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Fielding the Long-Range Standoff Weapon Prevents a Dangerous Gap in the U.S. Nuclear Deterrent

Patty-Jane Geller

KEY TAKEAWAYS

The U.S. must modernize its nuclear air-launched cruise missile to sustain the air leg of the nuclear triad as adversary air defenses advance.

Fielding the Long-Range Standoff Weapon will ensure the U.S. maintains the ability to hold defended targets at risk, helping deter adversaries and assure allies.

Congress and the next Administration must work together to back the full procurement of the LRSO and its accompanying warhead.

As part of its long-overdue effort to modernize the U.S. nuclear deterrent, the United States is developing the Long-Range Standoff weapon (LRSO) to maintain the ability of nuclear-capable bombers to hold targets in well-defended areas at risk. The LRSO will replace the Air Force's current nuclear-armed, air-launched cruise missile (ALCM), the AGM-86B, which has been in service since 1982—and is becoming increasingly obsolete against enemy air defenses. The LRSO will play an important role in maintaining the nuclear triad because it will sustain the nuclear ALCM capability that enables the triad's critical air leg. Fielding the LRSO will also sustain the nuclear ALCM's unique attributes that contribute to both the credibility of U.S. deterrence and the United States' extended deterrence commitments to allies. Finally, the LRSO will provide a hedge against both

technical failure in another leg of the triad and an uncertain geopolitical environment. Congress and the next Administration must work together to provide the necessary funding for the LRSO and its accompanying warhead to ensure an on-time delivery.

Background

The Air Force is acquiring the LRSO to replace the current AGM-86B air-launched cruise missile that is due to be retired in 2030. The LRSO will comprise part of the air leg of the nuclear triad, which consists of bombers armed with ALCMs and gravity bombs. The LRSO will be a low-observable, subsonic missile with a predicted range of at least 1,550 miles, and its advanced stealth design will make it more survivable against enemy air defense systems.[1] The LRSO program was initiated by the Obama Administration as part of its nuclear modernization effort and has enjoyed a measure of bipartisan support as it progressed under the Trump Administration.

In April 2020, the Air Force selected Raytheon Technologies as the primary contractor on the Technology, Maturation, and Risk Reduction (TMRR) phase of LRSO acquisition (the final phase before official production begins).[2] Raytheon submitted its proposal to the Air Force in November 2020, and pending Milestone B approval, the Air Force can proceed with LRSO development approximately nine months ahead of the Air Force's previous plan.[3] The Air Force intends to procure 1,000 LRSO missiles to provide an effective capability through 2060, with an initial operating capability expected in 2030 when the AGM-86B ages out.[4]

The LRSO will deploy the W80-4 nuclear warhead, which is being developed by the National Nuclear Security Administration (NNSA) in parallel with the Pentagon's LRSO program. The W80-4 is the product of a Life Extension Program (LEP) of the W80-1 warhead (the warhead found on the AGM-86B). The NNSA estimates it will deliver the first W80-4 warhead by 2025 and complete the entire LEP by 2031.[5] Since the LRSO cannot operate without a warhead, delay in the W80-4 program would also affect the LRSO's schedule. The joint Defense Department/Energy Department Nuclear Weapons Council manages coordination between the two programs.

Despite its importance to the defense of the nation, the LRSO is a relatively inexpensive nuclear modernization program. The Congressional Budget Office estimates the costs of the LRSO and its W80-4 warhead will comprise about 2 percent of the total nuclear modernization and sustainment budget through 2046.[6] For fiscal year 2021, the President's budget request included $474.4 million for the LRSO and $1 billion for the W80-4 LEP. In its fiscal year

2021 appropriations, Congress provided the full request for the W80-4 but reduced funding for the LRSO by $89 million. It attributed this cut to the Air Force's early decision to award the LRSO contract to Raytheon, reducing the number of competitors from two to one.[7]

The AGM-86B: No Longer Sustainable

The current AGM-86B ALCM was designed in 1974 and entered service in 1982 with an intended lifetime of only 10 years, but has undergone life-extension programs to last until 2030—38 years beyond its intended lifetime.[8] Russia's S-300 and S-400 air defense systems are some of the most sophisticated in the world, and Russia is close to fielding the S-500 with upgraded anti-stealth capabilities.[9] China's anti-access/area-denial systems make Chinese air space also increasingly prohibitive.[10] Robert Scher, Assistant Secretary of Defense for Strategy, Plans, and Capabilities under President Barack Obama noted in 2016 that the AGM-86B's "ability to survive modern air defenses is degrading over time" and "simply will not last much beyond the time planned for LRSO availability."[11] Similarly, when he was Commander of U.S. Strategic Command, Air Force General John Hyten stated that materials in the ALCM designed for a 10-year lifespan "are obsolete," and that life-extension programs "cannot keep pace with the rate of discovery of deficiencies."[12] In 2017, he said, "[I]t's a miracle that it can even fly."[13]

For nuclear deterrence to be effective, it must be credible, and any further attempts to sustain the AGM-86B would make it less so. Attempting to squeeze extra life out of the current ALCM in lieu of the LRSO would signal to adversaries that the United States does not have a modern and capable air-launched nuclear cruise missile capability. As stated by President Obama's Secretary of Defense Ashton Carter, "[I]t's not a choice between replacing these platforms or keeping them; it's really a choice between replacing them or losing them. That would mean losing confidence in our ability to deter, which we can't afford in today's volatile security environment."[14]

Because the AGM86-B will no longer be a viable option after 2030, maintaining our current nuclear ALCM capability requires replacing the AGM-86B with the LRSO. As such, the rest of this *Backgrounder* discusses the importance of developing the LRSO to sustain a nuclear ALCM capability for the future.

The LRSO's Role in Maintaining the Nuclear Triad

The U.S. nuclear triad consists of a ground leg (intercontinental-range ballistic missiles, or ICBMs), a sea leg (nuclear submarines armed with

FIGURE 1

How Raytheon's Long-Range Standoff Weapon Compares to Boeing's AGM-86B

AGM–86B		LRSO
1982	**Year entered service/expected**	2030
Boeing	**Manufacturer**	Raytheon Technologies
1,500+ miles	**Operational range**	Predicted 1,550+ miles
1,715	**Number built/planned**	1,000
B-52H	**Launch aircraft**	B-52H, B-2A, B-21
No	**Stealth**	Yes
W80-1	**Warhead**	W80-4 (in development)

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ballistic missiles), and an air leg (bombers armed with gravity bombs and cruise missiles), each of which plays a unique and complementary role in U.S. nuclear deterrence and assurance. Described below are the important capabilities provided by the air leg of the nuclear triad, followed by why an air-launched cruise missile capability is necessary for the air leg of the triad to remain viable.

Importance of the Air Leg of the Nuclear Triad. While ICBMs are responsive and constantly ready, and submarines armed with submarine-launched ballistic missiles (SLBMs) are survivable and mobile, the air leg of the nuclear triad provides the President a flexible option that complements land- and sea-based nuclear forces. Bombers can provide a highly visible means to signal U.S. intent during a crisis.[15] To signal U.S. resolve, the United States could move its nuclear-capable bombers to on-alert status[16] or deploy them to a region of conflict. For example, the United States has sent bombers over the Korean Peninsula after acts of North Korean aggression (as

in 2016, after a North Korean nuclear test) to demonstrate both U.S. resolve and commitment to its allies in the region.[17] The long flight times and ability to be recalled also provide the President with alternative response options in an escalating crisis when the prompt-strike attributes of land- or sea-based missiles may not be ideal.[18] Simply by forward deploying or flying bombers anywhere in the world, the United States can show its resolve and convince an aggressive actor to de-escalate without actually having to launch an attack. To guarantee this flexible option exists in the future, the United States needs the LRSO to replace the retiring AGM-86B.

The LRSO Is Necessary for a Viable Air Leg. For deterrence to be credible in the minds of U.S. adversaries, deterrence must be seen as effective. Canceling the LRSO would leave bombers to only carry gravity bombs, which would not provide an effective air-based nuclear deterrent.

When asked by Senator Deb Fischer (R–NE) in a written question if he believes the air leg of the triad would continue to be viable without an air-launched cruise missile capability, General Hyten responded, "No. The continued viability of the air-leg is dependent upon both a long range air-launched cruise missile and a penetrating bomber capability to cover operational requirements."[19] This is true for three reasons.

1. The LRSO is needed to enable the B-52H bomber in its nuclear role, which the Air Force requires to meet its nuclear-deterrence mission. Currently, the Air Force has 20 nuclear-capable B-2A stealth bombers and 46 nuclear-capable B-52H bombers.[20] The B-2A stealth bomber can carry gravity bombs to drop on enemy targets, but the B-52H relies on ALCMs because it can no longer survive enemy air defenses to come close enough to its targets to release gravity bombs.[21]

   To upgrade the bomber fleet, the Air Force has committed to ordering at least 100 B-21 Raiders, advanced stealth bombers to replace B-2 and B-1 bombers during the next decade.[22] But since the B-21s must replace *all* B-2s and B-1s, the Air Force also plans to continue using the B-52H[23] for the nuclear-deterrence mission to maintain a sufficient number of nuclear bombers.[24] Since the B-52H only carries ALCMs, and the AGM-86B will not be viable past 2030,[25] the LRSO is the only way to keep the B-52H nuclear-capable. Without the LRSO, the Air Force will not have enough nuclear-capable bombers to provide a credible bomber threat.

2. Only a stealthy cruise missile can hold at risk certain targets. Even the B-2, the United States' most modern bomber and the only long-range

stealth platform in the nuclear arsenal cannot reach many defended targets.[26] According to General Timothy M. Ray, Commander of Air Force Global Strike Command, "[T]he vast majority of targets covered by the bomber leg of the triad require the employment of stand-off weapons."[27] If cruise missiles are required to hold a large number of targets at risk, the bomber force could not perform its mission (and therefore provide a credible deterrent) with gravity bombs alone; the retiring AGM-86B must be replaced.

3. The LRSO will provide a hedge against future risk to the stealth of the B-21. While the B-21 will improve stealth against enemy air defenses compared to current stealth bombers, Russia and China are surely already working to improve their air defenses against advanced stealth measures. As the "ever-spiraling evolution" of military technology goes,[28] the B-21 will likely lose its edge over adversary air defenses. The LRSO will provide a necessary long-term hedge against this scenario.

LRSO Capabilities and the Credibility of Deterrence

In addition to maintaining the potency of the air leg of the nuclear triad for decades to come, the nuclear ALCM's unique attributes contribute to the credibility of U.S. deterrence and should be sustained through the LRSO program.

To effectively deter an adversary, the threat must be credible. Former Commander of U.S. Strategic Command General Robert Kehler has explained that the "paradox of the Nuclear Age is that, in order to prevent their use, you have to be prepared to use them."[29] A nuclear ALCM contributes to the credibility of U.S. deterrence by providing an option to hold multiple targets at risk while standing off from enemy air defenses and other threats. In a nuclear crisis, the President should have this added flexibility at his disposal to deter an adversary from attacking first.

The Nuclear ALCM Enables Bombers to Hold Multiple Targets at Risk and Strike in a Timely Manner. Bombers can carry multiple LRSO missiles and launch them simultaneously at independent targets.[30] In contrast, gravity bombs can only be dropped on a single target at a time; to strike multiple targets, a bomber would have to fly potentially long distances between them, encountering surface-to-air missiles and fighter jets along the way.[31] While advanced stealth may mitigate some vulnerability to these threats, only with ALCMs can bombers strike multiple targets simultaneously. In this sense, the LRSO acts as a force multiplier. The capability to strike multiple targets at once from afar is needed in addition to sending bombers into enemy territory.

The Nuclear ALCM's Ability to Stand Off from Enemy Targets Provides the United States with Flexibility to Visibly Threaten an Adversary. Unlike ICBMs and nuclear submarines that remain in a constant deterrence posture—always ready to attack from their positions—bombers can move around to manage conflict escalation and de-escalation. This ability to deploy LRSO-armed bombers in theater can also help fill a deterrence gap with Russia, whose unconstrained stockpile of theater nuclear weapons and apparent "escalate to win" doctrine indicate a greater willingness to use nuclear weapons on the battlefield.[32] By presenting a credible option to respond proportionately to an adversary's limited employment of nuclear weapons, the LRSO can deter such escalation in the first place.

A Nuclear ALCM Can Impose Significant Costs on Adversaries' Air Defenses, Requiring Large Investments to Challenge. ALCMs fly at low altitudes, making them much more difficult to detect and intercept by adversary air defenses. The LRSO will vastly improve this low observability because it will have advanced stealth compared to the AGM-86B. Nuclear ALCMs can also fly complicated routes. The AGM-86B has a terrain mapping navigation system to allow the missile to avoid threats and detection;[33] the LRSO is expected to have a sophisticated and reliable navigation system that enables automatic avoidance of threats, vastly improving its survivability against more advanced Russian and Chinese air defenses.

Without the LRSO, adversaries would only need air defenses aimed at bombers flying directly over targets with gravity bombs. While stealth reduces the chance of detection by radar, it does not make bombers invisible—and both Russian and Chinese air defenses are continuously improving. Instead, the LRSO makes air defense more complicated for Russia and China, forcing them to plan for incoming cruise missiles from multiple attack vectors that are likelier to survive air defenses.

Adversaries then have to make greater investments in air defenses to be able to detect both the low-observable bomber and each stealthy, survivable LRSO missile. The more money adversaries must spend on air defenses, the less they can invest in offensive systems to threaten the United States.[34] When adversaries realize that U.S. nuclear forces can penetrate and survive their air defenses, the threat of retaliation becomes more credible in their minds as they become forced to do more—not less—to defend themselves.

The LRSO Enables Crew and Platform Risk Mitigation. Because bombers armed with LRSO missiles reduce the need to fly into hostile enemy territory, they face less risk. Mitigating crew and platform risk

increases credibility, as adversaries will be less convinced of U.S. willingness to send people flying into air defenses than if the United States can launch safely from friendly territory.

As General Ray testified, "Without LRSO on B-21s and B-52s, our ability to hold adversaries at risk is reduced, the risk to our aircraft and aircrew is increased, and the execution of the wartime mission is degraded."[35] Letting the current ALCM retire without replacement would only make aggression easier for U.S. adversaries during an era of great-power competition when deterrence ought to be strengthened.

The LRSO and Extended Deterrence

The LRSO is critical to the extended deterrence of U.S. allies. The United States provides security assurances to 30 countries through its nuclear umbrella,[36] a large commitment whose credibility requires constant reinforcement. The LRSO enables the United States to deploy bombers in theater to signal to an adversary its willingness to defend its allies. Bombers that can threaten adversaries from beyond their peripheries improve the credibility of extended deterrence and give the President more flexibility than relying solely on ICBMs or SLBMs to launch a strategic attack. And because they are air-launched, the LRSO can contribute to extended deterrence without the need for additional basing commitments.

Since the retirement of the nuclear Tomahawk Land Attack Missile in 2013, the U.S. military's options for theater deterrence have been limited, especially in the Indo–Pacific.[37] As former Air Force Deputy Chief of Staff for Strategic Deterrence and Nuclear Integration Lt. Gen. Jack Weinstein testified, "NATO and our allies are extremely supportive of our LRSO project."[38] Conversely, canceling the LRSO program could foster doubt among allies that the United States is truly willing and able to meet its extended deterrence commitments. To sustain relationships with allies, the United States should continue the LRSO program.

Hedging Against Technical and Geopolitical Risk

Fielding the LRSO provides a hedge against technical risk to the rest of the nuclear triad as the global nuclear threat advances. The Pentagon is modernizing each leg of the nuclear triad—both delivery systems and warheads—at the same time, with little or no margin for delay as legacy programs have planned retirement dates.[39] The LRSO hedges against the risk of technical or schedule issues in delivering these major modernization

programs. Having entered the TMRR acquisition phase early, the LRSO is a relatively mature nuclear modernization program that will cost the least of all of the DOD's nuclear modernization efforts.

The LRSO can also hedge against technical failure in U.S. ICBM or nuclear submarine fleets by enabling the air leg of the triad. Compared to ICBMs' constant on-alert status and the nuclear submarine fleet's set deployment schedule, bombers have the unique ability to move from off- to on-alert status. Should technical failure arise in another leg of the triad, bombers can go on alert to compensate for any loss in capability.

Fielding the LRSO as a hedge increases in importance as the nuclear threat continues to expand, from primarily the Soviet Union during the Cold War to now include China, whose nuclear buildup is alarming, as well as North Korea and Pakistan—and potentially Iran.[40] During a time of geopolitical uncertainty, the LRSO can guarantee an effective capability to hold adversary targets at risk, and do so at a comparatively modest cost.[41]

The LRSO Does Not Weaken Strategic Stability

To be clear, the LRSO has consistently maintained strong bipartisan support, including from senior Obama Administration officials and both Democrats and Republicans in Congress.[42] Yet critics still argue that the LRSO is destabilizing. One version of this argument suggests that the LRSO's capabilities make it usable in a disarming first strike.[43] Yet the opposite is true. Since the LRSO can provide a clear signal to adversaries when bombers go on alert, it can de-escalate and, in fact, help stabilize a crisis. Former Obama-era Assistant Secretary of Defense Robert Scher perhaps put it best when he explained:

> Like the ALCM, the LRSO will not pose the threat of a disarming attack to Russia or China. The process of alerting strategic bombers is observable, and aircraft and missiles must then spend hours flying toward their targets, compared to less than 30 minutes for ballistic missiles. Hence, the LRSO provides more potential for explicit warning than do ballistic missiles, or the ground- and sea-launched cruise missiles the United States previously deployed, but has since retired.[44]

Given bombers' "rich signature sets," including aerial refueling, bomber basing, and long-flight times that adversaries can clearly detect, the claim that the LRSO can be used in a disarming first strike is nonsensical.[45] Rose Gottemoeller, Under Secretary of State for Arms Control and Security under

President Obama, has testified that for these reasons, the LRSO is in fact "valuable in maintaining strategic stability."[46]

Opponents also argue that the LRSO would hamper strategic stability because adversaries will not know whether cruise missiles are nuclear- or conventional-armed,[47] but this argument has been empirically disproven. During military operations conducted since 1987, the United States has employed over 350 conventional ALCMs, and not once did an adversary misjudge an ALCM launch to be nuclear.[48] Context here plays a clear role. Russia and China have no reason to believe that U.S. bombers conducting strikes against targets in Syria, for instance, would carry nuclear cruise missiles headed for Russia or China. As made clear throughout this paper, part of the LRSO's unique value comes from its ability to signal resolve to de-escalate conflict, which requires showing adversaries that bombers moving to alert status are nuclear-capable.[49]

Recommendations

The LRSO will sustain the air leg of the nuclear triad for the foreseeable future, provide the President with a flexible, credible option to deter adversary aggression, strengthen extended deterrence, and hedge against other technical and geopolitical risks.

To ensure a nuclear ALCM capability for decades to come, Congress should:

- **Robustly fund the LRSO in fiscal year 2022 to reduce long-term costs and enable the program to accelerate.** In fiscal year 2021, Congress missed an opportunity to reduce risk in the LRSO program schedule by cutting funding after the Air Force awarded an early contract and moved ahead of schedule. Congress needs to venture away from the mindset of paring back nuclear modernization programs at the lowest levels of funding possible before their schedules are jeopardized; deferring costs does not avoid them. Given both the LRSO's unique contributions to nuclear deterrence and relatively low cost, Congress should push this program to advance as quickly as possible—versus taking actions that could slow it down. This might require funding the program at a number greater than the $359 million the Trump Administration projected as required for fiscal year 2022[50] to adjust for the $89 million cut made in fiscal year 2021. Accelerating the program would reduce operational risk for U.S. nuclear forces and help smooth the coming "bow-wave" of total modernization costs.

- **Ensure that the Departments of Defense and Energy can coordinate the development of the LRSO with the W80-4 warhead through the Nuclear Weapons Council.** Because the Pentagon is pursuing the LRSO in parallel with the NNSA's W80-4 warhead, the Nuclear Weapons Council must be able to coordinate requirements and timing of these two programs, as the LRSO cannot operate without a warhead to carry. Last year, both the House appropriations and defense authorization bills included proposals that would severely hamper, if not eliminate, the Council's role in this coordination process. Fortunately, the final appropriations and defense authorization bills for fiscal year 2021 did not include those proposals. In future legislation, Congress must ensure the council can coordinate the LRSO and W80-4 programs, as well as other critical nuclear programs.[51]

The next Administration should:

- **Back the full procurement of the LRSO, and request enough funding for fiscal year 2022 and the subsequent years to ensure the LRSO remains on track for initial operating capability in 2030 or sooner.** The next few years could portend flat if not reduced defense budgets due to debt spending on the COVID-19 pandemic. In addition, the next Administration will likely face political pressure to cut nuclear modernization programs. Given the critical capability that the LRSO will sustain at a relatively low price, the next Administration should not succumb to demands to cancel or reduce funding for such an essential element of the U.S. nuclear deterrent.

- **Request sufficient funding for fiscal year 2022 and the following out-years for the W80-4 LEP to ensure this program can deliver on the same timeline as the LRSO.**

- **Conduct more bilateral and multilateral engagements on the value of the LRSO with U.S. partners and allies.** Since a nuclear ALCM plays an important role in U.S. extended deterrence, the Administration should seek improved understanding with allies and partners about how the LRSO will benefit them.

The Department of Defense should:

- **Offer briefings to Members of Congress, classified if necessary, on the need for the LRSO given the advancing threat environment.** Amid calls by Members of Congress to cut funding for the LRSO,[52] it is crucial that all Members of Congress understand the complete nature of the threat, the fading capabilities of the current nuclear ALCM, and the importance of sustaining the air leg of the nuclear triad through the LRSO. The department must ensure its senior officials testify to the importance of the LRSO and offer briefings to debunk false claims that the LRSO threatens strategic stability.

Conclusion

For a relatively inexpensive nuclear modernization program, the LRSO will have a significant impact on U.S. nuclear deterrence. Securing this option becomes all the more important as U.S. adversaries continue to advance both their own nuclear forces and their air defenses. The U.S. government must prioritize fielding the LRSO to protect the flexible deterrence option provided by the air leg of the nuclear triad.

Patty-Jane Geller is Policy Analyst for Nuclear Deterrence and Missile Defense in the Center for National Defense, of the Kathryn and Shelby Cullom Davis Institute for National Security and Foreign Policy, at The Heritage Foundation.

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