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Deterrence Requirements and Low-Cost Nuclear Upload Options

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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.[1]

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 on a bipartisan basis. 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.[2]

While the basic U.S. approach to nuclear deterrence has not significantly changed for decades,[3] 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.[4] 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.[5]

Today, the United States reportedly has ~1,660 deployed strategic nuclear weapons.[6] With this level of capability, even with planned U.S. force modernization, the United States likely cannot fully hold at risk new Chinese targets related to deterrence given Beijing's 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 approximately 2,200 warheads. The Trident SLBM force reportedly could be uploaded in months and the Minuteman ICBM force in about three to four years.[7] 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 weapons 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."[8] Unfortunately, the 2010 New START Treaty did the opposite, reducing the potential U.S. "responsive force." Given New START's limit on *accountable*, deployed weapons (1,550), the United States can upload its strategic missile force by only 131 warheads. The approximately 2,200 total 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, 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 on the reported size and payload of the B-21 bomber.[9]

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 ~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 to eliminate all but 528 nuclear ALCMs (now reduced by almost 20 years of testing) and all Advanced Cruise Missiles, eliminated 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.)

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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.

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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.

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."[10] 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 were 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. For example, the Navy plans to use the Trident II SLBM for almost 100 years.[11] The planned 12 Columbia-class submarines will carry fewer missiles and are "…the absolute minimum required to meet [the] strategic guidance."[12] 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.[13]

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…"[14] However, the Air Force reportedly has not given its nuclear bombs an inexpensive glide-bomb capability which it routinely gives to conventional weapons to help ensure effectiveness against defenses,[15] possibly because of the "no nuclear improvements" mentality.

The possible questioning of appropriate penetration characteristics on the B61-12 and B61-13 against targets that are defended by advanced short-range defenses has the potential to

undermine the B-21's deterrent effect in some contingencies. 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 otherwise could undermine deterrence.

Hard and Deeply Buried Targets (HDBTs)

The nuclear-armed authoritarian leaders appear to 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. 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 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." [16] The same principle certainly seems to apply to contemporary authoritarian leaderships. 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,[17] 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.

The U.S. modernization program appears not to emphasize these characteristics. 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 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. 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 available until 2034.[18] While only a small number of low-yield W76-2s reportedly 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;[19] 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."[20] 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…."[21] 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.[22] This is a very important possible step. 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 U.S. future 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."[23]

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 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.

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[19] "Lockheed Martin chosen to design and build reentry vehicle for future Sentinel nuclear ballistic missile," *Military Airospeace.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.

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[21] 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.

[22] See the suggestion by Dr. Rob Soofer in, Sydney J. Freedberg Jr., "Sub-launched nuclear cruise missile will need 'an entirely new industrial base,' warns Navy admiral, Breaking Defense," *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/.

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