployed warhead limit is incredible; Russia has had enough time to upload all of its strategic nuclear forces since the last New START Treaty inspection in March 2020.

¹⁰⁴ A prominent German commentator recently called for 1,000 additional European nuclear weapons to deter Russian nuclear threats. See, James Rothwell, "EU needs '1,000 more' nuclear missiles to deter Putin," *The Telegraph*, March 1, 2025, available at <https://www.telegraph.co.uk/world-news/2025/03/01/eu-needs-1000-more-nuclear-missiles-to-deter-putin/>.

In light of growing nuclear threats, the existing U.S. New START Treaty-limited strategic nuclear force and the planned modernization program are inadequate. The U.S. non-strategic nuclear capability is particularly limited. To preserve deterrence, the dangerous Russian, Chinese and North Korean nuclear buildups must be countered and their monopoly on forward deployed nuclear weapons in the Indo-Pacific must end. In the best case, this likely will take significant time with the current modernization program. Hence, a near-term option to redress the looming nuclear imbalance and threats to deterrence is through inexpensive upload. Upload can dramatically increase the capability of the current U.S. strategic nuclear forces and the benefits from the nuclear modernization program of record. Absent upload, the United States will realize only about half of the potential benefit from this program in terms of warhead numbers.

A prudent deterrence response to an unprecedented threat context involving the potential for opportunistic or coordinated aggression and the long-standing Russian and Chinese nuclear buildups includes nuclear weapons upload of legacy and future forces. It likely is impossible, for example, to hold at risk the increasingly large number of Chinese and Russian deterrence-related assets, including nuclear weapons and facilities, with a New START Treaty-limited force. The United States must proceed with the planned nuclear modernization program. But, it likely will be too slow and ultimately too limited for confident deterrence in a rapidly worsening threat environment. At this point, nuclear upload is likely the only way America can adequately enhance the force size and flexibility needed to tailor deterrence in the near term for the prevention of great power conflict, including major aggression against U.S. allies.

Appendix A. Sources for Tables 1 and 2

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About the Authors

Dr. Mark B. Schneider is a Senior Analyst with the National Institute for Public Policy. He joined National Institute in September 2004 and specializes in missile defense policy, nuclear weapons, deterrence, strategic forces, and arms control issues.

Before his retirement from the Department of Defense, Dr. Schneider served in senior positions in the Office of the Secretary of Defense for Policy including, Principal Director for Forces Policy, Principal Director for Strategic Defense, Space and Verification Policy, Director for Strategic Arms Control Policy and Representative of the Secretary of Defense to the Nuclear Arms Control Implementation Commissions. He also served as a member of the State Department Policy Planning Staff, the Professional Staff of the Senate Select Committee on Intelligence, the Department of Energy, the Energy Research and Development Administration and the Atomic Energy Commission. Prior to his government career, Dr. Schneider served as a policy analyst with the Stanford Research Institute and taught at the University of Southern California.

Dr. Schneider served as a member of the DoD Compliance Review Group. He chaired several working groups of the START and INF Treaty Implementation Commissions (JCIC and SVC) in Geneva, negotiating many implementation agreements with the successor states of the former Soviet Union. He most recently served as Acting Chairman of the U.S.-Russia Working Group on Missile Defense.

Dr. Schneider has been awarded two Presidential Rank Awards of Meritorious Executive in the Senior Executive Service, two Secretary of Defense Distinguished Civilian Service Medals and two Secretary of Defense Meritorious Civilian Service Medals.

Dr. Schneider earned his Ph.D. in history at the University of Southern California and Juris Doctorate from George Washington University. He was admitted to the Bar of Washington DC in 1977 and Maryland in 1978. He is the author of many articles on arms control, nuclear deterrence, strategic forces and intelligence issues.

Dr. Keith B. Payne is a co-founder of the National Institute for Public Policy, a nonprofit research center located in Fairfax, Virginia and Professor Emeritus, Missouri State University, Graduate School of Defense and Strategic Studies. In 2005, he was awarded the Vicennial Medal from Georgetown University for his many years on the faculty of the graduate National Security Studies Program.

Dr. Payne has served in the Department of Defense as the Deputy Assistant Secretary of Defense for Forces Policy and as a Senior Advisor to the Office of the Secretary of Defense (OSD). He received both the Distinguished Public Service Medal and the OSD Award for Outstanding Achievement.

Dr. Payne also served as a Commissioner on the original, bipartisan Congressional Commission on the Strategic Posture of the United States and is a co-author of the Commission's final report (2009). He also served in Democratic and Republican administrations as a member of the Secretary of State's International Security Advisory Board, and as Chair of U.S. Strategic Command's Senior Advisory Group, Policy and Strategy Panel. He is an award-winning author, co-author, or editor of over 225 published articles and 50 books and monographs, some of which have been translated into German, Russian, Chinese, Japanese and Spanish. Dr. Payne's articles have appeared in major U.S., European and Japanese professional journals and newspapers. His most recent book is, *Chasing a Grand Illusion: Replacing Deterrence with Disarmament* (National Institute Press, 2023).

Dr. Payne received an A.B. (Honors) in political science from the University of California at Berkeley in 1976, studied in Heidelberg, Germany, and received a Ph.D. (With Distinction) in international relations from the University of Southern California.

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