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## Feature Report

***“Are Drone Swarms Weapons of Mass Destruction?”***. By Zachary Kallenborn. Published by U.S. Air Force Center for Strategic Deterrence Studies.

<https://www.airuniversity.af.edu/Portals/10/CSDS/monographs/MONO60%20Drone%20Swarms%20as%20WMD.pdf?ver=2020-05-13-135901-057>

Public discussion has raised significant fears over armed drone swarms being used in a manner like weapons of mass destruction (WMDs). However, should they be considered WMDs? The first half of the article explores the question of comparing drone swarms to various conceptions of WMD. Overall, it finds that a subset of drone swarms, armed fully autonomous drone swarms (AFADS), are WMD. The second half examines the potential of drone swarms to serve in traditional WMD roles. Although drone swarms could be effective mass casualty weapons, they are likely to be a poor strategic deterrent. Drone swarms could be a useful anti-access/area-denial or assassination weapon in some contexts. The study has broad conceptual, legal, and policy implications. If drone swarms are WMD, then various international treaties apply, their use may justify military intervention in conflict, and new nonproliferation treaties should be developed.

Zachary Kallenborn is a senior consultant at ABS Group specializing in unmanned systems (swarms), WMD terrorism, and WMD warfare writ large. His research has been published in the Nonproliferation Review, Studies in Conflict and Terrorism, Defense One, War on the Rocks, and other outlets. This article represents the personal views of the author and do not necessarily represent the views of any current or past employer or funder.

The author is grateful to Philipp C. Bleek, Tony Barrett, Andrew Ross, Stuart Russell, and Russell Vane for providing invaluable feedback. Any errors are the author’s own.

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# NUCLEAR WEAPONS AND DETERRENCE

Defense News (Washington, D.C.)

## **DoD Asks Congress for a Two-Sub Columbia-Class Buy**

By Joe Gould, David B. Larter and Valerie Insinna

May 13, 2020

WASHINGTON — The Pentagon is asking Congress for authority to buy two of its new Columbia-class ballistic missile submarines, a potential mega-deal worth as much as \$17.7 billion with far-reaching implications for the ailing submarine industrial base.

If approved, the proposal would potentially lower the price by promising General Dynamics a steady stream of work at its shipyard as the Pentagon and its network of suppliers grapple with COVID-19's economic shocks. General Dynamics and the Navy have been negotiating the terms of a two-ship purchase, but nothing can be finalized until Congress authorizes the block buy.

As the House and Senate Armed Services committees ready their drafts of the 2021 National Defense Authorization Act, it's customary for the Defense Department to send legislative proposals for the annual policy bill. It was unclear how Congress will ultimately react to this one, but at least one key lawmaker would "seriously consider" the proposal.

Senate Armed Services Seapower Subcommittee Chairman David Perdue, R-Ga., "certainly supports and has been working toward better business practices in the Department of Defense. He would seriously consider any proposal that achieves cost savings or increases efficiency," said his spokesperson, Jenni Sweat.

The Columbia-class program is meant to design and build 12 new ballistic missile submarines to replace the Navy's current force of 14 aging Ohio-class boats. The president's budget estimated the cost of the lead Columbia-class sub at \$14 billion, the second at \$9.3 billion, and total procurement costs for all 12 at \$110 billion.

The Navy wants to procure the first Columbia-class boat in fiscal 2021, the second in fiscal 2024, and the remaining 10 at a rate of one per year from 2026 through 2035. The Navy has already spent about \$6.2 billion in advanced procurement for the Columbia, which leaves about \$8.2 billion remaining for the first boat.

A summary of its new legislative proposal, obtained by Defense News, said the move is intended to "permit the Navy to enter into one block buy contract for up to two Columbia-class submarines (SSBN 826 and SSBN 827), providing industrial base stability, production efficiencies, and cost savings when compared to an annual procurement with options cost estimate."

Complicating matters is the potential for the coronavirus pandemic to create construction or funding issues that delay SSBN 826's first scheduled patrol in 2031, according to a recent Congressional Research Service report. To boot, it was unclear whether the Navy had accurately projected costs or whether stable funding would be available across the Navy's procurement portfolio.

The Navy is confident the program is on track and negotiations are ongoing in line with what the Navy has previously disclosed, said Capt. Danny Hernandez, spokesman for the Office of the Assistant Secretary of the Navy for Research, Development and Acquisition.

"The Columbia program is on track, it is our top acquisition priority," Hernandez said in an email. "Per the Navy's Budget Submission, the Navy plans to award a contract modification for construction of the first two Columbia-Class ships as a priced option in FY20.

"Formal option exercise and SSBN 826 construction start are planned for October 2020, following required Congressional authorizations and appropriation of funds."

This week, the Navy and General Dynamics were still negotiating on the terms of the two-ship buy, but what the ultimate savings would be for contracting for two together was not clear yet, according to a source familiar with the talks. No final deal can be negotiated until Congress has authorized the contract.

Also unclear is how perturbations in the system from the COVID-19 outbreak might impact the supply and labor system, the source said.

Indeed, the potential impact of COVID-19 on an already stressed submarine industrial base is one reason the strategy could be important, said Bryan Clark, a retired submarine officer a senior fellow at the Conservative Hudson Institute think tank.

"There has already been advanced procurement money provided by Congress that has been used to build missile tubes, nuclear reactors and propulsion plants," Clark said. "But there is a bunch of other equipment on the ship that you would like to buy in quantities: Pumps, valves, fans, a lot of habitability systems.

"If you double the number of ships, you double the number that you buy and maybe you reduce your costs, but more importantly you support your industrial base."

To date, disruptions to the submarine supplier base and the Electric Boat shipyard have been comparatively mild, two sources familiar with the situation said.

General Dynamics is interested in locking in a larger block buy for the remaining ten boats, and a source familiar with the company's thinking said the precise savings would be clear once the company gets further along with construction of the first boat. The third ship will officially be procured in 2026, so it gives the parties time to understand the program better.

The Navy has been public about its desire to buy the first two submarines as a block but given that it's a new start program, that seemed premature, said Project On Government Oversight military analyst Dan Grazier. He noted that a multi-year procurement, under the law, would require a stable design, while a block buy would not.

"The Navy claims the Columbia's design is much further along in the process than the Ohio was at this point, but the Navy's track record of designing and building ships recently is quite poor," Grazier said.

"The Zumwalts, LCSs, and the Ford-class ships were designed using similar methods and the results have proven to be both costly and disappointing. It would be better to build the first boat and make sure the design actually works as intended because if it doesn't, then the money we save now will actually cost us much more in the future."

Clark, on the other hand, argued that while early multi-ship buys on new classes of ships are usually a bad idea, Columbia might be a special case where the risks associated with early block buys are sufficiently offset.

"You wouldn't want to do a block buy if you thought the design was going to change significantly, as in you were going to buy one or two hulls and then revise it based on the results of testing or production issues," Clark said. "On this one, more of the design is more complete so they are confident it is mature.

"And with the experience General Dynamics has with submarine construction, they are confident in their path to build it without significant design changes."

The Navy is aiming to have more than 80 percent of the Columbia's design complete prior to construction starting later this Fall, double where they were at the start of construction on the lead boat of the Virginia class.

The Columbia class is not the only big-ticket weapons program where the Pentagon is seeking latitude from Congress in pursuit of savings. For the Lockheed-made F-35 Joint Strike Fighter, DoD has separately proposed to use department funds to again bulk buy F-35 components – "material and equipment" in "economic order quantities," the proposal synopsis says – for Lot 15 in fiscal 2021 through Lot 17 in 2023.

Lawmakers have historically been supportive of such moves, and Congress authorized the purchase of F-35 economic order quantity buys in the fiscal 2020 defense policy bill.

In October, the Defense Department and Lockheed finalized a deal for F-35 lots 12, 13 and 14, but the order is structured so that lot 13 and 14 fall under separate contract options, differentiating it from a block buy.

Lt. Gen. Eric Fick, who leads the F-35 program on behalf of the government, has said that arrangement would likely continue over the next several production lots.

"To date, we are pursuing a base-plus-options production contract vehicle for [lots] 15 to 17," Fick said in March at the McAleese and Associates conference. "The business case that supports a three year multi year has not been there. We have not seen from Lockheed a business case that merits tying up three years of appropriated funds."

Clarification: The story has been updated to clarify the specific transaction for which the Navy is seeking authority from Congress.

<https://www.defensenews.com/congress/2020/05/13/dod-asks-congress-for-columbia-submarine-block-buy/>

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Washington Examiner (Washington, D.C.)

## **Russian Deterrence Funds to Europe Slashed to Pay for Border**

By Abraham Mahshie

May 14, 2020

When Russia invaded Crimea in 2014, it didn't just take a piece of Ukraine, it alerted a distracted NATO to the vulnerability of its newest member states on the eastern flank. Now, paying for the U.S. border wall with Mexico may be giving Russia another opening in Eastern Europe six years after masked Russian troops entered Ukraine.

Some \$1.1 billion dedicated to strengthening the capacity of the United States to respond to Russian aggression in Europe has been redirected to the southern border wall over the last two years as the Defense Department scrambles to pay the bills for President Trump's unfunded project.

To deter Russia from the Baltics and Eastern and Central Europe, the U.S. has invested more than \$20 billion since 2015 into a rotational troop presence, exercises and training, preposition of equipment, improved infrastructure, and partner capacity.

The U.S. had been playing catch-up because Russia was not seen as a threat in the aftermath of 9/11.

But projects in 13 countries have been delayed indefinitely according to interviews with U.S. European Command in Stuttgart, Germany, and an April 27 letter from Defense Secretary Mark Esper obtained by the Washington Examiner.

“NATO and the U.S. were focused on combating terrorism, and there was no political appetite whatsoever to strengthen those collective defense mechanisms,” Wojciech Lorenz, a security analyst at Warsaw’s Polish Institute of International Affairs, told the Washington Examiner.

The new NATO members on the eastern flank were far overmatched by Russia, and the U.S. had just withdrawn its last tanks from Europe and was down to two operational brigades just before the Crimea invasion, Lorenz said.

“There were no regular exercises of troop deployments, no command structure that would facilitate the defense of the new member states,” he added.

NATO had effectively created two distinct “zones of security” in the alliance. The eastern flank was not defensible.

“Russia was not bluffing that it may be ready to use force to regain the sphere of influence,” Lorenz said.

The answer was the European Reassurance Initiative, a more than \$1 billion Obama administration commitment to improve readiness.

Investments included \$13 million to improve the Siauliai airfield in Lithuania and \$14 million in Amari, Estonia, for barracks, a maintenance hangar, and squadron operations. The facilities allow U.S. and NATO Baltic Air Policing missions.

Even while Trump was making overtures to Russian President Vladimir Putin early in his presidency, American troops were on ships and planes being deployed to Poland to establish an Armored Brigade Combat Team.

The efforts complemented and encouraged NATO to make additional investments and troop commitments, including a \$200 million commitment to a Polish base in Powidz to serve as a hub for the region.

Under Trump, the reassurance program became the European Deterrence Initiative, and investments grew from \$3.4 billion in 2017 to \$6.53 billion in 2019.

Army preposition stocks and deployable air bases were dispersed throughout Eastern Europe, and anti-submarine infrastructure was upgraded as each year of the five-year plan focused on a different service.

Heel-to-toe rotations of a battalion task were also sent to a base in northeastern Poland, right on Russia’s doorstep.

The U.S. also started building an Aegis Ballistic Missile Defense System in Redzikowo, in Northern Poland, to protect against short and intermediate-range ballistic missiles.

Then the border wall needed funding, and the DOD had to take a hard look at which programs could be deferred.

NATO’s ‘growling’ dog on the Russian border

Al Viana, the division chief at U.S. European Command who oversees EDI, explained deterrence to the Washington Examiner as a guard dog in somebody’s backyard.

“If you walk up to somebody's yard, and you don't hear the dog, and you walk in the backyard because you don't hear the dog, are you deterred?” he asked, rhetorically.

“If you hear some growling, you're a little more careful about walking in that guy's backyard,” he said, trying to establish the difficulty of measuring the success of deterrence measures.

Piotr Szymanski, security analyst at the Warsaw Centre for Eastern Studies, said risk encounters with Russian vessels and fighter jets in the Baltic Sea region have led to numerous “unpleasant, aggressive scenarios.”

“There are several threats and risks scenarios in our region,” he told the Washington Examiner.

Szymanski said beyond the intercepts, Russian aggression has included cyberactivity, large-scale disinformation campaigns, and a bolstered Russian military presence in an area along Poland's northern border known as the Suwalki Gap.

There, Russia maintains the noncontinuous territory of Kaliningrad, a militarized outpost between Poland and Lithuania on the Baltic coast and studied by NATO as the potential area where trouble could begin.

So real is the threat of Russian intervention that in 2017 when Russia conducted its Zapad joint military exercises with ally Belarus on Poland's eastern border, the U.S. sped up a rotational force so that two brigades would overlap in Europe, just in case the exercises were actually a preparation for invasion.

“In the spring of 2016, we started to look at the problems,” said Viana, who has been part of the EDI program since the beginning. “It was more than just reassuring our allies, it appeared like Russia was not going to come out of Crimea.”

Since then, the European Deterrence Initiative has gone beyond reassuring allies to show NATO allies that the United States had the tools in place to leap into action, if necessary.

“What the project does for us, is it allows us to quickly fly soldiers into the theater, match up with its equipment set, and we rapidly go to wherever it needs to be,” he said. “When the allies go to the port and just see the amount of American equipment that comes off of a ship and how quickly it comes off the ship, you get this feeling that, 'Hey, U.S. is there for them.'”

Szymanski agreed.

“It is a huge deal for the entire eastern flank and the Baltic Sea region and Central, Eastern Europe mainly because of the fact that it is not only about infrastructure, but through the European Deterrence Initiative, the U.S. is providing financial aid to allied capabilities,” he said.

“The main goal is to deter Russia and simultaneously to modernize our armed forces,” he said, noting that one can easily track Polish Army and Air Force procurements of U.S. hardware. “The newest, most expensive stuff is bought from the U.S.”

The same goes for the Baltic states, which use U.S. assistance to buy U.S.-made Black Hawk helicopters and Javelin anti-tank missiles.

U.S. Navy Capt. Scott Raymond, chief engineer for the EUCOM logistics directorate, told the Washington Examiner that the program hadn't been eliminated, just delayed.

“The projects remain. They're valid requirements. What they're missing is the funding,” he said. “There's a lot more to our partnerships with our allies than just us building infrastructure.”

Nonetheless, Raymond said it was hard to quantify deterrence.

“I’m sure of this: Investments in infrastructure for things like airfields or stockpiles or fuel or munitions absolutely has to have a deterring effect,” he said. “That is combat power that is available and ready to apply on a moment’s notice, and that is something that if you didn’t have, we could always apply that combat power, but it takes time. A lot of what we do really is the calculus of time and distance.”

The Polish security experts admit that U.S. investments already made have had a measurable impact, but the reduction in funding is a concern.

“I think that it is an error of internal U.S. politics that this administration wanted to direct some money to building the wall with Mexico,” Szymanski said. “This is not a big amount of money for the U.S., for bolstering this presence on the eastern flank.

He added: “This is quite efficient, and at the same time it has a kind of low visibility, it is not like a part of this never-ending wars debate or overstretched defense budget.”

Lorenz admits Russian deterrence capability is vastly improved, but he worries the deferrals may be a sign that investments are winding down.

“If something is cut down, it is always a reason for concern,” he said. “Nevertheless, it is still a Copernican change what we have now and what we had before annexation of Crimea.”

<https://www.washingtonexaminer.com/policy/defense-national-security/russian-deterrence-funds-to-europe-slashed-to-pay-for-border-wall>

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Jamestown Foundation (Washington, D.C.)

## **Russia’s Aerospace Forces Prepare Training for Kinzhal Hypersonic Missiles**

By Roger McDermott

May 13, 2020

Russia’s Aerospace Forces (Vozdushno Kosmicheskikh Sil—VKS) are preparing to create a MiG-31K regiment in the Siberian city of Kansk, in the Central Military District (MD), fully equipped with Kh-47M2 Kinzhal hypersonic missiles. The training of flight crews will commence in late 2021, with the switch to the new weapons systems complete by 2024. The preparations at the VKS base in Kansk will also likely serve as a model for equipping other VKS regiments. However, the location itself confirms the strategic importance of the new hypersonic missile system and its importance to the Aerospace Forces (Ferra.ru, May 10).

President Vladimir Putin places great emphasis on Russia developing and introducing such hypersonic weapons, while also suggesting that the country is far ahead of peer competitors in this field (see EDM, September 4, 2019). The role of such systems in the strategic thinking and planning of Moscow’s political-military leadership will continue to burgeon in the future as more of these enter service. It marks Russia’s further advance into high-precision strike capability, which will greatly enhance its overall deterrence as well as offer additional options to target enemy forces at depth (see EDM, February 26, 2019).

The Kh-47M2 Kinzhal is a nuclear-capable air-launched ballistic missile (ALBM) with a claimed range in excess of 2,000 kilometers, achieving Mach 10, with the ability to perform evasive maneuvers at every stage of its flight. It can also be armed with a conventional high explosive fragmentation warhead. By introducing the Kinzhal to the VKS regiment in Kansk, it offers the capability to cover potential threats in all strategic directions across the Russian Federation. Flight

crews of the 712th Fighter Aviation Regiment, based in Kansk, will train in their MiG-31K aircraft to master the Kinzhal ALBM. The commander of the Central MD, Lieutenant General Alexander Lapin, confirmed that the rearmament of the fighter regiment to hypersonic missile systems is scheduled for completion in 2024 (Izvestia, May 10).

The training will prepare pilots for flights in the special circumstances necessary for the use of the Kinzhal ALBM. Russian military specialists have noted the significance of creating such a powerful “operational fist” in the Central MD, which can be used to strengthen Russian military forces in any required strategic direction at short notice. Moscow-based Russian military expert Vladislav Shurygin highlighted the selection of Kansk and its strategic importance: “The place of this deployment was chosen as rationally as possible. From Siberia, MiGs with a long flight range can be thrown to the north, south, west or east of the country. The situation in all these areas cannot be called calm. In particular, after the withdrawal of the American army from Afghanistan, the situation in Central Asia, where militants will come, may worsen. In the Far East, we have not resolved territorial disputes with Japan. There are disagreements in the Arctic with a number of NATO [North Atlantic Treaty Organization] countries over the use of the Northern Sea Route. Hypersonic missiles will certainly cool any hotheads” (Izvestia, May 10).

The Kinzhal was first tested using a MiG-31B, in the Southern MD, in March 2018. The weapon first entered service in that military district in May 2018, equipping ten MiG-31Ks (Bmpd.livejournal.com, May 6, 2018). In addition to the hypersonic capability of this ALBM, the Kinzhal flies at the stratosphere boundary to minimize air resistance and is specially designed to evade enemy air defenses and offer improved high-precision targeting. It can be launched from Tu-22M3 bombers or MiG-31K interceptors. Its overall weight and characteristics of the ALBM compelled the defense ministry to specially modernize the existing MiG-31B to the MiG-31K. The newer model of this interceptor received new onboard equipment, increased fuel supply, and communications equipment to facilitate the receipt of target designation data. These changes forced the VKS to redevelop the methodology for the combat use of the MiG-31K and to retrain its pilots (Izvestia, May 10). The MiG-31K accelerates to Mach 2.3 to provide the Kinzhal with the necessary launch speed to then accelerate to Mach 10. With its 2,000-kilometer range, the Kinzhal avoids requiring the MiG-31K to enter the coverage area of enemy air defenses (Rosssiyskaya Gazeta, November 31, 2019).

It is planned that the Kinzhal equipped regiment in Kansk will, in the future, be protected by the S-350 Vityaz surface-to-air missile (SAM) system, which will be put into service in another city in Krasnoyarsk Territory, Achinsk, by the end of 2025 (Ferra.ru, May 10). Military expert Shurygin explained, “The MiG-31 with Kh-47M2 missiles must be reliably covered by air-defense systems. The S-350 [see EDM, April 7] will meet enemy aircraft and cruise missiles on the far approaches to the airfield. The Pantsir-S1, armed not only with anti-aircraft missiles but also with an artillery mount, will cover the MiG-31 and finish off the enemy that has broken through” (Izvestia, May 10).

Russian defense specialists noted that following the first appearance of the Kinzhal in the country’s military inventory, experts from the United States initially dismissed the new ALBM. Nevertheless, Lockheed Martin has since received an almost \$1 billion contract from the US Air Force to develop an air-based hypersonic Air-Launched Rapid Response Weapon (ARRW) missile. It is planned to achieve initial operational readiness by 2022. Russian defense officials see such developments in the US as an attempt to play catch up in the field of hypersonic missile systems (Regnum, April 29, 2020; Naukatehnika, December 4, 2019).

The Kh-47M2 Kinzhal hypersonic missile is an invaluable asset for the VKS, providing high-precision strike and nuclear options. The refitted MiG-31K has been modernized to suit the new ALBM. Over a three-year period, the regimental flight crews will be trained, doubtless drawing on

the experience of testing the ALBM in the Southern MD and (in November 2019) over the Arctic, before this advanced system is fully functional within the Central MD. The hypersonic Kinzhal ALBM fits a pattern of concerted state investment in high-precision systems to offer scope and depth to the non-nuclear elements in Russia's deterrence strategy.

<https://jamestown.org/program/russias-aerospace-forces-prepare-training-for-kinzhal-hypersonic-missiles/>

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Defense News (Washington, D.C.)

### **Three British Nuclear Programs are \$1.67 Billion over Budget**

By Andrew Chuter

May 12, 2020

LONDON — Critical programs aimed at updating Britain's nuclear weapons infrastructure have been hit by long delays and huge cost increases, according to the parliamentary Public Accounts Committee.

Poor management on three nuclear projects involving warhead assembly, core reactor production and submarine building have resulted in combined cost increases of £1.35 billion (U.S. \$1.67 billion) as well as delays of between 1.7 and 6.3 years, the committee revealed in a report scheduled for release May 12.

The cost overruns were caused in large part by avoidable mistakes, such as beginning construction work without mature designs, said the committee.

The cost increases and delays cited in the report could be the tip of the iceberg in the nuclear sector. The three programs investigated by the committee represent about a quarter, by initial value, of the 52 nuclear infrastructure programs that the Ministry of Defence is pursuing. A report on nuclear infrastructure late last year by the government's financial watchdog, the National Audit Office, said the initial value of all the projects was almost £5 billion.

The parliamentary committee said the MoD admitted that costs on the three projects "could keep rising, as its poor contract design has left the taxpayer to assume financial risk, while doing little to incentivize contractors to improve their performance."

The report said the MoD has poorly managed the three programs, failed to learn from past mistakes and agreed to poorly designed contracts with the major companies that have a stranglehold on Britain's defense nuclear sector. The contracts did not allow the ministry to share the financial risk with contractors, which meant the government bore the full impact of cost increases, including those of subcontractors.

"To utterly fail to learn from mistakes over decades, to spectacularly repeat the same mistakes at huge cost to the taxpayer — and at huge cost to confidence in our defense capabilities — is completely unacceptable," said Member of Parliament Meg Hillier, who chairs the Public Accounts Committee.

"We see too often these same mistakes repeated," she added. "The department [MoD] knows it can't go on like this. It knows it must change and operate differently. The test now is to see how it will do that, and soon."

What happened with the three programs?

The worst offender in the committee's report is the MENSA program at the Atomic Weapons Establishment in Burghfield, southern England, where a new nuclear warhead assembly and disassembly facility is under construction.

"MENSA had seen a cost increase of £1.07 billion. Some of these cost increases were the result of poor planning decisions and were avoidable. For example, 48% of the total increased costs and nearly £400 million for MENSA was a result of construction starting before requirements or designs were sufficiently clear, which was time-consuming and costly to subsequently rectify," the report said.

The Atomic Weapons Establishment is run by a Lockheed Martin-led partnership involving Jacobs Engineering as well as Serco under a government-owned, contractor-operated arrangement.

The report by the National Audit Office estimated MENSA would be 6.3 years late.

When asked about how the MENSA program is faring, AWE provided Defense News with its latest in-service completion date of 2023, adding that the work is now "focused on procuring and fitting out the necessary equipment and seeking regulatory approvals."

The other two programs investigated by the Public Accounts Committee are based at the Rolls-Royce reactor-core production capability facilities at Raynesway, near Derby, England, and at BAE Systems' submarine-building yard at Barrow.

The cost of the Rolls-Royce facility being built to equip the upcoming Dreadnought-class of nuclear missile submarines with a new reactor design was forecast at £474 million, with a completion target date of 2026. The National Audit Office found that date to be 5.1 years behind schedule.

The future sub-building facility at BAE Systems' Barrow location is expected to cost £240 million, with a completion date of 2022. The new facility is to allow for the modular build of the four Dreadnought-class submarines destined to replace the Royal Navy's Vanguard boats. The National Audit Office estimated that BAE's infrastructure project is 1.7 years behind schedule under that completion date.

The watchdog also said in its report that despite earlier challenges, the projects had made progress in later stages. All programs are in their fitting-out stage.

A Rolls-Royce spokesperson noted that the creation of a new, nuclear-regulated facility is "a highly complex and intricate project."

"Our existing facilities have been in use since the 1950s, so this really is a once-in-a-generation construction project, and we're working closely with the MoD to ensure this important facility faces no further delays," the spokesperson said.

A BAE spokesperson said the company had not seen the report and therefore was unable to comment.

How are other nuclear projects getting along?

Another troubled AWE program — Project Pegasus — was not included in the parliamentary investigation, as construction had not even begun when the MoD paused the project. The ministry put it on hold to further mature the design of the facility to better handle and produce enriched uranium. The £634 million facility was originally planned to enter service in 2016.

The MoD told the Public Accounts Committee it had learned lessons from other programs, and so paused Pegasus to ensure the design is sufficiently mature and that requirements for a future warhead are clear.

The committee reported that the country's nuclear efforts account for about 18-19 percent of the U.K. defense budget, whereas it is only 6-7 percent of the U.S. defense budget.

The MoD told the committee that it had the necessary funding but will negotiate with the Treasury about future funding as part of the upcoming governmentwide spending review.

The ministry also said it wants to avoid cuts to the nuclear budget. "The Department is keen to place some form of ring-fence around the nuclear budget, given its high priority and importance," the committee report said.

In a statement, an MoD spokesperson cited the complexity of nuclear infrastructure projects, but said the ministry continues "to work closely with the regulators and our industry partners."

"Together, we are committed to strengthening the management of nuclear programs, including significant investments in infrastructure to store and update weapons."

<https://www.defensenews.com/global/europe/2020/05/12/three-british-nuclear-programs-are-167-billion-over-budget/>

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University of Reading via Phys.org (Isle of Man)

## **Cold War Nuke Tests Changed Rainfall: Study**

By University of Reading

May 13, 2020

Nuclear bomb tests during the Cold War may have changed rainfall patterns thousands of miles from the detonation sites, new research has revealed.

Scientists at the University of Reading have researched how the electric charge released by radiation from the test detonations, carried out predominantly by the US and Soviet Union in the 1950s and 1960s, affected rainclouds at the time.

The study, published in Physical Review Letters, used historic records between 1962-64 from a research station in Scotland. Scientists compared days with high and low radioactively-generated charge, finding that clouds were visibly thicker, and there was 24% more rain on average on the days with more radioactivity.

Professor Giles Harrison, lead author and Professor of Atmospheric Physics at the University of Reading, said: "By studying the radioactivity released from Cold War weapons tests, scientists at the time learnt about atmospheric circulation patterns. We have now reused this data to examine the effect on rainfall.

"The politically charged atmosphere of the Cold War led to a nuclear arms race and worldwide anxiety. Decades later, that global cloud has yielded a silver lining, in giving us a unique way to study how electric charge affects rain."

It has long been thought that electric charge modifies how water droplets in clouds collide and combine, potentially affecting the size of droplets and influencing rainfall, but this is difficult to observe in the atmosphere. By combining the bomb test data with weather records, the scientists were able to retrospectively investigate this.

Through learning more about how charge affects non-thunderstorm clouds, it is thought that scientists will now have a better understanding of important weather processes.

The race to develop nuclear weapons was a key feature of the Cold War, as the world's superpowers sought to demonstrate their military capabilities during heightened tensions following the Second World War.

Although detonations were carried out in remote parts of the world, such as the Nevada Desert in the US, and on Pacific and Arctic islands, radioactive pollution spread widely throughout the atmosphere. Radioactivity ionises the air, releasing electric charge.

The researchers, from the Universities of Reading, Bath and Bristol, studied records from well-equipped Met Office research weather stations at Kew near London and Lerwick in the Shetland Isles.

Located 300 miles north west of Scotland, the Shetland site was relatively unaffected by other sources of anthropogenic pollution. This made it well suited as a test site to observe rainfall effects which, although likely to have occurred elsewhere too, would be much more difficult to detect.

Atmospheric electricity is most easily measured on fine days, so the Kew measurements were used to identify nearly 150 days where there was high or low charge generation over the UK while it was cloudy in Lerwick. The Shetland rainfall on these days showed differences which vanished after the major radioactivity episode was over.

The findings may be helpful for cloud-related geoengineering research, which is exploring how electric charge could influence rain, relieve droughts or prevent floods, without the use of chemicals.

Professor Harrison is leading a project investigating electrical effects on dusts and clouds in the United Arab Emirates, as part of their national programme in Rain Enhancement Science. These new findings will help to show the typical charges possible in natural non-thunderstorm clouds.

<https://phys.org/news/2020-05-cold-war-nuke-rainfall.html>

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## US COUNTER-WMD

U.S. Army

### **America's Only Missile Defense Brigade 'Deployed in Place'**

By Staff Sgt. Zachary Sheely | 100th Missile Defense Brigade (GMD)

May 12, 2020

COLORADO SPRINGS, Colo. – As the stranglehold of the COVID-19 pandemic tightened its grip on America, closing schools, businesses and government institutions, the focus for the Soldiers at the 100th Missile Defense Brigade (Ground-based Midcourse Defense) became singular – maintain the mission, no matter what.

That mission is the federally mandated defense of the United States homeland from intercontinental ballistic missile attack. A limited number of U.S. Army Soldiers in Alaska, California and Colorado operate a sophisticated fire control system that can, on-order, launch ground-based interceptor missiles to destroy incoming warheads in outer space. This is a task that cannot be done from home, as missile defense crews operate together within the walls of secured facilities.

Since the onset of the pandemic, the 100th Missile Defense Brigade has implemented measures to ensure the continued execution of its mission, including sequestering crew members from their homes and families.

“I deployed to Afghanistan with an infantry platoon, so I know what it’s like to be truly deployed to a mountainous combat outpost in a war zone,” said Staff Sgt. Hayden Murray, a 100th Missile Defense Brigade readiness operations officer. “This is different, but not completely. We are ‘deployed in place,’ and our job is the defense of the homeland. At any time, we could go into a war posture and we must be able to engage threats 24/7/365.”

The brigade has operated on that 24/7/365 basis since 2004, its war posture predicated on the steadily increasing nuclear missile capabilities of near-peer nations and rogue states. Two redundant crews – one at Schriever Air Force Base, Colorado, that is responsible for the oversight of crisis procedures, and another at Fort Greely, Alaska, that handles the tactical, “right-now” portion of the fight – work in concert under the command and control of U.S. Northern Command.

They are the human interface to an otherwise highly automated system. Any degradation to crew readiness could leave America vulnerable to a nuclear detonation on U.S. soil.

Realizing the pandemic had the potential to interrupt its strategic mission, the staff at both the brigade headquarters in Colorado Springs and the 49th Missile Defense Battalion at Fort Greely began planning to provide viable courses of action to protect the health of the force and preserve the mission.

“Throughout the planning process, we worked in close coordination with our mission partners at Fort Greely garrison, the Missile Defense Agency and our higher headquarters in the Alaska Army National Guard and the 100th Missile Defense Brigade to understand and leverage resources,” said Capt. Luis Lugonazario, the chief of operations for the 49th Missile Defense Battalion. “That process produced an early operations order to be executed on a phased approach as we were meeting the preset triggers.”

One of the main challenges facing Col. Christopher Williams, 100th Missile Defense Brigade commander, was balancing the continuation of the mission with the local situation at each of the sites under his authority.

“The Soldiers at Fort Greely already live in relative isolation,” said Williams, noting the remoteness of Fort Greely in the Alaska interior. “Their situation is different from ours in Colorado or at Vandenberg Air Force Base in California.”

However, in early April, a Department of the Army civilian at Fort Greely tested positive for COVID-19, setting the crew sequestration plan in motion there.

“Crews on shift were sequestered to the barracks for the duration of their 14-day deployment cycles with no access to the commissary, post exchange, gym or other common access areas,” said Lugonazario. “Crew members are allowed no physical contact or gatherings with anyone outside of their current crew to minimize exposure and to guarantee a ‘clean’ crew is performing the mission at all times.”

Shortly thereafter, the brigade crews in Colorado Springs began a rotation of sequestration, starting with Murray’s crew and others.

“We can only go from work to our rooms, so it’s strange being in the town we live in, staying in lodging, and knowing that my wife and kids are down the road but I can’t go see them,” said Murray. “The crew jokes that we spend more time together than with our families, and now that is actually true.”

The missile defense crews are configured in five- to six-Soldier teams, with each member serving in a position of varying roles and responsibilities. Once 100th Missile Defense Brigade Soldiers – whether active component or National Guard – clock in for duty, they immediately transition to Title 10 and operate under federal authority.

Williams said that unlike with other military missions, a request for additional forces to augment organic troops is impossible due to the training each Soldier must undertake to become a certified operator.

“We can’t just plug and play another Soldier into the ground-based midcourse defense mission,” said Williams, estimating that it takes each Soldier three to six months of intensive training to become proficient on the system.

Williams said the brigade regularly faces variables that can diminish the readiness of a crew member or an entire crew, including car accidents, the seasonal flu, or family emergencies, but those situations do not often impact other crews. He acknowledged that this situation does have the potential to overlap from one crew to another, which is why protecting crew members is so vital.

Maj. Christopher Stutz, a 100th Missile Defense Brigade crew director, said the brigade has also increased the emphasis on sanitizing shared work consoles, even though the crew changeovers are not happening face to face, as is typical.

“There has been a definite focus on keeping our billeting and workspaces in top shape,” said Stutz. “We share the operational node with other crews, so cleanliness has always been a top priority. Our chief concern is the mission, and we must stay healthy to accomplish it.”

In addition to isolating crews, the 100th Missile Defense Brigade has been training additional Soldiers who normally serve in staff roles to certify as operators, increasing flexibility in crew configurations.

Williams said missile defenders are a high priority for the Department of Defense’s COVID-19 testing program to quickly identify any Soldiers who are sick and replace them; the brigade now has a robust assemblage of potential replacements.

“We are more ready now than we have been in the last 16 years,” said Williams. “We have been able to turn nearly 100 percent of our efforts to our operational mission, and our bench of additional operators is deeper than ever before. The job our missile defense operations and evaluations team has done to prepare and train backup crew members is nothing short of exemplary. We’re ready to replace entire crews with certified operators from within the brigade if needed.”

Still, Williams said his top priority is to protect Soldiers’ health and mitigate the spread of the coronavirus. Thus, he said the 100th Missile Defense Brigade will continue these heightened measures for as long as necessary.

Staff Sgt. Joseph Harris, a readiness operations officer in Colorado Springs, said he feels privileged to serve in the 100th Missile Defense Brigade during this time of uncertainty.

“It’s an honor to be part of something that means so much more than oneself,” Harris said. “It’s also tough to watch the citizens of this country lose their livelihoods and know that some of those citizens will have an extremely difficult time getting back on track. To the families who have lost loved ones, we are praying for you. We understand that this is a strange and absolutely difficult time, but we will get through this, and we will come out stronger on the other side.

“To our adversaries, we are always ready,” he continued. “There is no fighting force in the world as prepared and ready as the United States military.”

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How the National Guard is helping: <https://www.nationalguard.mil/coronavirus/>

Photos of the National Guard response:

<https://www.flickr.com/photos/thenationalguard/albums/72157713483827538>

Latest from the CDC: <https://www.cdc.gov/coronavirus/2019-nCoV/>

U.S. response: <https://www.coronavirus.gov/>

White House-CDC response: <https://www.coronavirus.gov/>

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## US ARMS CONTROL

Carnegie Endowment for International Peace (Washington, D.C.)

### **U.S.-Russian Nuclear Arms Control Negotiations**

By Rose Gottemoeller

May 13, 2020

In my line of work, you have to have a long memory. Periods of success in negotiations are followed by droughts, because of politics, military upheaval, arms buildups—yes, sometimes the weapons have to be built before they can be reduced—or a sense of complacency: “We have arms control treaties in place; let’s just focus on implementing them.” In those cases, new thinking and new negotiations may slow or even stop. Yet, the national security interest of the United States continues to drive the necessity for nuclear arms control. The calculation of our own national security interest must always be front and center when we consider a nuclear negotiation. Sometimes arms control is touted as an absolute good, one that should be pursued for its own sake. We do have international obligations in this realm, most prominently the commitment under Article VI of the Non-Proliferation Treaty to reduce and eliminate nuclear weapons until we reach zero. This commitment is shared by the other NPT nuclear weapon states— France, the U.K., Russia and China; and sometimes it gets a boost, as it did when President Barack Obama strongly reiterated U.S. intent to proceed on the path to zero nuclear weapons during his speech in Prague in April 2009, the first major foreign policy speech of his presidency.

That international obligation is important, but still we must consider first and foremost our own national security interest. I think about that interest as follows: Nuclear arms control is the only way that we can attain stable and predictable deployments of these most fearsome weapons, and it is the only way that we can assure that we won’t be bankrupted by nuclear arms racing. These points are especially important now, as we contemplate a world where China has more nuclear weapons and more missiles with which to deliver them.

China now has many fewer nuclear weapons than the United States and Russia, and it has not yet shown an interest in coming to the table to negotiate constraints on them. It is constrained by its doctrine, which has held that China will not strike first with nuclear weapons and will only maintain enough secure nuclear weapons to ensure a second strike can take place if another country strikes

China first. In the Chinese view, this doctrinal approach forges a kind of insurance policy for the international community. However, since China has now started to build more kinds of nuclear delivery systems, including long-range submarine-launched ballistic missiles, there is real concern that its doctrine may be changing.

So all of us need to think about the long arc of nuclear arms control—what it has accomplished, where it has failed and what it can do for our future security. In looking at the history, this article pulls the different strands from one period into the next, but does not delve into the details of any particular agreement. Nuclear arms control experts may take exception to this surface skimming, but I think it makes sense as food for thought: to remind us all how we determined the value of nuclear arms control in the first place, and how we have sustained it over time. Now we have to consider what makes sense for the future.

READ FULL TEXT

The full version of the article is published in the May 2020 edition of the Foreign Service Journal.

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<https://carnegieendowment.org/2020/05/13/u.s.-russian-nuclear-arms-control-negotiations-pub-81784>

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Foundation for Defense of Democracies (Washington, D.C.)

## **The JCPOA May Not See Its Five-Year Anniversary**

By Andrea Stricker

May 6, 2020

Two years after the United States withdrew from the 2015 Iran nuclear deal, the agreement's future hangs in the balance as Washington threatens to restore all UN sanctions on the Islamic Republic, thereby terminating the multilateral accord. The Trump administration's threats represent a response to one of the principal flaws of the agreement, formally known as the Joint Comprehensive Plan of Action (JCPOA), which is that its key restrictions start to expire, or "sunset," this year.

The first sunset is scheduled for October, when the UN's conventional arms embargo on Iran is set to lift. This would enable Tehran to buy advanced weapons from Russia and China despite Iran's persistent aggression against its neighbors as well as U.S. targets in the region.

Washington could block this first sunset by invoking the JCPOA's "snapback" mechanism, which grants any permanent UN Security Council (UNSC) member the right to revoke the deal's implementing measure, UNSC Resolution 2231. Doing so would restore all previous UN measures against Iran, including sanctions and the arms ban. When President Donald Trump withdrew from the JCPOA in May 2018 and re-instituted U.S. unilateral sanctions, he declined to invoke the snapback mechanism.

In December, the State Department released a legal opinion to Congress stating that Washington still has the right to terminate UNSC Resolution 2231 even though it withdrew from the JCPOA. First, however, the administration is trying to prolong the arms embargo without ending Resolution 2231, by getting Russia and China to agree to the embargo's indefinite extension.

The administration's push has received strong bipartisan backing from Congress. On May 4, more than three-quarters of the House of Representatives submitted a letter urging Secretary of State Mike Pompeo to undertake diplomatic action to prevent the arms embargo's expiration.

However, Russia says it will not go along, decrying Washington's move to determine the JCPOA's future after leaving the deal. Moscow and Beijing have lined up lucrative military pacts and arms deals with Tehran, and Iranian officials say the regime will leave the JCPOA or even the Nuclear Non-Proliferation Treaty if the UNSC extends the arms embargo.

Meanwhile, the JCPOA's utility is diminishing, and additional sunsets loom that will unshackle Iran's nuclear and missile programs. A phased lifting of restrictions on advanced centrifuges and an end to a UN missile import and export ban will occur in 2023 if the agreement remains in force. Iran's ballistic missile development and launches, unrestricted by the JCPOA, permitted the program to make meaningful strides. A full accounting of Iran's prior or possibly ongoing nuclear weapons work never occurred, and Tehran is now refusing to cooperate with international nuclear safeguards inquiries into its past. Finally, Iran has gradually and publicly rolled back its compliance with key JCPOA restrictions, enriching more uranium and deploying faster centrifuges. The net effect is a reduction in the time Tehran requires to build a nuclear weapon.

Tough choices lie ahead for the United States, underscoring that unsound strategic premises, like those underlying the JCPOA, typically result in painful policy course corrections. An enduring deal with Tehran must address the full spectrum of threats it poses. Absent a credible commitment by Iran to end its most destabilizing nuclear programs, halt its foreign aggression, and stop its grave human rights violations, the United States should intensify its maximum pressure campaign. Regardless of the victor in November's presidential election, the United States should not surrender leverage without comparable and verifiable concessions from Iran.

Andrea Stricker is a research fellow at the Foundation for Defense of Democracies (FDD), where she also contributes to FDD's Center on Military and Political Power (CMPP). For more analysis from Andrea and CMPP, please subscribe [HERE](#). Follow Andrea on Twitter @StrickerNonpro. Follow FDD on Twitter @FDD and @FDD\_CMPP. FDD is a Washington, DC-based, nonpartisan research institute focusing on national security and foreign policy.

<https://www.fdd.org/analysis/2020/05/06/the-jcpoa-may-not-see-its-five-year-anniversary/>

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Defense One (Washington, D.C.)

## **New START Treaty Looks Dead in the Water**

By Patrick Tucker

May 12, 2020

Unless Trump leads, observers say hopes for renewing the arms control deal with Russia, or a bigger one with China, will expire next year.

Last week, the new U.S. envoy on arms control reiterated the Trump administration's stance on New START: China should join the strategic arms treaty between the U.S. and Russia, or Washington may allow it to lapse next year. The former outcome, in theory, would increase the stability of relations between major nuclear powers. But some experts say the administration is gambling with a key arms-control agreement to pursue a goal it has no chance of obtaining, thus pushing the globe to a new nuclear arms race.

The New START treaty limits U.S. and Russian deployed strategic nuclear weapons and launch platforms and requires each side to allow inspections of its stockpile. It doesn't restrict the development of new missiles, and it doesn't cover China. Early in the Trump administration, officials began to suggest that they might not renew the treaty, signed by President Barack Obama in 2009. In a recent interview with the Washington Times, Marshall Billingslea, who last week was nominated to be undersecretary of state for arms control and currently serves as a special presidential envoy for arms control, said the deal "does nothing for the United States with respect to our concerns regarding China, and it does nothing for the United States with respect to our concerns regarding what Russia has been doing, which are a series of destabilizing activities outside of — and not constrained by — the treaty."

Tim Morrison, senior fellow at Hudson Institute and former Trump White House official in charge of U.S. arms control policy, welcomed the stance. "This is what a negotiation is all about: getting the other party or parties to give up something they don't want to give up in order to get a deal that benefits both parties. The starting position shouldn't be 'What does China want?' or 'what does Putin want?' The starting position must always be 'What is in America's national security interest?' If you don't agree, give me a call; I have an Edsel I can sell you for a great price," he told Defense One.

Morrison, who has pushed for an expanded deal, had worried that the State Department had been less than fully focused on the matter. He said the selection of Billingslea, who still requires Senate confirmation, has eased those concerns.

A former senior State Department official who spoke to Defense One in January said that it takes more than a special envoy or undersecretary to make something like a comprehensive trilateral arms control agreement work, especially between three competitive nuclear powers. "I think it will mean the president saying, 'I want to do this.' And it will mean him saying to his cabinet — Pompeo, Esper, the chairman [of the Joint Chiefs of Staff], etc. — 'We need to get this done.' So there has to be the high-level guidance."

The former State official cited the April 2009 meeting between Obama met with Russian President Dmitri Medvedev, which produced a "clear joint statement with guidance to both interagencies in Washington and Moscow to move out and get the negotiations done. That was really the tool by which we were able to bring together a very powerful team to negotiate the New START treaty." Obama took a very hands-on approach to crafting and negotiating a deal, and pushed lower cabinet members to contribute. That sort of attention from the Oval Office is necessary to get something like a major arms control deal negotiated, the former official said. Also, in 2009, there was some appetite for an agreement on both sides.

In 2020, by contrast, Russia has said that it isn't interested in broadening New START to include things like hypersonic weapons and China isn't interested at all in meeting the Trump administration on its terms. Trump is currently burdened by the coronavirus fight, fixated on reelection, and seems to devote more energy to a host of perceived grievances and vendettas than to arms control. All of that means that getting a three-way agreement now is going to be very difficult.

"It's the leadership vacuum that worries me, [leadership] of the interagency. It's not going to be this negotiator riding in on a white horse that's going to save the day. It's got to be top-level leadership, starting with the president and his cabinet secretaries working with the Russians to give high-level guidance," said the former official.

The former official said that allies are open to a three-way arms control deal, in theory. But they also suspect that the Trump administration may be intentionally setting conditions to keep

negotiations from even starting, “like the notion that you would force China early to the negotiating table before it’s really ready and then when China doesn’t want to start talking, say, well, we can’t possibly extend New START. That’s been a worry among the allies, that there are some potential poison pills that the administration has put in place that could really spell the end of nuclear arms control as we’ve known it.”

<https://www.defenseone.com/technology/2020/05/trump-administrations-aggressive-approach-arms-negotiations-could-backfire/165334/?oref=d-topstory>

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## COMMENTARY

Bulletin of the Atomic Scientists (Chicago, Illinois)

### **Pandemic Spending Will Force US Defense Budget Cuts—Some of Which Should Come from Nuclear Weapons Programs**

By Lawrence J. Korb

May 8, 2020

Even supporters of increased US defense budgets expect that, because the US government will likely spend trillions of dollars trying to rescue the economy from the effects of the COVID-19 pandemic, military spending in the United States is likely to decline significantly over the next couple of years. Those predicting such a decline include experts at the Stockholm International Peace Research Institute (SIPRI), the Center for Strategic and International Studies, (CSIS), American Enterprise Institute (AEI), the Center for Strategic and Budgetary Analysis, the RAND Corporation, and retired generals like David Barno and Hawk Carlisle.

According to SIPRI’s latest report, global defense spending has grown for five straight years and in 2019 amounted to almost \$2 trillion. US defense spending has also grown significantly over this period. Since President Trump took office, the annual defense budget—which, at \$740 billion, consumes more than half of federal discretionary spending—has increased by almost \$100 billion compared to Obama’s last budget, and during the Trump presidency, total US defense spending has amounted to almost \$3 trillion. As a result, the US alone now accounts for about 40 percent of the world’s total military expenditures and spends more than the next 10 highest defense spenders combined (seven of whom are our allies). In real terms—that is, taking inflation into account—the US defense budget is higher than it was during the Reagan military buildup or the wars in Korea and Vietnam.

In 2019, the combined budget of our two primary strategic competitors, Russia and China, was \$326 billion—less than half of the Pentagon’s annual spending. Moreover, these countries will also likely have to reduce spending on defense to cope with the damage caused by COVID-19.

The primary reason that many experts foresee a drop in defense spending involves the massive US deficit. Since Trump came into office, the federal debt has grown by more than \$3 trillion, and the deficit for 2020 was projected to reach \$1 trillion, even before the pandemic. The Congressional Budget Office (CBO) had already predicted that the federal deficit would reach 98 percent of the United States’ total gross domestic product within a decade. The three stimulus packages already passed will increase the deficit for 2020 to almost \$4 trillion.

But beyond the massive deficits, as retired Lt. Gen. David Barno and his colleague Nora Bensahel pointed out in a recent article in War On The Rocks, COVID-19 will also profoundly change the

military's role in defending the United States—something the Pentagon's leaders apparently have not yet realized. Barno and Bensahel believe this will happen because many Americans will look at the immeasurable damage caused by the pandemic and correctly conclude that defending the homeland from catastrophic threats is more urgent than defending against foreign threats far from America's shores. Barno and Bensahel offer specific areas—including personnel and some conventional programs like the F-35—that can and should be cut because of the vast cost of the pandemic. But they do not mention nuclear programs.

This omission is not surprising. Nuclear programs are often overlooked when it comes to budget reductions because many officials and analysts believe that those programs consume only a small part of the overall military budget. A closer analysis demonstrates that this is not the case.

In the proposed fiscal 2021 budget (which actually declines in real terms compared to fiscal 2020 and is now being considered by the House and Senate armed services committees), the Pentagon not only will spend significant amounts on nuclear programs but will increase that spending substantially. The 2021 budget proposal seeks to spend \$29 billion—a \$4 billion or 16 percent increase—on modernizing the weapons in its massive nuclear arsenal.

The National Nuclear Security Administration (NNSA), the part of the Energy Department that develops nuclear technology, wants to spend another \$20 billion, which represents a \$3 billion or 19 percent budget increase. If one adds in the \$5 billion the government will spend on cleaning up nuclear sites and the \$20 billion it proposes for missile defense, the cost of our nuclear programs climbs to approximately \$75 billion. Some will argue that even this total amounts to a little more than 10 percent of the overall defense budget. And if one ignores environmental and missile defense costs and counts only the cost of NNSA weapons development and Defense Department delivery systems, that \$50 billion amounts to only about 7 percent of the total budget.

But these claims underestimate the real impact of nuclear programs on the size of the defense budget. The nuclear programs include only the cost of developing and procuring nuclear weapons. They do not include support and operations for nuclear weapons and delivery systems like the Columbia Class ICBM submarine or the B-21 bomber.

To get a realistic handle on the cost of the nuclear program, it should be compared to the modernization (research and development and procurement) portion of the Defense Department budget. For fiscal 2021, Defense plans to spend about \$244 billion on this area. Developing nuclear weapons amounts to 20 percent of the modernization portion of the budget, and total nuclear spending consumes about 30 percent. These percentages are not trivial, and neither is the absolute amount being spent.

Even the low-end calculation of nuclear spending—\$50 billion—is more than we spend on the entire State Department, or on ship building, or on aircraft or tank procurement. In fact, to increase the NNSA budget this year, the Pentagon had to cancel a nuclear-powered attack submarine over the objections of the Office of Management and Budget. And nuclear spending is projected to rise.

Over the next five years, the Pentagon plans to spend increasing amounts on modernizing nuclear weapons and nuclear technology. If no changes are made, these two items will consume at least \$170 billion between fiscal 2021 and fiscal 2025 on just the Defense Department portion of the modernization budget, and they will draw another \$100 billion the NNSA budget.

To reduce spending on nuclear weapons safely over the next decade, the United States needs to do two things:

First, take up Russian President Vladimir Putin's offer to extend New START, which can be done without Senate approval, and begin negotiations to reduce the deployed nuclear weapons on both sides to no more than 1,000 from their current level of 1,550. This will allow us to cancel the land-

based portion of our nuclear modernization program and the Long Range Standoff Weapon (LRSO). Stopping these programs will save \$2 billion in fiscal 2021 and at least \$100 billion over the next five years.

Second, the Trump administration needs to begin talks with the Russians aimed at resolving our differences over the Intermediate-Range Nuclear Forces Treaty (INF). The Trump administration announced it would pull out of the treaty in October 2018 because it argued that the Russians were testing missiles that violated the treaty's terms; the US exit became final in the summer of 2019. The Russians, for their part, argued that the missile defense systems the United States has deployed in Poland and Romania could be retrofitted to launch intermediate range missiles, also in violation of the treaty. If talks on somehow reinvigorating the INF are begun, the United States could halt its programs to deploy intermediate range missiles on Navy ships and submarines. Spending on nuclear warheads in fiscal 2021 is projected to be more than \$2 billion. Not only is this a waste of money; it also increases the likelihood of nuclear war.

Since the Russian defense budget will also have to decrease as a result of the COVID-19 pandemic, Moscow should be open to discussions that lead to reduced nuclear costs. The Chinese also will find it difficult to keep increasing their defense budget at the pace they have maintained over the past decade. Therefore, they should be willing to join talks, particularly on intermediate-range weapons.

The pandemic has had and will continue to have a disastrous impact on the global community. But, if the United States uses this health and economic disaster as an opportunity to take the lead in limiting the danger of nuclear weapons, some good may come of it. As bad as this pandemic is, a nuclear war would be much worse.

<https://thebulletin.org/2020/05/pandemic-spending-will-force-us-defense-budget-cuts-some-of-which-should-come-in-nuclear-weapons-programs/>

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Modern War Institute (West Point, N.Y.)

## **Artificial Intelligence and the Bomb: Nuclear Command and Control in the Age of the Algorithm**

By James Johnson

May 7, 2020

Editor's note: The following is based on an article by the author recently published in the Journal of Strategic Studies, entitled "Delegating Strategic Decision-Making to Machines: Dr. Strangelove Redux?"

In 2016, DeepMind's AI-powered AlphaGo system defeated professional Go grandmaster Lee Sedol. In one game, the AI player reportedly surprised Sedol by making a strategic move that "no human ever would." Three years later, DeepMind's AlphaStar system defeated one of the world's leading e-sports gamers at StarCraft II—a complex multiplayer game that takes place in real time and in a vast action space with multiple interacting entities—devising and executing complex strategies in ways that, similarly, a human player would unlikely do. These successes raise important questions: How and why might militaries use AI not just to optimize individual and seemingly mundane tasks, but to enhance strategic decision making—especially in the context of nuclear command and control? And would these enhancements potentially be destabilizing for the nuclear enterprise?

Pre-Delegating Nuclear Decisions to Machines: A Slippery Slope

AI systems might undermine states' confidence in their second-strike capabilities, and potentially, affect the ability of defense planners to control the outbreak of warfare, manage its escalation, and ultimately terminate armed conflict. The central fear focuses on two related concerns: The first revolves around the potentially existential consequences of AI surpassing human intelligence—imagine the dystopian imagery associated with Terminator's Skynet. The second emphasizes the possible dangers caused by machines that lack human empathy or other emotional attributes and relentlessly optimize pre-set goals (or self-motivated future iterations that pursue their own) with unexpected and unintentional outcomes—picture something like Dr. Strangelove's doomsday machine.

AI, functioning at higher speeds than human cognition and under compressed decision-making timeframes might, therefore, increasingly impede the ability—or the Clausewitzian “genius”—of commanders to shape the action and reaction cycles produced by AI-augmented autonomous weapon systems. For now, there is general agreement among nuclear-armed states that even if technological developments allow, decision making that directly impacts nuclear command and control should not be pre-delegated to machines—not least because of the “explainability” (or interpretability), transparency, and unpredictability problems associated with machine-learning algorithms.

Psychologists have demonstrated that humans are slow to trust the information derived from algorithms (e.g., radar data and facial recognition software). However, as the reliability of the information improves, the propensity to trust machines increases—even in cases where evidence emerges that suggests a machine's judgment is incorrect. This tendency of humans—to use automation (i.e., automated decision support aids) as a heuristic replacement for vigilant information seeking, cross-checking, and adequate processing supervision—is known as “automation bias.”

Despite humans' inherent distrust of machine-generated information, once AI demonstrates an apparent capacity to engage and interact in complex military situations (e.g., wargaming) at a human (or superhuman level), defense planners would likely become more predisposed to view decisions generated by AI algorithms as analogous with (or even superior to) those of humans—even if these decisions lacked sufficiently compelling “human” rationality, characterized instead by fuzzy “machine” logic. AI experts predict that by 2040, AI systems may reach that threshold, demonstrating an ability to play aspects of military wargames or exercises at superhuman levels.

#### A Human in the Loop is Not a Panacea

Human psychology research has found that people are predisposed to do harm to others if ordered to do so by an authority figure. As AI-enabled decision-making tools are introduced into militaries, human operators may begin to view these systems, by virtue of their comparatively greater intelligence, as agents of authority, and thus be more inclined to follow their recommendations, even in the face of information that indicates they would be wiser not to.

This predisposition will likely be influenced, and possibly expedited, by human bias, cognitive weaknesses (notably decision-making heuristics), false assumptions, and the innate anthropomorphic tendencies of human psychology. For example, US Army investigators discovered that automation bias was a factor in the 2003 Patriot missile fratricide incidents, in which operators mistakenly fired upon friendly aircraft early during the Iraq War.

Experts have long recognized the epistemological and metaphysical confusion that can arise from mistakenly conflating human and machine intelligence, especially important in safety-critical, high-risk domains such as the nuclear enterprise. Further, studies have demonstrated that humans are

predisposed to treat machines that share task-orientated responsibilities as “team members,” and in many cases exhibit similar in-group favoritism as humans do with one another.

Contrary to conventional wisdom, having a human in the loop in decision-making tasks does also not appear to alleviate automation bias. Instead, human-machine collaboration in monitoring and sharing responsibility for decision making can lead to similar psychological effects that occur when humans share responsibilities with other humans, whereby “social loafing” arises—the greater tendency of humans to seek ways to reduce their own effort when working redundantly within a group than when they work individually on a task.

A reduction in human effort and vigilance caused by these tendencies could increase the risk of unforced error and accidents. Besides, a reliance on the decisions of automation in complex and high-intensity situations can make humans less attentive to—or more likely to dismiss—contradictory information, and more predisposed to use automation as a heuristic replacement—a shortcut—for information seeking.

### Regime Type and the AI-Nuclear Dilemma

The decision to automate nuclear capabilities might also be influenced by the regime type, political stability and legitimacy, and threat perceptions of a particular nuclear-armed state. An authoritarian, nuclear-armed regime—in China, North Korea, or Pakistan, for example—that fears either an internal coup or foreign interference may elect to automate its nuclear forces so that only a small circle of trusted officials is involved in the nuclear enterprise.

For example, during the Cold War, the Soviet Union developed a computer program known as VRYAN, a Russian acronym for “Surprise Nuclear Missile Attack,” designed to notify Soviet leaders of a pre-emptive US nuclear strike. However, the data used to feed the system was often biased, and thus, it propelled a feedback loop that heightened the Kremlin’s fear that the United States was pursuing first-strike superiority.

Currently, China maintains strict controls on its nuclear command-and-control structures (e.g., separating nuclear warhead and delivery systems), and the evidence does not suggest Beijing has pre-delegated launch authority down the chain of command if a first strike decapitates the leadership. As a means to retain centralized command-and-control structures and strict supervision over the use of nuclear weapons, AI-enabled automation might become an increasingly attractive option to authoritarian regimes such as China.

Autocratic states would also likely perceive an adversary’s intentions differently from a democratic one if there is a belief that a regime’s political survival (or legitimacy) is at risk, potentially causing leaders to consider worst-case scenario judgments, and thus behave in a manner predicted by offensive realist scholars. During a crisis or conflict, this assessment that a regime’s survival is at stake—especially when information flows are manipulated or communications compromised—would likely increase the appeal of expanding the degree of automation in the command-and-control process, in the hope that, in doing so, the regime might insulate itself against both internal and external threats.

Nondemocratic leaders operating in closed political systems such as China’s might exhibit a higher degree of confidence in their ability to respond to perceived threats in international relations. Biases from a nondemocratic regime’s intelligence services, for instance, might distort leaders’ view of their position vis-à-vis an adversary. If, for the reasons above, the regime has chosen to incorporate AI into its nuclear command-and-control structure, such a distortion could combine with compressed decision-making timeframes to become fundamentally destabilizing.

In short, nondemocratic nuclear states with relatively centralized command-and-control structures, those less confident in the survivability of their nuclear arsenal, and those whose political

legitimacy and regime stability depends on the general acceptance of official narratives and dogma would likely be more persuaded by the merits of automation, and less concerned about the potential risks—least of all the ethical, human cognitive, or moral challenges—associated with it.

Although Chinese statements pay lip-service to the regulation of military AI by global militaries, China is already demonstrating a willingness to deploy the technology for at least some security purposes, pursuing a range of AI-related initiatives (e.g., the use of data for social surveillance to enable a social-credit scoring system and ubiquitous facial-recognition technology), for example, focused on the impact on social stability, and in particular, efforts to insulate the legitimacy of the regime against potential internal threats. By contrast, and in the context of nuclear command and control, the political processes, accountability measures, nuclear-launch protocols, nuclear strategy and doctrine, mature civil-military relations, and shared values between allies (e.g., the United States and its NATO allies) in democratic societies should make them less predisposed—or at least more reticent—to use AI in the nuclear domain.

Technological developments are forcing strategists to contend with a world in which command and control of nuclear weapons could become increasingly enabled by AI. In a sense, that represents a dramatic change. Yet the framework in which that change could potentially take place is largely consistent with that which has defined most of the nuclear age. Today, states face contradictions, dilemmas, and trade-offs regarding the decision about whether or not to integrate AI and autonomy into the nuclear enterprise—just as leaders have faced in the quest for strategic stability, effective deterrence, and enhanced security in a multipolar nuclear world more generally.

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<https://mwi.usma.edu/artificial-intelligence-bomb-nuclear-command-control-age-algorithm/>

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Nuclear Threat Initiative (Washington, D.C.)

## **Untangling the Knot of Strategic Arms Control**

By Alexey Arbatov and Igor S. Ivanov

May 7, 2020

With the attention and resources of state leaders and publics fully occupied by the COVID-19 pandemic, addressing arms control challenges is low on the world's list of concerns.

Following the abrogation of the Intermediate-Range Nuclear Forces (INF) Treaty in 2019, no steps are being considered for prevention of a new arms race with medium-range missiles. Discussions about extending the 2011 New Strategic Arms Reduction Treaty (New START) between the United States and Russia, beyond its February 2021 expiration date, have stagnated. As a direct effect of the pandemic, on-site inspections, which are a key element of the New START verification regime, have been interrupted. The 50th Review Conference of the Nuclear Non-Proliferation Treaty (NPT), scheduled for April/May 2020 in New York, has been postponed until next year.

COVID-19, however, has not visibly affected the main weapons programs of the United States, Russia, China, and other leading military powers. A new cycle of the nuclear and advanced conventional arms race is gaining momentum. Against the background of the collapse of nuclear arms control regimes, this arms race inevitably will exacerbate controversies among the great

powers, creating a high probability of armed conflict and the ensuing risk of nuclear escalation. If, God forbid, this were to happen, the current crisis caused by the pandemic would look like a minor inconvenience.

That is why we strongly believe that COVID-19 must not serve as a pretext to ignore or postpone urgently needed resolution of current arms control controversies.

In particular, it is crucially important to salvage the essence of the INF Treaty. In 2019, the United States announced it would withdraw from the treaty, due to alleged Russian violations (deployment of prohibited missiles) and the massive build-up of such weapons by China (which was not a party to that agreement). Since U.S. plans for possible new missile deployments in Asia are said to be linked to Chinese programs, it is up to those two powers to search for possible mutual accommodation, however difficult this presently looks.

In Europe, U.S. and Russian medium-range missile deployments should be avoided at all costs. They would be highly destabilizing by precipitating mutual planning for preemptive strikes. Such developments also would block any possibility of continuing strategic arms control cooperation, since American intermediate-range missiles in Europe would be perceived by Moscow as threatening a decapitating and disarming strike on Russia's strategic deterrent, as was Russia's concern in the early 1980s.

A temporary deal on this issue, until a time when the U.S. and China reach some compromise, should be based on Russia's proposal to NATO states in late 2019 to agree on a moratorium on deployment of medium-range missile systems in Europe.

Controversies around the INF treaty were not alleviated when, in January 2019, Russian 9M729 (SSC-8) land-based cruise missiles, perceived by the United States and NATO as a treaty violation, were shown to foreign military representatives in an aircraft hangar in Moscow to demonstrate that they technically could not fly at the prohibited range. NATO states did not attend the demonstration and declared that the systems displayed were different from the missiles in question.

Hence the solution should be for the two sides to jointly develop additional means of verification, using confidence-building measures and on-site inspections, to make sure that the missiles deployed in Russian regular units are the same as those demonstrated in Moscow in 2019. In parallel, Russia's concerns also should be addressed. Moscow claims that U.S. missile defense launchers deployed in Romania and Poland could be used to deploy and launch offensive Tomahawk sea-based cruise missiles. This concern could also be resolved by agreed transparency and on-site inspection provisions.

Equally urgent is the need to address strategic arms control issues in the remaining months before the expiration of the New START treaty. The latest U.S. position is that extension, just like any START follow-on treaty, is conditioned on China's participation. This is flatly rejected by Beijing, with lukewarm support by Moscow.

We believe that New START extension cannot involve China as it would imply China was joining the treaty – something neither the U.S. nor Russia would welcome since it would legalize China's right to build up its strategic nuclear forces to the New START ceilings of 700 deployed missiles and bombers and 1,550 warheads (thus increasing its current forces in the two dimensions by 4.5 and 10 times correspondingly).

The New START extension should remain a Russia-U.S. bilateral issue—with two important mutual understandings. First, the new Russian Avangard boost-glide system and Sarmat heavy intercontinental ballistic missiles must be recognized as subjects of all treaty provisions. Second, the motive to extend the treaty should not be just to retain the transparency of the treaty

verification regime (as valuable as it is) for a few more years, but, still more importantly, to have time to begin work on a follow-on treaty.

Issues related to a New START follow-on could be settled during this extra time: First, the question of China's participation, and second, the scope and parameters of further arms reductions and limits.

Regarding China's participation, it is up to the United States to develop a proposal that would interest China. This would involve devising a U.S.-China balance of parity and stability without stipulating U.S. reductions down to Chinese force levels or legalizing China's build up to U.S. force levels. Whatever was agreed by the two parties would be considered by Russia when deciding on its participation. The parties also should find a way to engage the United Kingdom and France. In a new multilateral framework, Russia and China would certainly demand inclusion of the other two nuclear weapon states, and there would be no reason to exclude them. It would be fascinating to see how the Trump Administration solves this conundrum.

If forging a trilateral or five-party agreement proves impossible at this time, Moscow and Washington should proceed with plans for a bilateral deal, and its concept may be as follows.

We believe that if the nuclear forces of China, the United Kingdom, and France are not limited, then further deep cuts of the strategic forces of the two major powers (following very substantial reductions since 1991) are not an urgent goal and may be safely postponed. Hence, the New START follow-on ceilings can be lowered by just 100-200 deployed delivery vehicles and warheads (i.e. down to 600-500 and 1400-1300 respectively). Far more important is the scope of the next agreement, which should enhance strategic stability. It is essential that the air-launched nuclear and conventional cruise and hypersonic missiles and nuclear gravity bombs are included under a common warhead ceiling, and that they be counted according to the actual loading of the heavy bombers. Limits on strategic delivery vehicles and warheads should also include the new weapon systems: ground-based intercontinental cruise missiles and long-range autonomous underwater drones, as well as land- and sea-based boost-glide hypersonic systems with ranges defined similar to what was in the SALT and START treaties (e.g. land-based missiles with ranges greater than 5,500 km and sea-based missiles with ranges greater than 600 km). Such weapons should be limited regardless of whether their warheads are nuclear or conventional.

In this way, the most destabilizing long-range strategic systems which blur a clear line between conventional and nuclear warfare would become subject to verifiable arms control (including conventional missiles and low-yield nuclear bombs). Indirectly, their numbers would be limited, since under common ceilings they would "compete" with the number of nuclear-tipped strategic ballistic missiles. The latter would also have to be reduced to allow for ground- and air-launched cruise missiles, hypersonic boost-glide and ram-jet missiles, and underwater nuclear drones under the overall limit.

We recognize that such a treaty would not address a number of old and new potentially destabilizing weapon systems and technologies: tactical nuclear weapons, anti-missile defense, space arms, cyber-warfare, directed-energy weapons, and a great variety of drones with artificial intelligence—to name a few that are most commonly discussed. But those systems and technologies cannot be addressed immediately, either technically or diplomatically. Eventually they might be included in arms control, as well as the engagement of the three other recognized nuclear states, provided that the first steps outlined above are urgently taken to prevent the final collapse of the arms control regimes and process. The perfect should not become the enemy of the good, and the half-century successful history of nuclear arms control repeatedly has offered proof of this principle.

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38 North (Washington, D.C.)

## **Renewing US Extended Deterrence Commitments Against North Korea**

By Shane Smith

May 13, 2020

As COVID-19 upends millions of lives as well as traditional notions of security and the global economy, North Korea offers a stark reminder that the United States and its allies must still tend to military threats.[1] Pyongyang set a single-month record of nine missile launches this spring and declared it is now “more zealous for our important planned projects aimed to repay the U.S. with actual horror and unrest for the sufferings it has inflicted upon our people.” This was undoubtedly a reminder of Kim Jong Un’s New Year’s promise to soon unveil a “new strategic weapon” and his willingness to use it.

Does this portend a return to provocations and hostility reminiscent of 2017? There are good reasons to be concerned. Kim has called for “shocking” and “offensive” measures in charting a “new path” with the United States and South Korea. The return to missile tests, exercises and vitriol could be just the beginning. Similarly concerning are reports of political, economic and COVID-related uncertainty inside North Korea, given its purported history of lashing out in tough times to bolster domestic support for the Kim regime.

Understandably, extended deterrence issues have not received priority attention since denuclearization talks began in 2018. As prospects for those talks now appear grim, US and allied leaders may soon face decisions about how to revitalize a deterrence posture that has been largely dormant for two years. If and when they do, they will confront new challenges and old ones that have arguably worsened over time. Below, I take stock of those challenges and explore options for strengthening deterrence for a new era.

### **The Threat Grows On**

Kim was cryptic about what the “new strategic weapon” might be in his New Year’s address. But it is widely believed North Korea is working on a solid-fueled, mobile intercontinental ballistic missile (ICBM) that can deliver thermonuclear warheads anywhere on the globe. The Commander of US Northern Command hinted at such concerns when he recently testified before Congress. North Korea, he said, “may be prepared to flight test an even more capable ICBM design that could enhance Kim’s ability to threaten our homeland during a crisis or conflict.”

Indeed, a newly published United Nations report finds North Korea has not halted its nuclear or ballistic missile programs. Some estimates suggest it could now have enough fissile material to build between 50 and 100 weapons. And, while North Korea watchers look for signs of an upgraded ICBM, it has tested new types of regional missiles that can strike targets in South Korea and Japan with increasing accuracy and reliability as well as a new submarine-launched ballistic missile (SLBM).

Previous threats and exercises involving preemptive nuclear strikes on ports and airfields in neighboring countries suggest these new capabilities may be for purposes beyond retaliation. All signs point to an emerging strategy to enable limited nuclear first strikes against regional targets, while using a “new strategic weapon” to prevent full US retaliation by holding US cities at risk. Such a strategy aligns with many statements from North Korea’s leaders suggesting they may believe nuclear weapons can be used to compel adversaries, not just deter them, and even help unify the peninsula one day, by force, if necessary.[2] It is difficult to imagine the Kim regime ever concluding that it could actually launch a nuclear attack and survive, but the types of weapons Pyongyang is building, the way it exercises and its public pronouncements about using them make it hard to dismiss that possibility out of hand.

#### Extended Deterrence: Four Questions of Credibility

These developments put into sharp relief several questions about US extended deterrence. First, does North Korea believe the United States is willing to run nuclear risks to protect an ally (e.g., trade Seattle to save Seoul)? Signaling political resolve to take on such risk is no easy task, and presumably is becoming more difficult and costly for the United States. Perceptions of US resolve may have been damaged in recent years due in part to US President Donald Trump’s treatment of alliances as transactional arrangements rather than manifestations of core US national interests worth fighting to defend. This is especially poignant in South Korea’s case, given multiple reports that President Trump has questioned the value of the alliance and US forces stationed there.

Second, how does North Korea’s growing threat to Japan impact perceptions of US commitments to South Korea? More than once, North Korea has made clear that Japan is first on its nuclear target list. Leaders in North Korea might believe the United States would waver if confronted with the prospect of trading one ally in Tokyo to save another ally in Seoul. Or they might conclude that threats to Japan would lead Tokyo to deny US access to bases located on its territory for the defense of South Korea. Any daylight between the three countries surely emboldens North Korea, which is likely encouraged by the current state of trilateral relations and the open antagonism between Japan and South Korea.

Third, does North Korea believe the US-ROK alliance is credibly postured to fight and win a limited war under the nuclear shadow? North Korea may believe that holding hostage US and allied cities buys it an opportunity to wage conflict at lower levels. Its effort to deploy increasingly accurate and operationally flexible regional missiles, and the way it exercises them, suggest its leaders might even believe they can launch limited nuclear strikes without triggering an overwhelming allied response. Convincing North Korea that the alliance is willing and able to defeat aggression at any level of conflict must be a priority.

A fourth question stems primarily from developments off the peninsula: How does US-China competition shape North Korean perceptions of US commitments to South Korea? China remains North Korea’s most important patron and ally, whose military modernization and buildup is widely recognized. The 2018 US National Defense Strategy Commission concluded that the regional military balance has shifted to a point that the United States could suffer “unacceptably high” costs in a war with China that it “might struggle to win, or perhaps lose.” North Korean leaders might believe the United States would be unwilling or unable to defend South Korea if there is a credible threat of Chinese intervention. To date, there is little evidence the US-ROK alliance is developing combined measures to preclude such thinking.

#### Renewing US Commitments: Options and Opportunity

Should tensions with North Korea grow, US and allied leaders will face difficult tasks. Tending to the requirements of extended deterrence will be among the top priorities. The preceding section

presented four areas where deficits may exist: perceptions of US resolve; trilateral cohesion; ability to fight a limited war under the nuclear shadow; and deterring/countering Chinese intervention.

Below is an exploration of options to fill potential gaps. It is important to keep in mind, however, there will likely be very different views in South Korea of what should be done and much will depend on which political party is in charge. The Moon administration has tended toward a softer deterrence posture to advance diplomatic relations with North Korea and China. Historically, liberal governments like the current one have been more wary of the alliance and invested in options that preserve freedom of action. The opposition party has pledged a harder line on North Korea and China. In the past, conservative governments have emphasized efforts to highlight the alliance's combined deterrence posture and sought robust and tangible US commitments.

While only one of many tools, US nuclear weapons have long been a powerful instrument for signaling vital national interests and the resolve to defend them. Nuclear signals can provide high-profile expressions of political commitment to both accept and inflict terrible costs on behalf of an ally. There are three broad approaches for how leaders in Washington, as well as Seoul, might think about leveraging US nuclear forces in the future.

**Status Quo Plus:** The most modest approach would not involve major changes to existing arrangements. The United States would continue to rely on contiguous US (CONUS)-based capabilities, including the strategic deployment of bombers, to signal US commitment. The 2017 bomber overflight missions in which ROK and Japanese fighters provided tactical escort was a particularly strong show of unity. Building on, even routinizing, combined exercises of this kind could demonstrate both US resolve and alliance cohesion.

Other recent developments also provide new signaling opportunities. Earlier this year, the United States deployed a low-yield warhead option for its SLBMs. While characterized as a response to Russian doctrine and forces, this new capability could play a deterrence role against North Korea. It adds flexibility to US deterrence forces and offers potentially more credible response options in a narrow but critical set of scenarios. For instance, the 2018 Nuclear Posture Review calls for holding at risk North Korea's leadership and missile force. Having a prompt, accurate and penetrating low-yield option against those types of targets in limited attack scenarios likely conveys more credibility than relying on much higher-yield weapons or much slower delivery systems. A visit to Guam by a US ballistic missile submarine (SSBN) carrying the new warhead would signal its presence and potential utility in the region. Inviting ROK and/or Japanese delegations to tour the boat could highlight common purpose among allies.

US leaders might also consider opportunities afforded by the recent change in regional strategic bomber operations. No longer will bombers be based in Guam. Rather, CONUS-based bomber groups will now utilize a broader array of locations to increase resiliency and operational flexibility. Conducting an early demonstration of the ability to deploy and operate from multiple locations would signal sustained US commitment and ability to fight more effectively in a limited nuclear conflict. There also are opportunities to demonstrate alliance cohesion. An official statement about the change said, "We will maximize all opportunities to train alongside our allies and partners, to build interoperability, and bolster our collective ability to be operationally unpredictable." Perhaps that could involve joint exercises and investments in airfields, including on allied territory.

Lastly, the United States maintains mature high-level dialogues with South Korea and Japan that advance a common understanding of deterrence requirements, the role of US nuclear weapons and the value of policy coordination. Establishing a formal bilateral or trilateral operational-level nuclear crisis planning mechanism to support policy decisions could be an important next step to strengthen these relationships. The basic idea is to sustain attention on the operational implications of a North Korean nuclear attack as well as alliance mitigation and response options under a range

of scenarios. The specific goal is to strengthen combined and coordinated conventional military planning under the nuclear shadow. If established, such an enhanced consultative process should reflect the reality that an effective response to a North Korean attack at any level will require a coordinated US-ROK-Japan approach. A trilateral nuclear crisis planning mechanism would strengthen planning and serve as a powerful deterrence signal.

**Forward Deploy:** A second, more controversial approach would involve deploying US nuclear weapons to South Korea. This is an option long favored by a majority of South Koreans—about 55-65 percent—in public opinion polls for over a decade as well as prominent politicians, although not by South Korean President Moon Jae-in. There is scant support for this course of action in the United States for many good reasons. The main reason is that it is militarily unnecessary because the current suite of US capabilities can destroy any target in North Korea. In addition, US nuclear weapons based in South Korea would be vulnerable to attack and, thus, unreliable as a response option. Finally, their presence would provide first strike incentives that contribute to crisis instability.[3]

Arguments against the deployment option are valid in their own right but do not necessarily vitiate the underlying deterrence logic. Namely, it is difficult to imagine—in a world of garbled messages—a clearer signal of US willingness to run nuclear risks to defend a vital interest than placing nuclear weapons in harm's way. While this may not significantly enhance US military options, it certainly complicates North Korean targeting decisions for any attack in which it might hope to keep conflict limited. By increasing the perceived risk that any conflict would become a nuclear one, partly due to first strike incentives, North Korea may be persuaded that, in fact, it cannot wage a limited conflict and manage the risks of escalation.

It's possible the financial costs and escalatory risks inherent in this option would outweigh the deterrence benefits. China would be sure to make such costs as high as possible, if its reaction to the deployment of THAAD in South Korea is any indication. At the same time, it is precisely such high-cost and high-stake measures that can send powerful strategic signals. Cheap and easy actions do not carry much weight.

To be sure, the debate over the deployment option is not going away. It is likely to grow in intensity in the coming years. Pressure is mounting in South Korea to develop an independent nuclear capability, if the United States does not take seriously perceived credibility gaps in the US nuclear "umbrella." Few US strategists believe this would be a good outcome.

**Phased and Adaptive:** With that in mind, a third approach could adopt a phased, adaptive model. The United States could commit to deploying nuclear weapons to South Korea at some indeterminate time in response to a heightened North Korean threat, implementing a series of phased steps to create the necessary conditions and reduce the deployment timeline. For instance, a preparatory phase might include conducting a survey of potential storage locations and an environmental impact study. A subsequent phase could involve training combined US-ROK units to conduct perimeter security, incident response and recovery operations. A later phase could involve certifying Korea-based US F-16 units (or F-35 replacements) for nuclear missions and conducting combined exercises. A final phase would be the construction of storage facilities. Each step could be adapted to a changing security environment prior to putting actual US nuclear weapons in South Korea.

There are inevitable tradeoffs associated with this approach. Concretely conveying resolve but conditioning deployment on North Korea's behavior could strengthen deterrence and incentivize restraint. Each phase offers an opportunity to signal and apply incremental pressure on the North while preserving flexibility to manage associated costs and risks. However, perceived half measures would belie resolve. A convincing commitment toward deployment would be necessary but has the

potential to create unhelpful “tit-for-tat” expectations in which every North Korean provocation requires taking the next step. Drawing out the timeline also would invite pressure from China, Russia and domestic audiences to abandon the option. Pushing forward in the face of associated costs could reaffirm the perception of resolve but ultimately may come at a higher price than a “deploy now” option. Optimistically, if China and Russia see that deploying US nuclear weapons to South Korea is a serious option, they might apply more pressure to restrain North Korea.

The US-ROK alliance could also take conventional measures to strengthen extended deterrence. For one, it could resume large-scale military exercises after a long pause to signal strategic and operational readiness. Sustained investments toward an integrated missile defeat capability—both left- and right- of launch—can deny North Korea the benefits it seeks from its missile force. Establishing a combined element to advance and align growing strike and missile defense capabilities would signal commitment to that mission. Integrating new nonkinetic capabilities, such as cyber and electromagnetic warfare, can expand the range of alliance options and reinforce deterrence objectives. Moreover, the alliance could take measures to demonstrate operational flexibility and resiliency necessary for fighting a limited nuclear war, including the ability to disperse and operate using a diverse range of ports and air bases. Should exercises involve locations in Japan, it would be a stronger message of trilateral unity.

Lastly, the US-ROK alliance could address Chinese pressure on extended deterrence by establishing a bilateral China policy coordination mechanism. This could be a valuable first step to signal Beijing and begin to strengthen response options against any effort to split the alliance. The United States is already investing heavily to maintain access to allies in the face of China’s growing regional power. But Washington has made clear those allies must contribute in meaningful ways in a new era of global competition. South Korea, a formidable high-tech ally, has much to offer in this regard. However, the alliance and ROK military investments have largely neglected China. Strengthening combined policies and military planning for third-party intervention could disabuse China and North Korea from concluding the United States might be unwilling or unable to defend South Korea. A turn of this kind toward Beijing would likely be extremely difficult for leaders in Seoul, but a failure to do so risks weakening deterrence on the peninsula.

## Conclusion

As US and allied leaders consider how to respond to potential tensions with North Korea, they arguably face more challenging circumstances than two years ago. Demonstrating resolve may be a heavier lift largely due to North Korea’s and China’s growing capabilities. Fortunately, the allies have many tools and options for renewing US commitments. Each has costs and risks that must be weighed against expected deterrence benefits. None offers a silver bullet. The challenges discussed in this paper cannot be solved, only managed; they will require sustained attention and collective determination for the foreseeable future.

[1]

The views expressed here are solely those of the author and are not the policies or positions of National Defense University, the Department of Defense or any part of the US government.

[2]

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Real Clear Defense (Washington, D.C.)

## **Hypersonic Defense Requires Getting Space Sensor System Right**

By Douglas M. Fraser, Frank Gorenc and John S. Shapland

May 13, 2020

While the U.S. is rightly focused on combatting the COVID-19 pandemic, it is important for the leaders within Congress and the Pentagon to also prioritize preparing for another threat for which the nation currently has no defense: hypersonic weapons. Today, several adversaries possess hypersonic capabilities that present complex challenges, especially in a regional fight, which would demand the nation protect its forces, allies, and regional interests. Winning this fight requires U.S. forces and capabilities that can impose costs deemed unacceptable by the enemy through the potential use of offensive weapons and a defense that denies the enemy the benefit of their weapons. The ability to defend against the use of offensive hypersonic weapons does not exist. The time is now to develop U.S. defensive capabilities against hypersonic weapons before an adversary decides to exploit this vulnerability.

### **THREAT**

The U.S. leads the world in almost every aspect of military capability and capacity, except for hypersonic weapons. Both Russia and China are well ahead of the U.S. in the development and fielding of hypersonic weapons technology, and as stated by General John Hyten, then Commander of U.S. Strategic Command, in March 2018, "we don't have any defense that could deny the employment of such a weapon against us." This is still the case today.

The reason the U.S. is unable to defend against hypersonic weapons in a regional fight is the current defense design for countering air and missile threats was developed and deployed to defend against traditional ballistic missiles. The flight path, speed, altitude, and unpredictability of the hypersonic missile threat poses challenges that make these weapons virtually undetectable within the current defense design. While this article focuses on regional threats, hypersonic weapons also present significant challenges to the defense of the homeland that should be addressed in parallel with the regional threat.

The first challenge posed by hypersonic weapons is that their launch may not be seen by the current space-based infrared sensors designed to alert forces to an impending strike. An air-launched scramjet or hypersonic missile launched by a non-ballistic launch platform might not develop significant infrared plume during launch, and would not be detectable by current overhead early-warning systems.

A second challenge for defending against hypersonic missiles is due to their flight altitude and the curvature of the Earth. Traditional ballistic missiles fly well above 100 km (definition of space), making them more easily detectable at long range. Hypersonic missiles fly in the atmosphere at altitudes between 30-50 km above the ground (see picture below). Current U.S. ground- and sea-based missile detection systems find and track ballistic missiles at 3,000 to 4,000 km in a wide search fence, with time to pass intercept information to defensive systems. Hypersonic missile

detection range is shorter because the majority of their flight is masked by the curvature of the Earth. Detecting and tracking hypersonic missiles for adequate warning would require an unsustainable number of terrestrial sensors. To ensure an effective defense design against hypersonic weapons requires a space sensing layer.

A third challenge is the unpredictability of the hypersonic missile. The current defense design against ballistic missiles uses space-based infrared sensors that track the missile until its burnout and then predict an impact point which informs ground- or sea-based sensors to be able to reacquire and track on reentry. During the midcourse phase of flight, there are very limited means to track the missile. This system works because ballistic missiles do not maneuver in this phase, and their flight path is predictable. This is not the case for hypersonic weapons, which are capable of maneuvering, both in speed and vector, during the midcourse phase. This makes these weapons unpredictable as to where they are targeted and where they could be acquired by terminal sensors. Tracking a weapon with an unpredictable path would require an unreasonable number of terrestrial sensors since they would need to be continuously searching everywhere for incoming missiles. Hypersonic weapons flightpath unpredictability again requires a space layer that can continuously track the missile through the entire flight path.

Finally, the speed alone of the hypersonic missile poses a challenge to the current defense design. Even if the defense design could resolve the problems of predictability and altitude by increasing the number of sensors, seeing a missile in flight with a radar is like looking through a soda straw at a golden B.B. It takes incredible accuracy just to find it, and the higher the speed, the less detection and decision time there is (the engagement window), especially when the detection range is so short due to the weapon's altitude. And, even if the sensor is able to maintain a track on one of these challenging weapons, the sensor could easily be overwhelmed by an attack with multiple weapons.

So, U.S. forces currently find themselves in a hypersonic defense predicament where they may not detect the launch, can't track the weapon through midcourse, can't predict the impact point, and won't have a defensive interceptor ready or capable of defeating the incoming weapon. The ability to maneuver forces in and around a battlefield, and logistically support those forces, would be significantly degraded with a lack of defenses against these weapons. Even with a regional fight, U.S. forces throughout the world would be vulnerable to attack.

## RESPONSE

There is a pathway to overcome these challenges. Just like any other missile defense system, there must be an effective chain of weapon engagement capabilities to "Find, Fix, Track, Target, Engage, and Assess" (F2T2EA) hypersonic vehicles throughout their flight profiles. Foundational to the kill chain is the ability to Find, Fix, Track and Target (F2T2). Developing a weapons-quality target track is necessary for any interceptor to engage and destroy the target. First things first, the defense design must get the F2T2 system right, or even the best interceptor in the world will be unable to engage the target.

For the hypersonic threats, policymakers and national security experts agree that priority No. 1 for establishing a credible defense is the development and deployment of a space sensing layer. The task was assigned to the Missile Defense Agency (MDA), and they are pursuing this capability through the Hypersonic and Ballistic Tracking Space Sensor (HBTSS) program. Using the high ground of space, this space sensor layer will provide continuous tracking of hypersonic and ballistic missiles, from launch through intercept, anywhere in the world. These sensors would most likely be placed in Low Earth Orbit (LEO), be lightweight, low power, and modular. These LEO sensors would be low cost and could be easily replaced at end of life. Vice Chairman of the Joint Chiefs of

Staff General Hyten also suggested that we might consider using Medium Earth Orbit (MEO) in order to increase survivability and provide alternate fields of view.

Unfortunately, to date, the HBTSS remains underfunded (\$150 million invested in 2020) compared to the \$2 billion invested in offensive hypersonic capabilities. Even in Fiscal Year 2021, the entire budget for Space Technology Development is only \$136 million out of a \$3.2 billion budget for all hypersonic-related research, and HBTSS is but one program in all of the Space Development Agency's (SDA) budget that includes sensor, spacecraft, launch vehicles, and space communications. The current pace of investment will not close the widening gap in hypersonic defense capabilities. While the U.S. Department of Defense (DoD) is clearly focused on developing offensive hypersonic capability, it should not lose perspective that the ability to detect, track, and determine the origin and target of hypersonic weapons is critical to the timely and effective use of U.S. offensive hypersonic retaliatory capability. HBTSS provides this critical warning and tracking capability.

#### IMPERATIVES

As the U.S. works to build the network of sensors to be able to Find, Fix, Track, and Target an adversary's hypersonic missile system, there are a few imperatives the U.S. should pursue:

The DoD must "get after it." As General John Hyten said, the U.S. needs to stop sitting around "studying the heck" out of potential space solutions and begin testing them in orbit. The DoD should get money out to the industry to conduct Low Earth Orbit multispectral sensor experiments as soon as possible and structure the contracts to incentivize the competitors to share the results of their tests with one another. This is a low-cost way to get moving on solving the problem, mitigating risks, and benefitting all parts of the system.

HBTSS must be synchronized with the overall Integrated Air and Missile Defense (IAMD) missions and architecture, such as air defense, ballistic/cruise missile defense, and space surveillance, and these features must be built into the HBTSS program requirements. The DoD should put IAMD-minded planners on the various hypersonics teams to enable this synchronization. It should enhance these other missions, adding capabilities such as warhead discrimination. This cannot be a single-mission capability that is bolted onto the air/ground/sea weapons and sensors at the end. The military has seen this approach before in unique air, space, and cyber programs that are incredibly powerful as a stand-alone mission, but become unwieldy when utilized by commanders responsible for integrating offensive and defensive strategies, plans, and operations in an all-domain battlespace.

HBTSS must be created in an open architecture that allows linkages to current IAMD components – such as Aegis, Naval Integrated Fire Control, F-35, THAAD, and Patriot, among others – and enables capabilities to link with future programs. While the space layer will be crucial to maintaining midcourse track, HBTSS will need to feed information to other air-, sea-, land-, and space-based sensors, shooters, or information processors.

The development of the sensor system must be done in parallel with the development of the Command and Control (C2) system that will be used to engage the incoming weapon. The C2 system must support "Engage on Remote" capabilities and be part of the Joint All Domain Command and Control (JADC2) system. To counter hypersonic weapons, the kill vehicle will need inflight targeting corrections as the hypersonic vehicle maneuvers. Additionally, the C2 system must integrate the space layer with the ground- and sea-based layers in the current and future Command and Control Battle Management and Communications (C2BMC) system. It must be able to push and pull information to and from C2BMC.

The DoD must ensure that the HBTSS sensor suite employs a field of view that is able to support multiple missions, including the ability to Find, Fix, Track, and Target against ballistic missiles,

advanced maneuvering missile systems, and hypersonic weapons (both glide vehicles and cruise missiles) separately and simultaneously. While some believe that you might be able to reduce cost by focusing solely on the hypersonic threat (reducing the required field of view), the reality is that sensor field of view will not drive constellation cost. Rather, the majority of the costs are driven by launch and the satellite bus, and costs are largely independent of the sensor.

The DoD must ensure that HBTSS builds in multiple layers of clutter rejection, including the use of high frame rates, multispectral sensing, or hyperspectral sensing, among others. The sensor layer must provide high confidence that it will maintain custody of weapons throughout their flights and not be distracted by the debris, decoys, or other clutter that may accompany the weapon. Precise tracking of hypersonic weapons is critical to enable the interceptor, with only a small window to open its eyes on the incoming hypersonic missile (due to the speed and heat), to enable it to find the incoming weapon.

And finally, program requirements should also reflect the satellites' likely need for onboard processing and the ability to pass weapons-quality tracks to the other satellites to maintain custody of multiple hypersonic weapons with minimal latency. The sensor, or sensor suite, will also need to be able to talk directly to the interceptor. Passing tracks through a ground node could create unacceptable time delays that would enable the hypersonic weapons to get outside the engagement window of the interceptor or require the seeker to open its eyes too early and risk sensor burn out. The system must be redundant enough to operate effectively even if a satellite falls out.

#### WAY AHEAD

Hypersonic weapons will continue to threaten U.S. forces and allies while defending America and its interests worldwide. Today, the lack of hypersonic weapons defense makes deployed forces vulnerable to attack. Unfortunately, those forces are vulnerable in the future and U.S. investment is still low.

The good news is that the U.S. can catch up, and the DoD way ahead is straightforward. First, the DoD must work in parallel on multiple offensive and defensive initiatives to integrate all elements of the HBTSS with the other layers of IAMD. Second, the DoD must move forward with HBTSS – with the necessary program requirements outlined above – and get launching. The Department needs to run relatively inexpensive LEO sensor experiments and push the resultant data throughout the industrial base. With air, land, and sea-based offensive weapons on track for operational fielding in the next three to five years, there should be plenty of opportunities to run concurrent offensive and defensive sensor tests. As General John Hyten has stated, “Put some sensors on some satellites, fly them cheap, fly them fast, see what they can do, and then figure out what you need to actually go build.” And finally, the DoD must ensure the required funding is available to the right organizations to fill this critical vulnerability. While the slight plus-up for hypersonic defense in Fiscal Year 2021 is a good sign, substantially more investment will be required to support additional launches and tests. Priority No. 1 for establishing a credible defense against hypersonic weapons is developing and deploying a space sensing layer, and it should be funded as such.

The U.S. is definitely at risk right now, and the threat is growing. Hypersonic weapons and the nation's lack of defense exposes a risk to its national interests and forces in a regional fight that their adversaries may choose to exploit. The current defense design also destabilizes the overall strategic deterrence by highlighting a national vulnerability, while providing a technological advantage to U.S. adversaries. HBTSS is part of the larger effort to reduce this risk and build a hypersonic and ballistic missile defense design to address this vulnerability. The time is now to accelerate HBTSS implementation and set a path to protect the nation, allies, and strategic interests.

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[https://www.realcleardefense.com/articles/2020/05/13/hypersonic\\_defense\\_requires\\_getting\\_space\\_sensor\\_system\\_right.html](https://www.realcleardefense.com/articles/2020/05/13/hypersonic_defense_requires_getting_space_sensor_system_right.html)

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Real Clear Defense (Washington, D.C.)

## **Moving Forward with the W93 SLBM Warhead Strengthens U.S. and British Security**

By Linton F. Brooks, John R. Harvey and Franklin C. Miller

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In his 2009 Prague speech, President Obama declared that "As long as [nuclear] weapons exist, the United States will maintain a safe, secure and effective arsenal to deter any adversary, and guarantee that defense to our allies." To ensure that goal, he advanced a modernization program for America's aging nuclear forces. President Trump, in his 2018 review of U.S. nuclear posture, reaffirmed that commitment and carried forward the program for force modernization that now will include a new program for a modern SLBM warhead—the so-called W93 to be carried in a new Mark 7 reentry vehicle.

The requirement to maintain a safe, secure and effective arsenal is often taken to mean the replacement of America's aging strategic triad forces and their command and control. That effort, while truly vital, is only half what is needed. The other half is to have a modern and functioning nuclear weapons complex. This task involves repairs to the facilities which make up the complex, a significant portion of which date back to the Manhattan Project and early Cold War periods; it involves regaining capabilities we have allowed to lapse, such as the ability to manufacture so-called "war-reserve" pits for nuclear warheads; finally, it involves refreshing the scientific and engineering prowess of the DoD and DoE in order to be able to design, when needed, modern nuclear warheads and the reentry vehicles which carry them. The United States has not designed

and developed a modern nuclear warhead or fielded a new reentry system in over thirty five years (since Ronald Reagan was President). The scientists and engineers who performed this all important work are nearly all retired, and some are no longer with us. Before the surviving veterans finally pass from the scene, it is absolutely essential that a new generation of scientists and engineers become proficient in continuing this legacy.

The 2021 President's budget requests funding, among other things, for beginning initial design feasibility work on the W93 and Mark 7 reentry vehicle. If authorized and funded by Congress, the W93 design will be based on previously tested nuclear designs and will not require additional nuclear explosive testing to certify its safety and reliability. It will draw from extensive stockpile component and material experience. The W93 program proposes to incorporate modern technologies to improve safety, security, and flexibility to address future threats—and be designed for ease of manufacturing, maintenance, and certification. In addition to that, the W93 program supports other critically important national security goals:

The Energy and Defense portions of the W93/Mark 7 design and development program provide the much-needed opportunity for DoD and DOE weapons scientists and engineers to regain essential skill sets necessary for future U.S. security.

A W93, if developed and deployed in the late 2030s, will be an important addition to the U.S. SSBN force, which forms the backbone of our strategic nuclear deterrent. The current force carries a disproportionate mix of W76 and W88 warheads (because W88 production was halted at the end of the Cold War, the mix is inordinately dependent on the W76; any problem with that warhead would have major implications for the overall U.S. deterrent). These two warheads provide almost 60 percent of the total U.S. deployed nuclear deterrent. This is an area where we can least afford to take risk. The W76 has just completed a life extension program; the W88 is undergoing limited modernization (less than a full scale life extension). By the time the W93 is deployed, both warheads will have been in service for nearly half a century. Adding a third warhead in the form of the W93 will hedge against inherent technical risks to those warheads—and reduce current over-reliance on the W76. Beginning initial design feasibility work now will ensure NNSA is ready for the major design effort once current life extension programs are completed. Ultimately, depending on future U.S. deterrent requirements and the health of its predecessors, a W93 could replace either the W76 or the W88. In this context, it is important to note that the W93 is not intended to increase the number of deployed US SLBM warheads: if designed and built, it would replace existing W76s or W88s on a one-for-one basis, thereby supporting existing and future arms control efforts. Indeed, the improved reliability of Columbia will allow a significant reduction from the 280 SLBM launchers on the Ohio class to a total of 192 launchers on the Columbia

There is a third critically important but not well recognized reason for proceeding now with the W93/Mark7. It is vital for continuing our longstanding support to the United Kingdom, which is also modernizing its nuclear forces. As an allied but independent nuclear power that contributes to NATO's nuclear deterrence posture, the U.K.'s continuous at-sea nuclear deterrent is critical to U.S. and allied security. The United Kingdom is currently engaged in modernizing its nuclear deterrent force, building four new SSBNs (elements of which, including the missile compartment and radio room, are being designed jointly with the new US Columbia class SSBN). Replacing the U.K.'s current nuclear warhead and reentry vehicle is a key part of their modernization effort. While the design and manufacture of the U.K.'s future warhead will be solely a U.K. responsibility, that program, building on decades of British-American cooperation on the nuclear deterrent, will rely on the U.K.'s ability to procure non-nuclear components – including the reentry vehicle—from the U.S. As the Trident II/D-5 SLBM remains central to both nations' SSBN forces, parallel U.S. and U.K. warhead and reentry vehicle development programs benefit both of our deterrents. Given the time it takes to design, develop, certify and manufacture a replacement warhead and reentry vehicle, it is

important that both nations start detailed design options work now. British Defence Secretary Ben Wallace has noted that Congressional support of the F.Y. 2021 W93 budget requests is "critical to the success of {the U.K.} replacement warhead program and to the long-term viability of the U.K.'s nuclear deterrent and therefore, the future of NATO as a nuclear alliance."

Amidst the understandable public and media focus today on the COVID crisis, the modernization of our nuclear deterrent is rarely discussed. The need for that will exist long after COVID is behind us. Russia and China and North Korea have increased their reliance on nuclear weapons. Returning to Mr. Obama's pledge, the United States must have a safe, secure, and effective nuclear deterrent. So, too, must our closest ally. As our two nations' deterrents are modernized, the W93 program will be a necessary element.

Linton F. Brooks, John R. Harvey, and Franklin C. Miller have among them over a century of experience serving in senior posts in the U.S. government overseeing nuclear weapons policies and programs: Brooks in the Departments of State, Defense and Energy and the National Security Council Staff, Harvey in the Departments of Defense and Energy and Miller in the Department of Defense and the National Security Council Staff.

<https://www.realcleardefense.com/articles/2020/05/12/moving-forward-with-the-w93-slbm-warhead-strengthens-us-and-british-security-115277.html>

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## ABOUT THE USAF CSDS

The USAF Counterproliferation Center (CPC) was established in 1998 at the direction of the Chief of Staff of the Air Force. Located at Maxwell AFB, this Center capitalizes on the resident expertise of Air University — while extending its reach far beyond — and influences a wide audience of leaders and policy makers. A memorandum of agreement between the Air Staff's Director for Nuclear and Counterproliferation (then AF/XON) and Air War College commandant established the initial personnel and responsibilities of the Center. This included integrating counterproliferation awareness into the curriculum and ongoing research at the Air University; establishing an information repository to promote research on counterproliferation and nonproliferation issues; and directing research on the various topics associated with counterproliferation and nonproliferation.

In 2008, the Secretary of Defense's Task Force on Nuclear Weapons Management recommended "Air Force personnel connected to the nuclear mission be required to take a professional military education (PME) course on national, defense, and Air Force concepts for deterrence and defense." This led to the addition of three teaching positions to the CPC in 2011 to enhance nuclear PME efforts. At the same time, the Air Force Nuclear Weapons Center, in coordination with the AF/A10 and Air Force Global Strike Command, established a series of courses at Kirtland AFB to provide professional continuing education (PCE) through the careers of those Air Force personnel working in or supporting the nuclear enterprise. This mission was transferred to the CPC in 2012, broadening its mandate to providing education and research on not just countering WMD but also nuclear operations issues. In April 2016, the nuclear PCE courses were transferred from the Air War College to the U.S. Air Force Institute for Technology.

In February 2014, the Center's name was changed to the Center for Unconventional Weapons Studies (CUWS) to reflect its broad coverage of unconventional weapons issues, both offensive and defensive, across the six joint operating concepts (deterrence operations, cooperative security, major combat operations, irregular warfare, stability operations, and homeland security). The term "unconventional weapons," currently defined as nuclear, biological, and chemical weapons, also includes the improvised use of chemical, biological, and radiological hazards. In May 2018, the name changed again to the Center for Strategic Deterrence Studies (CSDS) in recognition of senior Air Force interest in focusing on this vital national security topic.

The Center's military insignia displays the symbols of nuclear, biological, and chemical hazards. The arrows above the hazards represent the four aspects of counterproliferation — counterforce, active defense, passive defense, and consequence management. The Latin inscription "Armis Bella Venenis Geri" stands for "weapons of war involving poisons."

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