ADAPTING THE HARDWARE OF NATO'S FORWARD-DEPLOYED NUCLEAR FORCES

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NATO's theater nuclear posture, generally unchanged since the end of the Cold War, has come under increased scrutiny as Russia's recent actions in Ukraine raise questions about Allied forces' nuclear credibility and sufficiency. An exploration of alternative hardware options—using the criteria of military and political credibility as well as political and technical feasibility—demonstrates that NATO's current posture must evolve into a more diversified force to effectively enhance extended nuclear deterrence and Allied assurance.[1]

The decades-old asymmetry in favor of Russia regarding the nonstrategic nuclear balance of forces on the European continent has become increasingly untenable.[2] Russia's threat to use nuclear weapons during its war against Ukraine has created a dangerous precedent that demonstrates its willingness to employ its nuclear arsenal for regional territorial expansion. Moreover, the nuclear two-peer problem involving Russia and China specifically is putting pressure on the strategic arsenal of the United States.[3] Such threats to international security—together with global developments including Iran's proximity to a nuclear weapons breakout and North Korea's

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2. Jacek Durkalec, *Nuclear-Backed "Little Green Men": Nuclear Messaging in the Ukraine Crisis* (The Polish Institute of International Affairs, July 2015), https://www.files.ethz.ch/; and Liviu Horovitz and Martha Stolze, "Nuclear Rhetoric and Escalation Management in Russia's War Against Ukraine: A Chronology," working paper, no. 2 (German Institute for International and Security Affairs [SWP], Research Division International Security, August 2023), https://www.swp-berlin.org/.

3. Brad Roberts et al., *China's Emergence as a Second Nuclear Peer: Implications for U.S. Nuclear Deterrence Strategy* (The Center for Global Security Research at Lawrence Livermore National Laboratory, 2023), https://cgsr.llnl.gov/.

continued expansion of its nuclear and ballistic missile program—have led to an era of "unbalanced nuclear multipolarity."[4]

While this poses strategic challenges for the United States, it has also potential implications for the credibility of American extended nuclear deterrence in the context of NATO. For instance, the United States could transfer nuclear capabilities, such as US-based or forward-based B61 gravity bombs and dual-capable aircraft (DCA), to the Indo-Pacific theater for certain contingencies. This would, however, result in even greater asymmetry in the European theater's nonstrategic nuclear capabilities. Such a situation could adversely impact the credibility of American extended nuclear deterrence and render NATO Allies more vulnerable to Russian threats to use nuclear weapons. Additionally, the Trump administration's attempts to end Russia's war in Ukraine has led to a public debate on the credibility of the American umbrella in Europe. While the White House has renewed its extended deterrence commitments to South Korea and Japan, it has yet to do so with NATO.[5] Nonetheless, if the United States wants to avoid Allied proliferation in Europe, for instance, the Alliance needs a credible European-based capability to deter and, if necessary, respond to limited Russian nuclear aggression. Therefore, this article is written on the assumption that the United States continues its extended nuclear deterrence guarantees to NATO.

This article explores the options to strengthen NATO's nuclear posture within the existing framework and additionally examines air, sea, and land nuclear and nonnuclear capabilities. Based on current analyses of alternative hardware options, this article employs the criteria of military and political credibility and political and technical feasibility to identify a more diversified force mix necessary to enhance the credibility and flexibility of theater nuclear forces and to ensure US strategic stability.

Background

Because Russia is diversifying and modernizing its nonstrategic nuclear capabilities—efforts illustrated by the introduction of the Novator 9M729 (SSC-8) ground-launched cruise missile (GLCM) and the new Oreshnik intermediate-range ballistic missile (IRBM)—NATO is again facing "a gap in the spectrum of escalation," just as during the Cold War with the Soviet deployment of the RSD-10 Pioneer (SS-20) IRBM.[6] Subsequently, a similar logic applies to the current situation whereby NATO needs to close

4. Mark Fitzpatrick, *The Iran Nuclear Deal: Consequences of Moribund Diplomacy* (NATO Defense College, Research Division, February 2023), https://www.ndc.nato.int/; and Mary Beth D. Nikitin, *North Korea's Nuclear Weapons and Missile Programs*, In Focus (IF) 10472 (Congressional Research Service [CRS], 19 December 2023), https://sgp.fas.org/; and David N. Miller et al., "Ten Propositions Regarding Nuclear Weapons and Deterrence," *Æther: A Journal of Strategic Airpower & Spacepower* 2, no. 4 (2023): 22, https://www.airuniversity.af.edu/.

5. Zuzanna Gwadera, "US Allies Question Extended Deterrence Guarantees, but Have Few Options," *Military Balance Blog*, IISS [International Institute for Strategic Studies], 20 March 2025, https://www.iiss.org/.

6. *Final Communiqué* (NATO, 13–14 November 1979), https://www.nato.int/.

this gap and retain "options for restrained and controlled responses."[7] Although important in their own right, software changes alone will be insufficient. Yet there are also limits regarding potential hardware changes.

Scholars have been debating different options. One analysis on the possibilities of bolstering NATO's nuclear forces assesses these alternatives by the key criteria of military effectiveness; escalation control; coupling, or linking US security with that of its European Allies, and burden sharing, or being part of the nuclear mission; Alliance unity; timeliness; and cost-effectiveness. It concludes that deploying nuclear short-range standoff weapons next to the B61-12 nuclear gravity bombs and delivered by DCA in Europe would provide the Alliance with a "credible response to a limited Russian nuclear strike" while at the same time guaranteeing "the coupling of European security to US strategic forces at an acceptable economic and diplomatic cost."[8]

The 2023 Center for Global Security Research Study Group report, which discusses the second nuclear peer challenge of China's buildup, also focuses on adapting the hardware of extended deterrence, listing military and political criteria that nonstrategic extended nuclear deterrence capabilities must meet. The military criteria are survivability, promptness, target versatility, and impact on the United States. The political criteria are persistent in-theater presence, visibility, option for burden sharing, and political acceptability for Allies. While the report outlines a potential future mix of extended nuclear deterrence capabilities, it does not offer a consensus on the specific mix.[9] Yet another analysis points to three options regarding the future of NATO's nuclear forces, namely modernizing, enhancing, or complementing the current framework.[10]

NATO itself mentions in its 2022 *Strategic Concept* that it "will take all necessary steps to ensure the credibility, effectiveness, safety and security of the nuclear deterrent mission."[11] While the public debate is mostly focused on the ongoing modernization of DCA capability and occasionally includes discussions on expanding the geographical scope of the nuclear sharing arrangements, NATO has not publicly considered any further hardware changes. Therefore, the question of what other capabilities could be useful to strengthen nuclear deterrence and are politically feasible is being neglected in many Allied capitals.

This article considers the options to strengthen NATO's nuclear posture within the existing framework and reviews additional air, sea, and land nuclear and nonnuclear capabilities. It does so by combining the aforementioned guidelines, with

7. *Final Communiqué*.

8. Matthew Kroenig, *Toward a More Flexible NATO Nuclear Posture: Developing a Response to a Russian Nuclear De-Escalation Strike* (Atlantic Council, Brent Scowcroft Center on International Security, November 2016), https://www.atlanticcouncil.org/.

9. Roberts et al., *China's Emergence*, 48–50.

10. Robert G. Bell, *Modernise, Expand or Complement: NATO's Nuclear Posture in the Post-2022 Strategic Environment*, CSDS In-Depth no. 11 (Brussels School of Governance, Centre for Security, Diplomacy and Strategy, 19 March 2024), 12–18, https://www.brussels-school.be/.

11. *NATO 2022 Strategic Concept: Adopted by Heads of State and Government at the NATO Summit in Madrid 29 June 2022* (NATO, 29 June 2022), 8, https://www.nato.int/.

the following four criteria: military credibility, political credibility, political feasibility, and technical feasibility.

This analysis identifies the need for a more diversified force mix consisting of dual-capable aircraft with nuclear-capable air-launched cruise missiles (ALCM) as well as of gravity bombs. This enhances the military credibility of DCA and is politically more feasible, as it only requires complementing or replacing current bombs rather than introducing new delivery systems. In terms of technical feasibility, introducing nuclear-capable ALCM is only possible in the longer term. Emerging and disruptive technologies (EDT) also promise to provide complementary non-nuclear capabilities. EDTs can enhance both military and political credibility and are politically more feasible by their very nature as non-nuclear systems. Technical feasibility depends on the specific technology.

The United States should also consider increasing the frequency of rotational bomber deployments in Europe when the B-21 Raider becomes operational. The B-21 is not only militarily credible (as the first sixth-generation bomber) but also politically credible (visible deployment on European soil). While the B-21's political feasibility depends on the acceptability of the Allied nations at which the bombers are stationed, it remains technically feasible—it is under development, and the B-52/B-2s have done rotational deployments to Europe.

Lastly, the United States could arm its attack submarines with nuclear-armed sea-launched cruise missiles (SLCM-N). These are militarily credible but less politically credible because of their lack of visibility and options for burden sharing. They are politically feasible because no forward basing in Europe is required and technically feasible as the seemingly earliest available option.[12]

While the above represents an ideal mix, most of these options will require several years before becoming fully operational. In the short term, then, NATO would need to strengthen its existing framework.

Options Within the Existing Framework

NATO has several options to do this. The first steps to reinforce the current nuclear sharing capability have already been taken through the modernization of the dual-capable fighter jet fleet with F-35As, excluding those of Türkiye, which had been dropped from the program in 2019. In addition, the United States has upgraded its nuclear gravity bombs to the B61-12 variant. This new variant is more capable than its predecessors because of its guided tail kit, which improves accuracy.[13] The bomb's modest standoff range also increases the survivability of the delivering fighter jet.[14] Combined with the stealth characteristics of the F-35A, the DCA capability modernization will result in a significant qualitative improvement.

12. Roberts et al., *China's Emergence*.

13. Hans M. Kristensen et al., "Nuclear Weapons Sharing, 2023," *Bulletin of the Atomic Scientists* 79, no. 6 (2023), https://doi.org/.

14. Frank Kuhn, "Making Nuclear Sharing Credible Again: What the F-35A Means for NATO," *War on the Rocks*, 14 September 2023, https://warontherocks.com/.

Nevertheless, there are several means by which NATO can further strengthen its capabilities. For one, DCA Allies could acquire more aircraft. The United States could deploy more B61-12s and shorten the readiness time. Second, the survivability of DCA air bases could be reinforced by acquiring the necessary Integrated Air and Missile Defense (IAMD) capabilities. Dispersion plans inside the territory of DCA Allies or other NATO Allies closer to Europe's east and north that provide dispersed operating bases and improvised airstrips on roads should also be updated.[15] Additional storage locations for the nuclear munitions could be built, or dormant facilities in countries like the United Kingdom or Greece, for instance, could be reactivated.[16] Unofficial sources have also reported that US nuclear weapons may return to the UK after more than 15 years of non-deployment.[17] Moreover, NATO is currently modernizing and adapting its nuclear command and control systems as part of the modernization of its DCA posture.[18] Conventional support to nuclear operations (CSNO) could be strengthened by deploying new kinetic and non-kinetic capabilities, including air, land, maritime, cyber, space, and special operations forces. Enhanced CSNO would increase dual-capable aircraft survivability because it enables deeper and more secure penetration of hostile airspace.

Additionally, non-nuclear Allies could support the nuclear messaging of NATO through national statements that offer a "more active declaratory policy."[19] DCA Allies could signal their commitment to their new role as "co-providers of extended deterrence."[20] Improved information and intelligence sharing, planning, and more frequent consultations and dialogues among Allies could enhance the software side of extended deterrence. Further efforts to raise subject matter expertise—or in NATO's terms, the nuclear IQ—are necessary to improve the understanding of the nuclear component in integrated deterrence and NATO's multidomain operations approach.

Air-based Nuclear Capabilities: Building on the Existing Framework

Since the early 2020s, analysts have discussed expanding the number of dual-capable aircraft Allies as a first option. Poland is the NATO member state that is most

15. "Poland's Bid to Participate in NATO Nuclear Sharing," *Strategic Comments* 29, no. 7 (2023), https://doi.org/.

16. Bell, *Modernise*, 14.

17. Tony Diver, "US to Station Nuclear Weapons in UK to Counter Threat from Russia," *The Telegraph*, 26 January 2024, https://www.telegraph.co.uk/; and Eliana Johns and Hans M. Kristensen, *Reawakening a Nuclear Legacy: The Potential Return of the US Nuclear Mission to RAF Lakenheath* (Federation of American Scientists, February 2025), https://fas.org/.

18. Bell, *Modernise*.

19. Wannes Verstraete, *Strengthening the Political Credibility of NATO Extended Nuclear Deterrence* (Egmont Royal Institute for International Relations [Egmont Institute], February 2024), 4, https://www.egmontinstitute.be/.

20. Alexander Mattelaer, *Upgrading the Belgian Contribution to NATO's Collective Defence* (Egmont Institute, July 2023), 6, https://www.egmontinstitute.be/.

eager to join nuclear sharing.[21] Other possible candidates include Finland, the Czech Republic, and Romania.[22]

In June 2023, then-Prime Minister Mateusz Morawiecki revealed Poland's interest in hosting nuclear weapons "under NATO's nuclear-sharing policy."[23] Earlier in that same year, then-Foreign Affairs Minister Zbigniew Rau indicated that the Polish government supported ending the NATO–Russia Founding Act from 1997, which specified that member states "have no intention, no plan and no reason to deploy nuclear weapons on the territory of new members."[24]

As one analysis notes, such statements should not be construed as an escalation by NATO. Neither should NATO's declaration for plans to re-posture its own nuclear force in response to Russia's July 2022 announcement of its deployment of nuclear weapons into Belarus "be seen by Moscow as provocative or escalatory." Furthermore, it argues that having a willing non-nuclear Ally to take up the dual-capable aircraft role might be "a prudent risk-mitigation measure" in case of withdrawal by an existing DCA Ally.[25] Another study points to the primary military benefit of having DCA Allies further to the east: such a move would decrease the distance from the air base to the mission target in a hypothetical conflict.[26]

Nevertheless, other experts question the military value of positioning B61s in Poland because it creates incentives for Russia to preemptively strike the air bases at the beginning of a conflict. Such forward-basing would thus "paradoxically . . . limit NATO's nuclear survivability."[27]

An intermediate position, however, could be delivering nuclear-certified F-35As to nations seeking to join nuclear sharing and training for the successful nuclear mission execution while not hosting US nuclear weapons.[28] This has the benefit of creating a larger and more dispersed fleet of certified F-35As to increase survivability, and if necessary, the ability to rapidly generate extra full-DCA Allies by bringing in additional B61s during conflict. Moreover, as one expert argues, this would benefit the political credibility of nuclear sharing: "Due to their diverging threat perceptions, the Polish government and Polish pilots, for example, might well be more willing to employ nuclear weapons than, say, the German government and German

21. Justyna Gotkowska, "Moving NATO's Military Power Centre Towards Central and Northern Europe. Poland's Political and Military Goals," GSSC: Geopolitics and Security Studies Center, 12 February 2024, https://www.eesc.lt/; "Poland's Bid"; Robert Peters, *NATO's Nuclear Posture Needs Updating* (The Heritage Foundation, 31 August 2023), https://www.heritage.org/; and Joseph Trevithick, "Poland Wants to Host NATO Nukes to Counter Russia," *TWZ* [*The Warzone*], 30 June 2023, https://www.twz.com/.

22. Bell, *Modernise*; and Peters, *Nuclear Posture*.

23. "Poland's Bid," 1.

24. "Poland's Bid"; and Founding Act on Mutual Relations, Cooperation and Security Between NATO and the Russian Federation, 36 ILM 1006 (1997), https://www.nato.int/.

25. Peters, *Nuclear Posture*, 4, 6.

26. Bell, *Modernise*.

27. "Poland's Bid," 2.

28. Gotkowska, "Military Power Centre"; and Kuhn, "Nuclear Sharing."

pilots."[29] The downside is that such a measure would lead to different tiers of DCA Allies, which could result in the perception of inequality for certain Allies, as some would not host forward-based US nuclear munitions but only contribute with dual-capable aircraft and crews. Subsequently, this might corrode attempts at achieving the necessary consensus in the NATO Nuclear Planning Group (NPG).

The United States could also expand its activities related to strategic bomber deployments to European Allies by increasing the frequency of rotational dual-capable bomber deployments in Europe of the B-52, the B-2, and in the future, the B-21. Such capabilities strengthen the military credibility of extended nuclear deterrence due to the B-2's and B-21's advanced stealth characteristics and Allied assurance because of the visibility of such deployments. Such deployments could be combined with the forward-basing of AGM-86B nuclear ALCMs or its successor, the AGM-181 long-range standoff weapon.[30] Nevertheless, the United States will probably need to procure more B-21s than the 100 currently planned if it decides to significantly expand its bomber presence in Europe.[31]

Furthermore, the US Department of Defense plans to pursue a new variant of the B61, namely the B61-13, with a higher yield than the B61-12.[32] While this type of bomb is currently not planned for use by dual-capable aircraft Allies, US strategic bombers deployed in Europe could carry them. Introducing other types of munitions next to the B61-12 would enhance the flexibility regarding nuclear strike options, strengthening extended nuclear deterrence and Allied assurance. One historical example is the tactical short-range attack missile (SRAM-T) program, which was cancelled because of unilateral US cuts to its nuclear arsenal under the Presidential Nuclear Initiatives of 1991 and 1992.[33] Nevertheless, developing a new, nuclear ALCM that could be deployed by the F-35A DCA fleet would significantly increase the military credibility of forward-deployed nuclear forces in NATO.

While a forward-deployed ALCM such as the SRAM-T would be a superior capability compared to current gravity bombs, questions remain about the technical feasibility of creating this new type of nuclear weapon, considering US constraints regarding production capability, resources, and human expertise.[34] An additional

29. Kuhn, "Nuclear Sharing."

30. "AGM-86 Air-Launched Cruise Missile (ALCM)," Missile Threat, Center for Strategic & International Studies (CSIS), last modified 23 April 2024, https://missilethreat.csis.org/; and Hans M. Kristensen and Matt Korda, "United States Nuclear Weapons, 2023," *Bulletin of the Atomic Scientists* 79, no. 1 (2023), https://www.tandfonline.com/.

31. "B-21 Raider," US Air Force [website], accessed 11 December 2024, https://www.af.mil/.

32. Joseph Trevithick, "Plans for More Destructive B61 Nuclear Bomb Unveiled," *TWZ*, 27 October 2023, https://www.twz.com/; and "Department of Defense Announces Pursuit of B61 Gravity Bomb Variant," US Department of Defense (DOD), press release, 27 October 2023, https://www.defense.gov/.

33. Susan J. Koch, *The Presidential Nuclear Initiatives of 1991–1992*, Case Study 5 (Center for the Study of Weapons of Mass Destruction, National Defense University, 2012), 11, https://ndupress.ndu.edu/.

34. Roberts et al., *China's Emergence*.

factor to consider is that dual-capable aircraft with ALCMs would also need conventional support to nuclear operations.

Sea-Based Nuclear Capabilities: Lack of Visibility

The Cold War witnessed the use of sea-based nuclear capabilities on US surface vessels and submarines, but all nonstrategic nuclear weapons were offloaded in 1991.[35] The United States, UK, and France do deploy strategic submarine-launched ballistic missiles (SLBM) on ballistic missile submarines (SSBN). Yet France retained a nuclear capability on its aircraft carrier *Charles de Gaulle*, namely the Nuclear Naval Air Force (Force aéronavale nucléaire, FANu) that can be deployed on the aircraft carrier with 10 Rafale-M(arine)s. These fighter aircraft can carry the medium-range air-to-ground missile, ASMPA (air–sol moyenne portée–améliorée).[36]

Nevertheless, French nuclear policy does not align with NATO policy. Retired Vice Admiral Jean-Louis Lozier stated in January 2023 that France has "always refused to consider nuclear weapons as battlefield weapons that could lead to a nuclear war," limiting such weapons to "extreme circumstances of self-defence" as outlined by UN Charter Article 51.[37] France is also the only Ally that does not participate in the NPG. French President Emmanuel Macron, however, did declare in 2020 that "France's vital interests now have a European dimension."[38] While this divergence is beneficial for strategic ambiguity reasons, France could clarify this stance to support the overall deterrence credibility of NATO.

The return of this mission to US aircraft carriers would enhance extended deterrence in both the European and Indo-Pacific theaters, and increase reassurance due to their visibility through, for instance, port visits and patrolling off the coast of Allied nations. The B61 nuclear gravity bomb has been deployed on US aircraft carriers from 1968 to 1994.[39] Subsequently, the redeployment of the modernized B61-12 together with certifying F-35Cs could provide an additional nuclear capability that would strengthen US extended deterrence commitments. Such a development would also politically be more feasible because it does not necessitate the hosting of additional nuclear weapons by Allies.

In 2019, the United States fielded the W76-2 low-yield SLBM warhead on its SSBNs. These modified versions of existing SLBMs represent forward-deployable capability

35. Robert S. Norris and Hans M. Kristensen, "Declassified: US Nuclear Weapons at Sea During the Cold War," *Bulletin of the Atomic Scientists* 72, no. 1 (2016), https://doi.org/.

36. Bruno Tertrais, *French Nuclear Deterrence Policy, Forces, and Future: A Handbook*, Recherches & Documents no. 4, (Fondation pour la Recherche Stratégique, 2020), 58, https://www.frstrategie.org/.

37. Jean-Louis Lozier, *French Nuclear Policy* (International Centre for Defence and Security, 19 January 2023), 2, https://icds.ee/.

38. Lozier, *Nuclear Policy*; Astrid Chevreuil, "France's Nuclear Offer to Europe," CSIS, 23 October 2024, https://www.csis.org/; and "Speech of the President of the Republic on the Defense and Deterrence Strategy," Élysée, 7 February 2020, https://www.elysee.fr/.

39. Norris and Kristensen, "Declassified."

with greater survivability and promptness. In creating this low-yield version, the United States wanted to send the main signal to potential adversaries that "there is no advantage to limited nuclear employment because the United States can credibly and decisively respond to any threat scenario."[40] Another sea-based capability that some American decisionmakers are currently contemplating is the nuclear-armed sea-launched cruise missile (SLCM-N) that could be deployed on US attack submarines (SSN). As one expert notes, this capability "provides all the necessary attributes" to enhance NATO's nuclear strategy.[41] The SLCM-N is one of the few feasible options to change the US forward-deployed nuclear arsenal in the near future.[42]

While an additional submarine-based capability would indeed be the most survivable option, it does lack visibility compared to aircraft carriers. Nevertheless, port visits and exercises could be used to credibly reassure Allies. Yet such visible demonstrations, in turn, have a negative effect on survivability. The SLCM-N is, however, contested within the White House, Congress, and the US Navy.[43] One of the fears of arming US attack submarines with SLCM-N is the risk of detracting or distracting from their "primary goal," namely the conventional denial mission.[44] Yet one study criticizes the Biden administration's opposition to the SLCM-N program, stating that the nuclear-armed Tomahawk land attack missile (TLAM-N) and the SLCM-N cases are illustrative of "the inconsistency with which the United States pursues capabilities that allies deem important."[45]

Notwithstanding this contestation, Congress has continued to fund the development of the SLCM-N and adapting the W80-4 warhead over the last years.[46] Moreover, former Acting Assistant Secretary of Defense for Space Policy Vipin Narang mentioned in August 2024 that the administration is "complying with congressional direction to develop and field a nuclear-armed sea-launch cruise missile." Narang further stated that while the 2022 *Nuclear Posture Review* cancelled the SLCM-N program, the administration finds itself in a security environment that is deteriorating more rapidly than expected.[47]

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40. John Rood, "Statement on the Fielding of the W76-2 Low-Yield Submarine Launched Ballistic Missile Warhead," DOD, press release, 4 February 2020, https://www.defense.gov/.

41. Gregory Weaver, "The Urgent Imperative to Maintain NATO's Nuclear Deterrence," *NATO Review*, 29 September 2023, https://www.nato.int/.

42. Anya L. Fink, *Nuclear-Armed Sea-Launched Cruise Missile (SLCM-N)*, IF12084 (CRS, 31 May 2024), https://crsreports.congress.gov/.

43. Megan Eckstein, "The Navy Doesn't Want Nukes on Ships, Despite Interest from Some Combatant Commanders," *Defense News*, 13 May 2022, https://www.defensenews.com/.

44. Roberts et al., *China's Emergence*, 50.

45. Keith B. Payne and Michaela Dodge, "Subordinating Extended Deterrence to Antiquated Arms Control Initiatives," *Journal of Policy & Strategy* 3, no. 3 (2023): 37.

46. Fink, *Cruise Missile*.

47. Vipin Narang and Heather Williams, "Nuclear Threats and the Role of Allies: A Conversation with Acting Assistant Secretary Vipin Narang," transcript, CSIS, 1 August 2024, https://csis-website-prod.s3.amazonaws.com/.

The United States could also share SLCM-Ns with European Allies that have conventionally powered attack submarines (SSK), similar to the current dual-key arrangements with the B61. Just as with the bombs, these forward-based SLCM-Ns would be kept in storage until the Nuclear Planning Group decides to upload the missiles on the submarines. Subsequently, by keeping the forward-based SLCM-Ns in storage, the impact on the conventional mission of these dual-capable SSKs and the risk of conventional-nuclear entanglement would be limited. As one expert contends, however, the introduction of NATO commanded and controlled SLCM-N-armed submarines would fail to achieve consensus amongst all NATO Allies.[48] A decision for arming US attack submarines with SLCM-N would not need this consensus and would provide the United States with an additional, survivable, and flexible capability that can be deployed in both the Indo-Pacific and Euro-Atlantic theaters. Nonetheless, access and basing for the conventional support to nuclear operations required to support such capability and the issue of its overflight and the SLCM would still need to be worked out.

Land-Based Nuclear Capabilities: Politically Unfeasible for Now

During the Cold War, land-based nuclear capabilities were also deployed on European soil. In the 1980s, for instance, MGM-31B Pershing II road-mobile nuclear medium-range ballistic missiles (MRBMs), and BMG-109 Gryphon road-mobile nuclear ground-launched cruise missiles (GLCMs) were stationed in Europe. These deployments were part of NATO's *Double-Track Decision* from 1979, the response to the deployment of Soviet SS-20 nuclear intermediate-range missiles in Europe.[49] The missile deployments were combined with arms control talks that resulted in the Intermediate-Range Nuclear Forces (INF) Treaty in 1987. Yet large public protests erupted against these deployments.[50] Consequently, some Allies would probably oppose redeploying similar capabilities because of the potential for public contestation.[51] Allies on the eastern flank, however, would be more receptive toward such changes due to the developments on the other side in Kaliningrad and Belarus, where Russia has deployed dual-capable 9K720 Iskander-M (SS-26 Stone) road-mobile short-range ballistic missiles.[52]

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48. Bell, *Modernise*, 19.

49. *Special Meeting of Foreign and Defence Ministers (The "Double-Track" Decision on Theatre Nuclear Forces) Chairman: Mr. J. Luns* (NATO, 12 December 1979), https://www.nato.int/.

50. Susan Colbourn, *Euromissiles: The Nuclear Weapons That Nearly Destroyed NATO* (Cornell University Press, 2022).

51. Eric Edelman et al., *Arming America's Allies: Historical Lessons for Implementing a Post-INF Treaty Missile Strategy* (Center for Strategic and Budgetary Assessments [CSBA], 2022), https://csbaonline.org/.

52. Chels Michta, "Putin Points Nuclear Weapons at NATO: Time to Respond," CEPA [Center for European Policy Analysis], 17 July 2023, https://cepa.org/; and Pavel Slunkin, "Escalating Dependence: Russia's Nuclear Plans for Belarus," European Council on Foreign Relations Commentary, 29 March 2023, https://ecfr.eu/.

After the demise of the INF Treaty in 2019, former Secretary General Jens Stoltenberg emphasized that NATO "will not mirror Russia's destabilising behaviour" and had "no intention to deploy new land-based nuclear missiles in Europe."[53] Nevertheless, some analysts have proposed the reintroduction of conventional land-based missiles in the European theater.[54] One study argues that ground-based, theater-range missiles could augment deterrence in NATO's northeastern flank "by giving NATO more intermediate options on the deterrence ladder," which would basically establish a dual-track approach by helping to "restore the local strategic balance in a post-INF context, thus creating leverage to get Russia back into meaningful arms control talks in the future."[55] The missiles should, however, remain conventional to avoid misunderstanding that they can carry nuclear warheads.[56] Such conventional land-based missiles will be discussed below.

In contrast, another analysis supports developing a more diverse set of nonstrategic nuclear capabilities that includes a Pershing III.[57] Such a new MRBM could be reintroduced on the NATO side in the European theater as a reaction to similar Russian capabilities. Other possible types of land-based capabilities are nuclear cruise missiles and nuclear hypersonic missiles. As another analysis notes, "Given the challenges of detection and interception, very-high-speed, in-atmosphere weapons could provide Washington with a formidable means of addressing concerns over Chinese and Russian IAMD capabilities without necessarily increasing the size of the United States' nuclear stockpile." Considering the technical feasibility, this would be "time-consuming and expensive but might still reward the effort."[58]

While such deployments would thus mirror Russia's moves and considerably strengthen the nonstrategic nuclear capabilities in NATO, the potential political contestation that could be triggered by a deployment of such ground systems in Europe—and the necessary time to develop such capability—makes it unfeasible in the short term. The deployment of air- and sea-based nuclear cruise missiles and hypersonic missiles that remain under US control seems more realistic.

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53. "Press Conference by NATO Secretary General Jens Stoltenberg Following the First Day of the Meeting of NATO Ministers of Defence," NATO, 21 October 2021, https://www.nato.int/.

54. Jacob Cohn et al., *Leveling the Playing Field: Reintroducing U.S. Theater-Range Missiles in a Post-INF World* (CSBA, 2019), https://csbaonline.org/; and Luis Simón and Alexander Lanoszka, "The Post-INF European Missile Balance: Thinking About NATO's Deterrence Strategy," *Texas National Security Review* 3, no. 3 (2020), http://dx.doi.org/.

55. Simón and Lanoszka, "Post-INF," 14–15; and see also Camille Grand, *Missiles, Deterrence and Arms Control: Options for a New Era in Europe* (IISS, September 2023), 24, https://www.iiss.org/.

56. Simón and Lanoszka, "Post-INF,"29–30.

57. Robert Peters, research fellow at The Heritage Foundation, "Integrated Deterrence Across the Whole of Government" panel discussion, US Strategic Command Deterrence Symposium, Omaha, NE, 16 August 2023.

58. Douglas Barrie and Timothy Wright, "Not More, But More Assured: Optimising US Nuclear Posture," *Survival* 66, no. 4 (2024): 19–20, https://doi.org/.

Non-Nuclear Capabilities: Insufficient but Complementary

Another path toward enhancing forward-deployed nuclear forces in NATO is through the deployment of emerging and disruptive technologies as support for the nuclear mission, such as artificial intelligence, cyber and space capabilities, unmanned systems, conventional precision-strike weapons, and hypersonic missiles. Firstly, these EDTs can be used to strengthen conventional support to nuclear operations. For instance, unmanned combat aerial vehicles could be used for the destruction or suppression of enemy air defenses. Secondly, conventional precision-strike weapons can be used in tandem with forward-deployed nuclear weapons to maximize the effect of an attack. Third, conventional precision-strike weapons can also take over targets from nuclear weapons due to the increase in accuracy—leading to a reduced need for forward-deployed nuclear weapons in certain scenarios.[59] Fourth, certain capabilities such as hypersonic missiles are promising for extended deterrence because they enable "rapid deployment and low-altitude/lower-risk missions that evade existing defence, at a lower cost-point."[60]

An example of a hypersonic missile to be deployed by US strategic bombers that is currently under development is the AGM-183A Air-Launched Rapid Response Weapon.[61] Other conventional air-launched precision strike missiles under development are the Stand-in Attack Weapon (SiAW) and the Mako Air-Launched Hypersonic Missile. Due to their smaller dimensions, however, both are designed for delivery by tactical fighter jets. Both the SiAW and the Mako can be carried internally by a range of tactical aircraft, including the F-35A and C.[62] This means that the aircraft could maintain the benefits of its stealth characteristics.

An example of a ground-based conventional system is the Typhon Strategic Mid-Range Fires (SMRF) System. Developed as a reaction to the recent developments regarding Russian and Chinese artillery systems, the conventional SMRF system is part of the ongoing long-range precision fires modernization by the US Army. A SMRF battery will be part of the Strategic Fires Battalion of the Army's Multi-Domain Task Force, next to a HIMARS battery and a Long-Range Hypersonic Weapon battery.[63]

During spring 2024, such an SMRF battery was temporarily deployed to the Philippines for exercises.[64] Nevertheless, in the context of the demise of the INF Treaty

59. Fabian Hoffmann and William Alberque, *Non-Nuclear Weapons with Strategic Effect: New Tools of Warfare?* (IISS, March 2022), https://www.iiss.org/.

60. Rupal N. Mehta, "Extended Deterrence and Assurance in an Emerging Technology Environment," *Journal of Strategic Studies* 44, no. 4 (2021): 18, https://doi.org/.

61. Joseph Trevithick and Thomas Newdick, "B-52 Armed with Hypersonic Missile Makes Appearance in Guam," *TWZ*, 1 March 2024, https://www.twz.com/.

62. Thomas Newdick, "The Lowdown on Lockheed's Newly Revealed Mako Hypersonic Missile," *TWZ*, 11 April 2024, https://www.twz.com/; and Joseph Trevithick, "Stand-In Attack Missile Released from Fighter for First Time in USAF Test," *TWZ*, 2 December 2024, https://www.twz.com/.

63. Andrew Feickert, *The U.S. Army's Typhon Strategic Mid-Range Fires (SMRF) System*, IF12135 (CRS, 16 April 2024), https://crsreports.congress.gov/.

64. Feickert, *Typhon*, 2.

and the provocative dual-capable deployments on the Russia side, introducing such a battalion in the European theater would strengthen regional deterrence but would also not entail a tit-for-tat deployment that the former NATO secretary general ruled out. Subsequently, the July 2024 US–Germany joint statement on long-range fires deployment in Germany should be welcomed. The conventional weaponry that will be deployed include the SM-6, Tomahawk, and "developmental hypersonic weapons."[65] While it is not surprising that Russian President Vladimir Putin sees these deployments as a provocation, one study contends that "Putin's comparison of the present situation with NATO's 1979 decision to deploy US missiles to Europe disregards the fact that, in both instances, US missile deployments have followed a Russian precedent."[66]

Ideally, such units would be based on the territories of multiple Allies. Poland in particular should be one of those host nations as this would increase its role in NATO's deterrence efforts. Due to the conventional nature of the system, it would also more easily gain political approval by the other Allies and would not be perceived by the adversary as a nuclear provocation. The July 2024 European agreement between France, Germany, Italy, and Poland to develop jointly ground-launched cruise missiles has a similar potential to bolster Europe's role in the conventional deterrence posture of the Alliance.[67]

Nevertheless, it is important to stress that these and other non-nuclear strategic capabilities are still under development. Consequently, EDT options are not yet a valuable alternative to substitute the forward-deployed nuclear forces in NATO due to symbolic and political reasons, and psychological effects.[68] Therefore, complementing the current nuclear capabilities with EDTs remains the most attractive option.

Conclusion

Because of the growing risk of a future nuclear crisis triggered by Russia and wider uncertainties regarding future contingencies, NATO and the United States as guarantor require a range of forward-deployed nuclear options to manage escalation dynamics. Relying solely on the B61-12 seems imprudent in the face of a revisionist nuclear power that possesses a significant number of nonstrategic nuclear weapons and sees

65. "Joint Statement from United States and Germany on Long-Range Fires Deployment in Germany," The White House, press release, 10 July 2024, https://bidenwhitehouse.archives.gov/; and see also Jonas Schneider and Torben Arnold, *Significant and Sound: US Medium-Range Missiles in Germany* (SWP, 2024), https://www.swp-berlin.org/.

66. Timothy Wright and Douglas Barrie, "The Return of Long-Range US Missiles to Europe," IISS, 7 August 2024, https://www.iiss.org/.

67. Sabine Siebold and John Irish, "France, Germany, Italy, Poland Agree to Jointly Develop Long-Range Cruise Missiles," Reuters, 11 July 2024, https://www.reuters.com/.

68. Jacek Durkalec et al., *Nuclear Decision-Making, Complexity and Emerging and Disruptive Technologies: A Comprehensive Assessment* (European Leadership Network Report, February 2022), 24, https://www.europeanleadershipnetwork.org/.

them as flexible instruments to achieve various goals during conflict and war.[69] The B61-12 provides the dual-capable fleet with an improved gravity bomb; however, these munitions should thus in the medium term be supplemented and later replaced by dual-capable air-launched cruise missiles or air-launched hypersonic missiles.

While fielding such capability would increase risks related to warhead and intent ambiguity, it would also greatly enhance the military credibility of the F-35A DCA fleet without pressuring Allies to make decisions that risk undermining the cohesion of the Alliance, a concern raised by analysts in the 1960s and echoed today.[70] According to one study, introducing nuclear-armed ALCMs would not violate the INF, the Presidential Nuclear Initiatives, or the NATO-Russia Founding Act, and would merely complement an already existing capability, "which takes into account technological changes in adversary air defenses." Furthermore, it could be seen as a justified reaction to the INF violations of Russia, while at the same time be potentially useful as a bargaining chip in future arms control initiatives.[71]

What, then, is feasible in the short term? The options worth exploring are improvements within the existing framework—such as the reactivation of the UK as an active DCA Ally—improving the Integrated Air and Missile Defense of DCA air bases, and developing dispersion plans. Furthermore, the permanent basing of a US bomber squadron—ideally, in the future, the B-21—in the European theater and having US nuclear-powered attack submarines with SLCM-N patrolling the Euro-Atlantic area, would also lead to an increase in the military and political credibility of American extended nuclear deterrence. Complementary non-nuclear capabilities could also reinforce CSNO or forward-deployed nuclear capabilities. It will, however, be important to pre-assign such assets to the European theater to avoid abandonment fears in the case of a two-front war.

The results should be a more diversified posture consisting of forward-deployed nuclear forces under NATO/NPG control, namely the DCA capability with ideally dual-capable ALCMs next to the B61 bombs; conventional forces under NATO/Supreme Allied Commander Europe; and nuclear forces under US control, namely the bombers and US attack submarines. Such a mix could enhance the credibility and flexibility of forward-deployed nuclear forces as there would be more controlled response options than only the B61-12 to close the gap in the escalation spectrum. Furthermore, this changed posture would be more politically feasible for both Europe and the United States because the additional nuclear delivery systems of bombers and SSNs would remain under US command and control. It will, however, be important for the United States to consult regularly with NATO Allies in the Nuclear Planning Group

69. William Alberque, *Russian Military Thought and Doctrine Related to Non-Strategic Nuclear Weapons: Change and Continuity* (IISS, January 2024), https://www.iiss.org/.

70. See F. C. Iklé et al., *The Diffusion of Nuclear Weapons to Additional Countries: The "Nth Country" Problem* (US Air Force Project RAND, 15 February 1960), https://www.rand.org/; and Bell, *Modernise*, 18.

71. Kroenig, "NATO Nuclear Posture," 10.

on bomber and SSN deployments in the Euro-Atlantic region to avoid the problem that one nuclear strategist refers to as "no annihilation without representation."[72]

Consequently, if the United States wants to remain the "ultimate guarantor" and avoid proliferation pressures amongst its Allies, it will need to continue sharing the nuclear burden.[73] Adjusting the mix of US nuclear capabilities will also be necessary to maintain the credibility of extended nuclear deterrence, considering the emerging threats. Finally, while this discussion has focused on identifying what capabilities might be involved, the analysis of locations and the quantity of such capabilities warrant further research. *Æ*

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72. Klaus Knorr, as cited in Jeffrey H. Michaels, "'No Annihilation Without Representation': NATO Nuclear Use Decision-Making During the Cold War," *Journal of Strategic Studies* 46, no. 5 (2023): 1014, https://doi.org/.

73. Wannes Verstraete, "Anticipating Europe's Nuclear Futures," *The Washington Quarterly* 47, no. 1 (2024), https://doi.org/.