



# MITCHELL INSTITUTE

## Policy Paper

### Key Points

DOD's civilian leadership should direct a comprehensive study to determine the mix of capabilities that would maximize its future long-range strike capacity as a whole, instead of on a "stove-piped" service-by-service basis. It should compare the cost effectiveness of air-to-surface and surface-to-surface alternatives, while avoiding excessive redundancy.

DOD should assess the opportunity costs of the Army's planned long-range strike investments. The assessment should determine if some of these resources could be better used to increase the Army's capacity to perform its core mission of defending U.S. forces and theater installations against Russian or Chinese missile salvos.

DOD should address Indo-Pacific host nation issues for Army long-range strike batteries and rules of engagement for their use in a crisis before committing to substantial investments to acquire them for the theater.

While they would be most useful in Europe, Army mid-range strike batteries might have some benefit in the Indo-Pacific. The Army and Marine Corps should cooperatively develop operating concepts, tactics, techniques, and procedures that would integrate their littoral counter-maritime strikes in the Indo-Pacific along with Air Force and Navy capabilities.

## Understanding the Long-Range Strike Debate

By Mark Gunzinger

Director of Future Concepts and Capability Assessments, The Mitchell Institute for Aerospace Studies

Lukas Autenried

Senior Analyst, The Mitchell Institute for Aerospace Studies

and Bryan Clark

Senior Fellow and Director of the Center for Defense Concepts and Technology, Hudson Institute

### Introduction

The Department of Defense's (DOD) strategic shift toward planning for great power conflict dramatically changed its force structure requirements, including those for long-range strike capabilities to attack targets at scale to defeat peer aggression. Although there is broad consensus in DOD on the need to increase its long-range strike capacity, there is significant debate over *which* investments would result in the greatest return for America's warfighters. This report compares the ranges, costs, target suitability, and other attributes of the surface-launched long-range missiles the Army intends to acquire to those of precision-guided munitions delivered by U.S. strike aircraft. These comparisons indicate that, while a mix of weapons is certainly desirable, increasing the U.S. military's inventory of combat aircraft capable of attacking multiple targets per sortie has greater potential to increase DOD's long-range strike capacity in a period of flat or declining defense budgets.



Figure 1: B-2 launching an AGM-158 JASSM.

Source: U.S. Air Force Photo.

The following initiatives would help DOD to determine how it should maximize its future capacity to strike over long ranges and avoid wasting resources on excessively redundant capabilities.

- DOD should compare the cost and combat effectiveness of candidate surface-launched long-range missiles—including shipborne weapons—with weapons that can be delivered by U.S. strike aircraft. This will help determine the best mix of capabilities to provide theater commanders with multiple options for long-range strikes against peer adversaries without excessive redundancy.
- DOD should assess the opportunity costs of the Army's planned long-range strike investments. This assessment should determine if allocating some of these investments toward increasing the Army's capacity to perform one of its core missions—defending theater airbases against missile attacks—would result in an even greater increase in the combatant commands' joint offensive capacity.
- DOD should determine where the Army would posture its new long-range strike batteries in the Indo-Pacific, the potential for host nations to approve stationing them on their sovereign territory, and the rules of engagement for their use in a crisis. This should be completed before committing substantial investments to acquire them for the theater.
- Finally, the Army and Marine Corps should cooperatively develop concepts, tactics, techniques, and procedures that would integrate their counter-maritime operations in the Indo-Pacific along with those of the Air Force and the Navy. Both services are procuring

shore-based long-range weapons for counter-maritime operations and should cooperate to prevent excessive overlap.

### What is the Need?

According to DOD's *2018 National Defense Strategy*, defeating a Chinese or Russian campaign to seize and occupy the territory of a U.S. partner or ally is a pacing challenge for sizing and shaping the U.S. military. Potential conflict scenarios include a Chinese invasion of Taiwan—which the U.S. Indo-Pacific Command has warned could occur this decade—and a Russian invasion in the Baltics or other areas along NATO's eastern front. Immediately engaging enemy forces at the outset of an invasion using a combination of U.S. forces postured in a theater of conflict and long-range strikes will be critical to preventing China or Russia from achieving its objectives.<sup>1</sup>

All the services are investing in new long-range strike systems to meet this need, including hypersonic (Mach 5 or greater) weapons. The Army is investing in medium-range and very long-range surface-to-surface missiles to equip its newly formed Indo-Pacific and Europe Multi-Domain Task Forces (MDTF). The Air Force, which has long provided DOD with the preponderance of its long-range strike capacity, is acquiring B-21 stealth bombers, next-generation cruise missiles, and other munitions that can be delivered by aircraft against targets in contested areas. The Navy and Marine Corps are fielding new strike munitions for sea control and sea denial in the Indo-Pacific, including shipborne long-range hypersonic boost-glide land attack weapons and vehicle-mounted medium-range missiles capable of attacking ships in littoral areas.<sup>2</sup> The Navy and Air Force are also increasing the range, effectiveness, and capacity of their “kill chain” capabilities needed to find, fix, track, and attack targets over long ranges.

## What are the Issues?

The Army's plan to field long-range missiles to bolster NATO defenses in Europe is not a controversial issue. Most defense experts agree that batteries of ground-launched precision strike missiles postured in Europe would improve deterrence and increase NATO's ability to conduct decisive operations against invading forces for a cost per target that is sustainable. Moreover, the Army's planned mid-range (approximately up to 1,500 km) missiles will have sufficient range to strike targets across potential European battlespaces. In Europe's more compact geography, the preponderance of the Army's strikes could be against targets located a few hundred kilometers from its missile launchers. For context, the city of Gdansk in northern Poland is only 60 kilometers from the border of Russia's Kaliningrad exclave on the Baltic Sea.

This is not the case in the Indo-Pacific region.

Overcoming challenges such as the tyranny of distance imposed by the vast expanses of the region, more limited basing alternatives compared to Europe, and China's anti-access/area-denial (A2/AD) threats will require DOD to greatly increase its capacity to conduct precision strikes over thousands of kilometers. Army surface-to-surface missiles located in Guam would need ranges of at least 2,900 kilometers to reach China, and Army missiles postured along the Pacific's First Island Chain would need ranges of 800 km or more just to reach China's coastline, although shorter-ranged weapons could engage ships at sea.<sup>3</sup>

These long-range missiles would be larger and more costly than weapons delivered by stealth aircraft that could penetrate China's airspace to attack targets from short ranges, or even weapons launched by manned and unmanned ships that can

maneuver closer to target areas. Obtaining permission from Indo-Pacific allies to posture the Army's new missile batteries on their sovereign territory is another issue, as is the likely requirement for host governments to approve—possibly on a salvo-by-salvo basis—any missile attacks directed against China during a conflict.

The Army also intends to procure new air- and space-based surveillance, reconnaissance, communications, and fire control systems so it can complete its own long-range kill chains. A number of these systems—including low-Earth orbit (LEO) satellites and fixed-wing aircraft with sensors capable of detecting moving targets—would be highly redundant with Navy, Space Force, and Air Force capabilities already in existence. The Army's push to develop its own long-range targeting capabilities runs counter to jointness and well-established joint doctrine. True jointness entails using the right capabilities at the right places and right times to achieve a commander's objectives regardless of service origin.

Finally, decisionmakers should consider the opportunity costs of the Army's long-range strike investments. Spending billions on duplicative capabilities would reduce resources available for the Army to perform its core mission of defending U.S. forces and bases against Chinese attacks—including theater installations needed to store and maintain the Army's future missile stockpiles. As noted by the U.S. Indo-Pacific Command, failing to field these defenses would severely erode its ability to deter and defeat Chinese aggression.

## Comparing the Cost Effectiveness of Long-range Strike Alternatives

### Future Army Long-Range Strike Weapons

Long-range precision fires (LRPF) is one of the "big six" modernization initiatives the Army says are required to ensure its forces

**True jointness entails using the right capabilities at the right places and right times to achieve a commander's objectives regardless of service origin.**

are capable of Multi-Domain Operations (MDO).<sup>4</sup> According to the Army, a family of LRPF weapons including the ballistic Precision Strike Missile, Mid-Range Capability, and the Long Range Hypersonic Weapon will allow it to “penetrate and neutralize enemy A2/AD capabilities” that limit the U.S. military’s freedom of action.<sup>5</sup>

**Precision Strike Missile (PrSM, or “prism”).** The Army will soon begin to replace its legacy short-range MGM-140 Army Tactical Missile System (ATACMS) with PrSMs that have a range of more than 500 km and carry a 200-pound class blast/fragmentation warhead.<sup>6</sup> Smaller than ATACMS, two PrSMs will fit into each launch pod mounted on the Army’s M270A1 Multiple Launch Rocket System and the M142 High Mobility Artillery Rocket System. PrSMs have a GPS/INS guidance system suitable for attacking stationary air defense threats, missile launchers, command and control (C2) centers, troop staging areas, and other non-armored “soft” targets. Early production PrSMs will cost approximately \$1.2 million each.<sup>7</sup>

**Mid-Range Capability (MRC).** The Army intends to buy several new weapons to attack targets at ranges between 500 and 1,500 kilometers. As an interim solution, the Army is procuring SM-6 Block I/IA dual-mode surface-to-air and surface-to-surface missiles and Tomahawk Block V cruise missiles using existing Navy contract vehicles.<sup>8</sup> SM-6 Block I/IA missiles cost about \$4.3 million each and have a range of more than 420 km, and Tomahawk Block Vs have a range that exceeds 1,600 km and cost \$1.5 million per missile. Both can attack ships and targets ashore, and with additional investments in fire control systems, the Army could also use its SM-6s against airborne threats. Upgrading the PrSM’s booster engine to double or more

its range is the Army’s preferred mid-range solution in the long run. The Army will also equip these PrSMs with a multi-mode seeker to attack “maritime targets in the Pacific and emitting [Integrated Air Defense Systems] in Europe.”<sup>9</sup> Extended-range PrSMs could cost \$3 million each depending on the cost of their upgrades. DARPA is developing an intermediate-range hypersonic boost-glide weapon that could be another MRC candidate, although it will likely be more costly.<sup>10</sup>

**Long Range Hypersonic Weapon (LRHW).** The LRHW pairs a rocket booster with the Common Hypersonic Glide Body (C-HGB) jointly developed by the Navy and Army. The C-HGB will separate from its booster after reaching high altitudes and hypersonic speeds and then glide to its target using a dynamic, non-ballistic flight path. Some reports indicate LRHWs will have a range of at least 2,250 kilometers.<sup>11</sup> A LRHW battery in an Army strategic fires battalion could consist of a battery operations center and four transporter erector launchers (TEL), each of which carries two weapons. The LRHW is designed to attack high-payoff and time-sensitive A2/AD targets such as over-the-horizon (OTH) radars. A LRHW could cost \$40 million or more depending on the cost of their booster stack and hypersonic glide vehicle.<sup>12</sup>

### **Affordable Mass?**

Chief of Staff of the Army General James McConville and other Army leaders have said their service’s new long-range strike systems will bring much-needed mass to a fight with China or Russia.<sup>13</sup> Others have claimed the Army’s new long-range missiles will be more expensive than long-range airstrikes, are not reusable, and will have significant operational limitations

against challenging targets such as mobile weapon systems or hardened facilities. So, what is the reality? Would they provide a cost-effective supplement to U.S. long-range strike capability?

In the case of the Army, the “mass” or number of warheads it can place on targets over long ranges will greatly depend on where it can forward posture its launchers and the range of its missiles after launch. The Army’s capacity to conduct strikes will also depend on the ability of theater logistics networks to support its batteries and the affordability of missiles, which can affect the number of reloads the Army can afford to buy and preposition forward. Surface-to-surface weapons are much larger than air-launched weapons of equivalent payload size and range. Resupplying the Army’s future launch batteries with missile reloads and other material support will require significantly more airlift, sealift, and ground transportation compared to the logistics needed to replenish air-launched weapon stocks in a theater.

**Forward basing.** Ideally, the Army should posture its missile batteries in

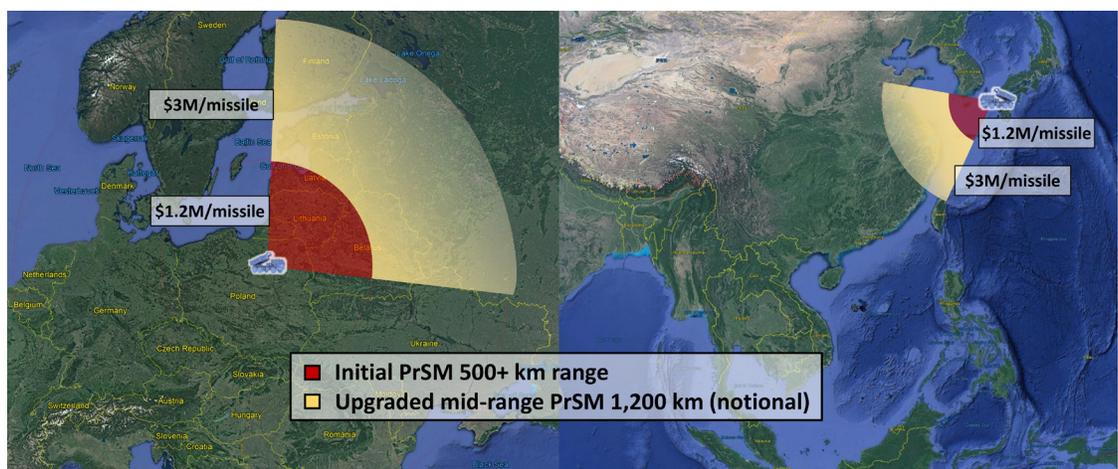
forward locations that ensure they will be within range of targets at the onset of a conflict with China or Russia. The alternative would be to deploy batteries into a theater from the United States or other regions, which could take weeks or even months depending on competing demands for Air Force airlift and Navy sealift. Compounding this challenge are persistent deficiencies in the U.S. military’s logistics enterprise that the Department of Defense has yet to resolve. This includes a decline in readiness in the sealift forces needed to move U.S. forces and material to a theater of conflict in a crisis.<sup>14</sup>

Batteries of mid-range PrSMs deployed permanently or rotationally to Poland and other areas along NATO’s eastern front would have more than enough range to attack Russian forces invading one or more of the Baltic states (see Figure 2). These batteries would also have access to Western Europe’s well-developed transportation networks, NATO’s supply depots, and other infrastructure needed to support their operations.

The Indo-Pacific is a different story. Army PrSM batteries postured in Japan, the Philippines, or elsewhere along the First Island Chain would be about 800 km from China’s coastline at best. PrSMs with a 500 km range will be sufficient for maritime

**In the case of the Army, the “mass” or number of warheads it can place on targets over long ranges will greatly depend on where it can forward posture its launchers and the range of its missiles after launch.**

Figure 2: Potential range and coverage of Precision Strike Missiles launched from Poland and Japan.



Source: Mitchell Institute

attacks alongside Marine Corps littoral strike units—assuming PrSMs have sensors to locate and track moving ships. Upgraded mid-range PrSMs could cover target areas along China’s coastline but may cost about \$3 million each depending on their upgraded boosters and sensors.<sup>15</sup>

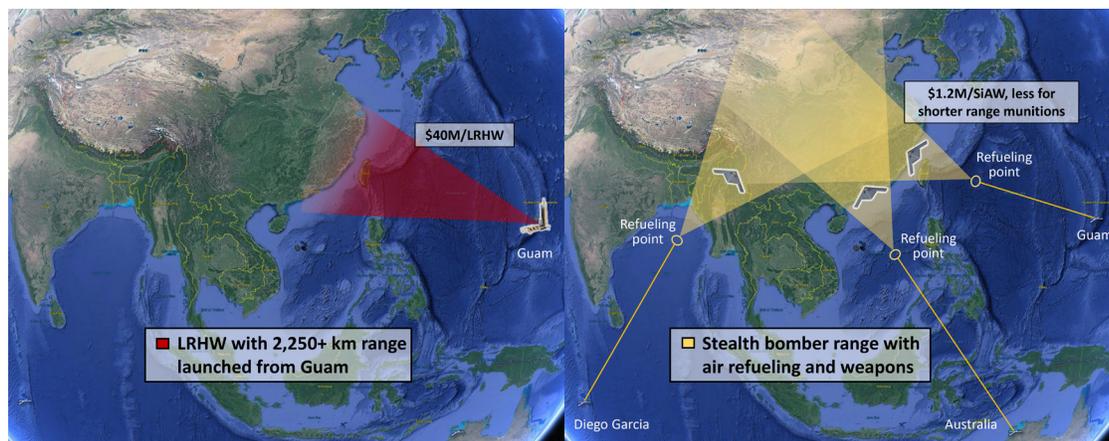
The range penalty of operating from the First Island Chain would require the Army to use MRC missiles and LRHWs to strike A2/AD targets such as SAMs located along China’s coastal areas. In comparison, the long range, low observability, and other features of stealth bombers allow them to fly from airbases along the Second Island Chain, northern Australia, Diego Garcia in the Indian Ocean, and even the United States to attack targets across China. The ranges of stealth bombers (thousands of miles) can be greatly extended by aerial refueling, allowing them to attack an enemy from multiple directions. Moreover, bombers can carry large payloads of shorter-range, smaller-sized, and substantially lower-cost weapons to strike multiple targets per sortie. For context, a stealth B-2 carrying 16 JASSMs or JASSM-ERs could reach targets anywhere in China, as shown in Figure 3.

A similar dynamic applies to shipborne

and undersea-launched weapons. Navy surface combatants carry missiles including Tomahawk and SM-6 Block I/IA but may not have sufficient defenses to survive while operating inside the First Island Chain during a conflict; they would likely operate outside the most contested areas and focus their attacks on ships and islands in the East and South China Seas. Navy attack submarines with vertical launch systems (VLS) could operate inside the First Island Chain to strike maritime targets with missiles or torpedoes or use longer-range missiles like Tomahawk to increase the depth of their attacks into China.<sup>16</sup>

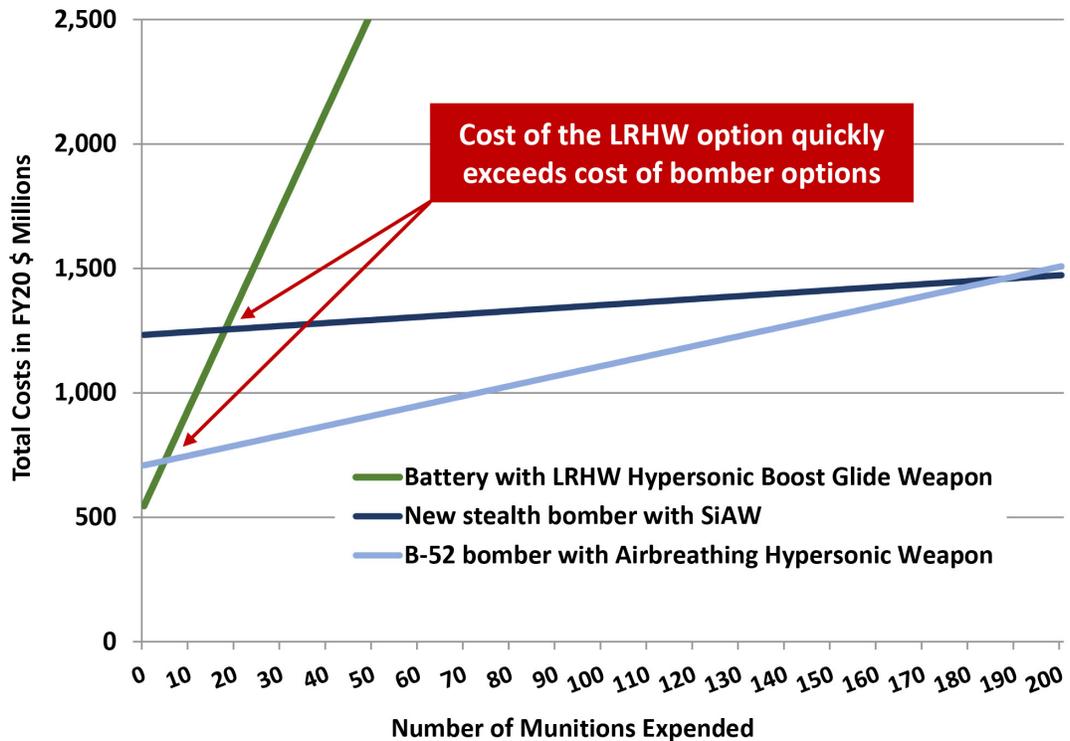
**Relationships between weapon range, speed, and cost.** Three rules of thumb help explain the relationships between the ranges, sizes, speeds, and unit costs of missiles and other munitions. First, as the ranges of standoff missiles increase, so do their sizes; they must carry more fuel for their engines or use bigger boosters to extend their flight, sophisticated guidance systems to maintain their trajectory, and so on. All these features increase their cost. Second, surface-launched missiles are generally larger and more expensive than air-launched missiles with similar ranges and payloads; the former must have larger

Figure 3: Comparing potential ranges and target coverage of Army Long Range Hypersonic Weapons launched from Guam with Air Force long-range stealth bombers.



Source: Mitchell Institute. The comparison assumes the bombers refuel about 500nm from China outside the range of most land-based air defenses. The bombers may need additional air refueling during their missions depending on their flight profiles.

Figure 4: Comparing the cost of long-range strike alternatives



Source: Mitchell Institute. The stealth bomber line in Figure 4 includes the cost to acquire a stealth bomber, operate and support (O&S) it for 30 years, and the cost of weapons it expends. The LRHW line includes the cost to acquire an Army missile battery, its O&S costs for a 30-year period, plus the cost of weapons it launches. The B-52 example includes O&S and weapon costs only since B-52s are an existing capability. All strike systems, whether airborne, shipborne, or land-based, that operate inside Chinese A2/AD threat envelopes will need to be supported by defensive systems. The cost of these defenses is assumed to be roughly comparable for the different alternatives and are not included in Figure 4. Ground-based missile batteries will require air defenses because they will be postured within range of China-based missiles and bombers. They will also need significant logistics support to sustain their operations. Depending on the threat environment, bombers may need support from other aircraft to counter enemy air patrols and potentially attack enemy air defenses. They will also require aerial refueling for very long-range operations. These costs are assumed to be roughly equivalent for the purposes of the Figure 4 comparison. Basing costs for the bombers is not included because they will operate from garrison, and the missile batteries will also have a garrison from which they deploy to their forward-postured locations.

boosters that propel them from ground level to airborne trajectories that allow them to reach distant targets. Third, the faster a weapon flies, the more costly it is—an important consideration for future hypersonic weapons.

Figure 4 illustrates the relationship between weapon ranges and cost. Long Range Hypersonic Weapons could give Army batteries located in Guam and other U.S. territories the ability to attack targets in China. However, the LRHW's high unit cost—potentially \$40 million to \$50 million each—would make it difficult to buy in the numbers necessary to have a significant impact in a major conflict with China. In comparison, DOD could procure additional stealth aircraft that can penetrate contested airspace and deliver large payloads of smaller, shorter-range, and less-expensive munitions.

As the figure shows, the high cost of LRHWs could quickly exceed the cost to buy additional stealth bombers, operate and support them over a 30-year period, and procure its payloads of next-generation Stand-in Attack Weapon (SiAW) missiles.<sup>17</sup> Bombers are also reusable assets that can be applied to multiple missions, while an LHRW is expended once. The same applies for the second example that compares the cost of LRHWs against a non-stealth B-52 bomber that launches airbreathing (scramjet) hypersonic cruise missiles that cost \$4 million to \$5 million each. In this case, buying the cruise missiles combined with the cost to operate and support the B-52 over a 30-year period is quickly exceeded by the cost of a handful of LRHWs and their launch battery.

**Considering weapons effectiveness against challenging targets.** It is also important to consider the effectiveness of

different weapons against challenging targets such as mobile or relocatable missile launchers, hardened or deeply buried facilities or targets located deep in an adversary's interior.

In the case of mobile targets, a good rule of thumb is that the more time a weapon requires after launch to reach its designated aimpoint, the less effective it will be against targets that can quickly change locations. Depending on its speed and trajectory, an Army ballistic missile launched from Japan could require 10 to 15 minutes to reach a mobile threat such as an HQ-9 SAM located in China. In addition, the need to complete other operations in the Army's kill chain, such as relaying target data from a remote sensor to a joint command and control center, assessing the data, deconflicting airspace for a missile launch, and then commanding a launch would increase its response time. HQ-9s are designed to employ "shoot and scoot" tactics, which means they can launch a surface-to-air missile and then begin to relocate in about 5 minutes. This rapid mobility means an Army missile might impact the aimpoint where the HQ-9 used to be, rather than its current location. Stealth bombers and fighters could reduce their response time or be ready to engage fleeting targets by penetrating contested airspace and attack mobile targets from shorter ranges before targets can move or take other defensive actions. If necessary, B-2s, future B-21s, F-22s, and F-35s can also use their onboard systems to find, fix, track, target, and engage targets without outside support, which can greatly reduce latency in their kill chains.

Of course, munitions can be equipped with active sensors such as a millimeter wave radar (like the SDB II) and passive infrared or optical sensors capable of finding a target that has moved, characterizing it, and then guiding the weapon to a new point of impact. While this can greatly improve

weapon effectiveness against targets that have moved or are moving, weapons must also be able to change their trajectories to reach their new aimpoints. This can be a limitation for ballistic missiles in their final stage of flight. Unlike cruise missiles that can loiter in a target area to find and attack mobile/relocatable targets, ballistic missiles that trade their speed for range over long trajectories may not have enough kinetic energy and steering authority from their small control surfaces to make major course corrections to a new aimpoint.

In general, long-range stand-off weapons also cannot carry large enough warheads to kill targets that are structurally hardened or deeply buried, a tactic widely used by China, Russia, Iran, North Korea, and others to counter precision strikes. PrSMs with 200-pound class warheads would be ineffective against these targets. Penetrating bombers on the other hand can deliver much larger weapons designed with enough kinetic punch to destroy hardened or deeply buried facilities. For example, B-2 bombers can deliver 5,000-pound "bunker buster" weapons and even the 30,000-pound GBU-57A/B Massive Ordnance Penetrator. It is simply unrealistic to design weapons with these sizes and weights to also launch and fly very long ranges.

### **Other Operational Considerations**

**Maritime strike.** PrSMs upgraded with sensors needed to attack moving ships could contribute to sea denial operations for parts of the East China Sea and South China Sea, depending on where the Army postures its PrSM launchers. However, the Army's maritime strike capabilities would duplicate the Marine Corp's anti-ship initiatives and would require the Army to develop new infrastructure to support expeditionary operations, possibly in austere locations.

**Indo-Pacific theater host nation access.** The extent to which the Army's long-range strike batteries can contribute to a future operation to defeat peer aggression will be heavily impacted not just by their range, but by the willingness of U.S. partner nations to host them and approve their use. Army Chief of Staff General McConville has said that basing these weapons in forward theaters is "a political decision ... the politics of where they're based, how they're based, will be up to the policymakers and the diplomats."<sup>18</sup> Although this is partially correct, a less risky approach would

**In the event of a Chinese invasion of Taiwan, would Japan approve direct missile strikes to be launched from its territory against Chinese forces? Possibly, but it is certainly not a given.**

be to first resolve posture issues for the Army's planned long-range strike batteries in the Indo-Pacific before committing funding to buy them.

This should not be a significant issue for LRHWs if their range will allow them to be based in Guam and other U.S. territories in the

Indo-Pacific and still reach their targets. However, due to the LRHW's very high cost, most of the Army's future long-range strike capacity in the Indo-Pacific will likely come from mid-range weapons with lower price points. MRC missiles will need to be postured in western Japan and other First Island Chain locations to reach targets along China's coastline—and possibly a couple hundred kilometers deeper depending on their trajectories. There are significant challenges associated with creating this forward posture.

First, it will require host nation permission to station new U.S. long-range strike missile batteries on their sovereign territory. Convincing any nation along the First Island Chain to host long-range missile launchers aimed at Chinese targets, even on a rotational basis, will be a tough diplomatic

sell. Consider the significant South Korean domestic opposition—and Chinese pressure on its government—in response to South Korea hosting a U.S. Terminal High Altitude Area Defense (THAAD) battery, which is a purely defensive capability.<sup>19</sup> A move toward hosting offensive systems such as long-range strike missiles capable of directly attacking China could face even greater, potentially insurmountable opposition. Recognizing this, Army LTG Thomas Spoehr (retired) noted that, "Today, there is probably not one of our regional partners in the First Island Chain that would be willing to base Army—or any other service—long-range strike missiles in their country."<sup>20</sup>

Second, assuming the United States finds regional partners willing to base the Army's missile launchers, it will still require host nation permission to use these weapons in a crisis. This permission should not be taken for granted. A host nation could deny launch permission for a wide range of reasons, including a desire not to risk retaliation by China. Or permission could be granted on a case-by-case basis or even a weapon-by-weapon basis. In the event of a Chinese invasion of Taiwan, would Japan approve direct missile strikes to be launched from its territory against Chinese forces? Possibly, but it is certainly not a given.

In contrast, basing requirements for combat aircraft are a function of their ranges and the availability of aerial refueling. Bombers stationed in the United States, Guam, other U.S. territories, Diego Garcia, and elsewhere in the region, combined with aerial refueling, can attack targets throughout China and do so from multiple aspects. This also gives them much broader leeway in the event of political opposition within a given allied country that might deny basing access for U.S. long-range strike forces or constrain combat operations from

their sovereign territory. Likewise, ships are not dependent on host nation access and have significant flexibility in terms of maneuvering into positions necessary to launch strikes.

Army MRC missiles have undoubted utility in Europe, and there may be value in posturing a small number of LRHW in Guam or other U.S. territories in the Pacific to strike extremely high-value, time-sensitive targets. This said, the challenges associated with host nation access should be addressed before DOD commits to buying Army long-range strike missiles for the Indo-Pacific.

**Deconflicting ground-based surface launches.** It is worth stressing that the time needed to deconflict airspace to ensure Army missile launches will not place friendly military or commercial air traffic in danger could delay its strikes against mobile/relocatable targets. Airspace deconfliction is part of the U.S. military's joint kill chain and its operational planning process. During Operation Desert Storm, it required over an hour to deconflict Army ATACMS launches into Iraq. Advances in communication networks and other capabilities decreased this to seven minutes during Operation Iraqi Freedom, but it could take longer to deconflict missile launches from more heavily developed countries such as Japan.<sup>21</sup> Integrating these ground-launched weapons as part of a joint integrated air attack plan would lessen this challenge as deconfliction is a fundamental element of such planning. However, the Army has not acceded to such integration of ATACMS in the past.<sup>22</sup>

### **Other Significant Issues**

**Redundant sensing capabilities.** To provide targeting for its medium-range and long-range fires the Army is developing new air and space sensor platforms, communications networks, and decision

support tools, some of which have been demonstrated through the service's Project Convergence.<sup>23</sup>

The Army's Terrestrial Layer System-Large (TLS-Large) is a vehicle-based electronic intelligence and electromagnetic warfare (EW) system that will support brigade-level units in conducting electromagnetic spectrum operations (EMSO) that combine EW with spectrum management and electromagnetic battle management (EMBM). TLS-Large will be essential to counter the Russian Armed Forces, which have capable EW systems and forces. The Army has two MQ-1 Grey Eagle UAVs that can carry TLS aerial systems, and it is developing helicopter-launched small UAVs for over-the-horizon surveillance and targeting.

To enable medium-range sensing and targeting in a theater like INDOPACOM, the Army is developing an aircraft-based sensing and targeting platform called Airborne Reconnaissance and Targeting Multi-mission Intelligence System (ARTEMIS).<sup>24</sup> ARTEMIS would be able to operate at higher altitudes—around 40,000 feet—enabling it to identify targets more than 400 km away. ARTEMIS will be duplicative to existing Navy and Air Force high-altitude, long-endurance (HALE) UAVs such as the MQ-4 Global Hawk and Triton. It will also be more vulnerable than these aircraft; MQ-4s can fly at higher altitudes, which allow them to standoff longer distances from air defense threats.

To provide targeting for long-range fires, the Army is also pursuing space-based sensing systems like the Gunsmoke-J satellite. Like ARTEMIS, small satellites such as Gunsmoke are duplicative to multiple existing space-based sensing systems as well as the growing array of commercial and military satellites in low earth orbit (LEO), including the Missile

Defense Agency's Hypersonic and Ballistic Tracking and Surveillance System (HBTSS), DARPA's Blackjack, and Hawkeye360's signals intelligence system.<sup>25</sup>

**Opportunity cost: Indo-Pacific air and missile defense?** The merits of the Army's plan to allocate significant funds toward the long-range strike mission should also be weighed against the opportunity costs of other forgone investments that might provide greater overall value to the joint combatant commands. Of particular note, U.S. military forces and installations throughout the Indo-Pacific remain nearly undefended against Chinese air and missile attacks—this is USINDOPACOM's top

unfunded priority.<sup>26</sup> It is also an Army core mission that the service has long neglected, a fact that has been recognized by the U.S. Congress.<sup>27</sup> As the 2019 National Defense Authorization Act put it, "In too many respects, the Army Missile Defense (AMD) forces fielded today fall considerably short of being an effective foundation for the kind of conflict envisioned by the National Defense Strategy."<sup>28</sup>

Massive air and missile attacks on U.S. and allied airbases in Japan, Guam, and elsewhere in the Indo-Pacific may now be the greatest threat to the joint force's ability to generate combat power. The Army has yet to demonstrate how the addition of its own long-range fires batteries serves to mitigate this risk more than prioritizing and sufficiently resourcing its air and missile defense mission. To that end, DOD should compare the net gain in the number of targets it would be able to strike by investing in Army long-range missiles that cost millions per shot with the potentially much greater increase in targets that could

be attacked by U.S. strike aircraft if their bases were defended against Chinese air and missile attacks. These defenses could include high energy lasers and high power microwave systems that have the potential to kill cruise missiles and armed drones for pennies per shot, and hyper-velocity projectiles that cost approximately \$65,000 to \$85,000 each that can be rapidly fired by Army howitzers at incoming airborne threats.<sup>29</sup> These and other maturing capabilities could be part of theater airbase defenses capable of countering an enemy's strikes at a cost that is advantageous to the United States.

Joint force operations depend on air and missile defense to conduct effective operations. Chinese missile attacks will also threaten the Army's long-range strike batteries. Even granting the unproven assumption that the Army's mobile launchers will be difficult for the Chinese to target, they will not be immune from attacks. The Army cannot claim that its future long-range missiles will be able to strike China's mobile targets, and that China will not be able to reciprocate. Moreover, the Army will need to store supporting logistics and missile reloads in depots that can be easily targeted. This means the Army's missile batteries and their theater infrastructure will need defenses as well.

## **Conclusion and Recommendations**

Reshaping the U.S. military to meet challenges in a renewed era of great power competition will require DOD to invest in capabilities that are fundamentally different from what it fielded for counter-terror and counterinsurgency operations over much of the past two decades. Doing so in an era of flat defense budgets means DOD should seek the best, most cost-effective solutions instead of allowing initiatives that create

**The Army cannot claim that its future long-range missiles will be able to strike China's mobile targets, and that China will not be able to reciprocate.**

excessive redundancy by seeking new roles. The latter now appears to be the case for the Army's long-range strike investments. Although "letting a thousand flowers bloom" might be an appropriate approach given unconstrained resources, allowing excessive redundancy in long-range strike systems would reduce, not increase, the U.S. military's ability to meet emerging threats. The following recommendations are intended to inform development of a diverse mix of long-range strike capabilities for America's warfighters in a cost-effective manner:

- **DOD should complete a cost-effectiveness assessment.** DOD's civilian leadership should direct a comprehensive study to determine the mix of capabilities that would maximize its future long-range strike capacity as a whole, instead of on a "stove-piped" service-by-service basis. This assessment should compare the cost effectiveness of air-to-surface and surface-to-surface—including shipborne—long-range strike alternatives, as well the best mix that will provide theater commanders with multiple options to strike peer adversaries without excessive redundancy.
- **Consider opportunity costs.** DOD should assess the opportunity costs of the Army's planned long-range strike investments. The assessment should determine if some of these resources could be better used to increase the Army's capacity to perform its core mission of defending U.S. forces and theater installations against Russian or Chinese missile salvos.
- **Do not assume-away host nation issues.** Where to forward posture the

Army's long-range strike batteries is also a warfighter issue, not a decision that should be left up to "the policymakers and the diplomats."<sup>30</sup> DOD should address Indo-Pacific host nation issues for Army long-range strike batteries and rules of engagement for their use in a crisis before committing to substantial investments to acquire them for the theater. The Army should continue to develop and procure mid-range weapons to deter and defend NATO allies against Russian aggression, given the greater opportunities that exist to posture Army batteries in at-risk allied countries such as Poland and the Baltic states.

- **Integrate Army and Marine Corps counter-maritime strike.** While they would be most useful in Europe, Army mid-range strike batteries might have some benefit in the Indo-Pacific if they are able to deploy and sustain their operations alongside Marine units for counter-maritime operations. The Army and Marine Corps should cooperatively develop operating concepts, tactics, techniques, and procedures that would integrate their littoral counter-maritime strikes in the Indo-Pacific along with Air Force and Navy capabilities.

The *2018 National Defense Strategy* rightfully shifted DOD's planning and resource priorities toward preparing for great power competition and conflict. These priorities include fielding new strike systems that will provide theater commanders with the precision, long ranges, and mass they will need to defeat peer aggression. A mix of surface-launched long-range missiles including shipborne capabilities, bombers, and next-generation penetrating fighters

equipped with long-range weapons will create multiple options with which to attack China and Russia and complicate their ability to counter U.S. attacks. However, expending resources on overly duplicative capabilities could decrease, not increase, the

long-range strike capacity available to theater commanders. DOD's overriding objective for long-range strike and its other investments should be to ensure integrated cost-effective joint force operations to optimize impact against peer adversaries.✪

## Endnotes

- 1 See Elbridge A. Colby, testimony before the Senate Armed Services Committee on ["Implementation of the National Defense Strategy,"](#) January 29, 2019, page 6.
- 2 Jason Sherman, ["Successful test firing last November clears way for USMC to advance development of Chinese ship-killing vehicle,"](#) *Inside Defense*, April 5, 2021.
- 3 The First Island Chain in the Western Pacific follows the Japanese island of Kyushu down the Ryukyus to the north of Taiwan, runs west toward Luzon, then south along Palawan to Singapore. The Second Island Chain includes the northern Marianas and the Volcano Islands, runs south to Guam, and then down to Palau and New Guinea.
- 4 John Grady, ["Army Keying in on Anti-Ship Hypersonic Weapons for 'All Domain' Pacific Fight,"](#) *USNI News*, August 3, 2020.
- 5 The Army has said its LRPF systems will ensure adversaries cannot "out-range and out-gun" their U.S. equivalents. Michael O'Hanlon and General James C. McConville, [How the Army is Adapting to Great Power Competition](#) (Washington, DC: The Brookings Institution, March 25, 2021), page 10. Although part of the Army's LRPF portfolio, the Extended Range Cannon Artillery, which will have a range requirement of 70 km, is not considered a long-range strike system for the purposes of this report. This report also does not address the Army's Strategic Long-Range Cannon since the Army is still assessing its technical feasibility.
- 6 Sydney J. Freedberg Jr., ["Can Army Triple PrSM Missile's Range?"](#) *Breaking Defense*, April 2, 2021.
- 7 The PrSM cost estimate is based on Army budget documents for Fiscal Year 2020. Department of Defense, ["Fiscal Year 2021 Budget Estimates, Army Justification Book of Missile Procurement,"](#) February 2020, pages 23–25.
- 8 Jason Sherman, ["Army taps Lockheed to integrate Tomahawk, SM-6 into prototype land-launch system,"](#) *Inside Defense*, November 9, 2020.
- 9 Matthew Beinart, ["Army Has Second Successful Test Of New Multi-Mode Seeker, Planning Max-Range PrSM Test Shot This Fall,"](#) *Defense Daily*, February 10, 2021.
- 10 See Sydney J. Freedberg Jr., ["DARPA's Hypersonic OpFires Aims For Army 1,000-Mile Missile,"](#) *Breaking Defense*, October 23, 2020.
- 11 Kelley M. Saylor, [Hypersonic Weapons: Background and Issues for Congress](#) (Washington, DC: Congressional Research Service, December 1, 2020), page 5.
- 12 Sydney J. Freedberg Jr., ["Hypersonics: Army Awards \\$699M To Build First Missiles For A Combat Unit,"](#) *Breaking Defense*, August 30, 2019.
- 13 From an online event with Army Chief of Staff General James C. McConville, Commanding General, U.S. Army Pacific General Paul J. LaCamera, and Mark F. Cancian, ["The Army in the Indo-Pacific: A Conversation with General James McConville and General Paul LaCamera,"](#) March 30, 2021.
- 14 David Larter, ["The US Army is preparing to fight in Europe, but can it even get there?"](#) *Defense News*, October 8, 2018.
- 15 Freedberg, ["Can Army Triple PrSM Missile's Range?"](#) The Army's interim SM-6 could augment Navy and Marine Corps anti-ship attacks. Army Tomahawk Block V cruise missiles would reach targets in China if postured in Japan or the Philippines.
- 16 Surface ships and attack submarine also have limited magazine capacity and cannot rearm at sea, which reduces the size and number of salvos they can launch.
- 17 SiAW will be carried internally by stealth aircraft for strikes against rapidly relocatable targets such as missile TELs and integrated air defense systems. Department of Defense, ["Fiscal Year 2021 Budget Estimates, Air Force Justification Book Research Development Test and Evaluation Vol II,"](#) February 2020, page 785.
- 18 Ethan Sterenfield, ["McConville: Stationing long-range fires in foreign countries a 'political decision,'"](#) *Inside Defense*, March 30, 2021.
- 19 Ethan Meick and Nargiza Salidjanova, [China's Response to U.S.-South Korean Missile Defense System Deployment and its Implications](#) (Washington, DC: U.S.-China Economic and Security Review Commission, July 26, 2017).
- 20 Sydney J. Freedberg Jr., ["\\$64K Question: Where In Pacific Do Army Missiles Go?,"](#) *Breaking Defense*, March 26, 2021.
- 21 "In Operation Desert Storm it took over an hour to process and clear the airspace for an ATACMS mission, but in OIF the average time was only seven minutes." Major Henry T. Rogers III, USAF, [Army Tactical Missile Systems and Fixed-Wing Aircraft](#)

- [Capabilities in the Joint Time Sensitive Targeting Process](#) (Fort Leavenworth, KS: Army Command and General Staff College, 2006), page 33.3
- 22 During Desert Storm the Army's ATACMS was requested by the combined force air component commander to help suppress Iraq's surface-to-air missile systems and reduce enemy threats to coalition aircrews. ATACMS were repeatedly denied for use to suppress enemy air defenses for the entirety of the 43-day air campaign. The Army rationale for not allowing them to be used as a part of an integrated concept of "multi-domain operations" was that ATACMS was an Army "corps asset," and they needed to be "saved" for when the Army moved into Kuwait.
- 23 Sydney Freedberg, "[Kill Chain In The Sky With Data: Army's Project Convergence](#)," *Breaking Defense*, September 14, 2020.
- 24 Mark Pomerleau, "[The Army is working to see across thousands of miles](#)," *C4ISRNet*, August 19, 2020.
- 25 Sandra Erwin, "[U.S. Army satellite to bring imagery directly to troops on the ground](#)," *Space News*, February 15, 2021.
- 26 Mark Montgomery and Bradley Bowman, "[Listen to America's Top Commander in the Indo-Pacific and Fund the Pacific Deterrence Initiative](#)," *War on the Rocks*, March 31, 2021.
- 27 For more information, see Alan J. Vick, Sean M. Zeigler, Julia Brackup, and John Speed Meyers, [Air Base Defense: Rethinking Army and Air Force Roles and Functions](#) (Santa Monica, CA: RAND Corporation, 2020).
- 28 United States Senate Committee on Armed Services, "[The John S. McCain National Defense Authorization Act for Fiscal Year 2019](#)," June 5, 2018, page 73.
- 29 For more on these novel air and missile defenses and concepts for their operations, see Carl Rehberg and Mark Gunzinger, [Air and Missile Defense at a Crossroads: New Concepts and Technologies to Defend America's Overseas Bases](#) (Washington, DC: Center for Strategic and Budgetary Assessments, 2018). Also see Theresa Hitchens, "[THOR: Air Force Tests Counter-Drone Microwave In Africa](#)," *Breaking Defense*, December 17, 2020; and Christen McCurdy, "[Air Force destroys surrogate cruise missile in hypervelocity projectile test](#)," *UPI*, September 15, 2020.
- 30 Sterenfield, "[McConville: Stationing long-range fires in foreign countries a 'political decision'](#)."

## About The Mitchell Institute

The Mitchell Institute educates about aerospace power's contribution to America's global interests, informs policy and budget deliberations, and cultivates the next generation of thought leaders to exploit the advantages of operating in air, space, and cyberspace.

## About Hudson Institute

Hudson Institute challenges conventional thinking and helps manage strategic transitions to the future through interdisciplinary studies in defense, international relations, economics, health care, technology, culture, and law. Hudson guides public policy makers and global leaders in government and business through a vigorous program of publications, conferences, policy briefings, and recommendations.

## About the Series

The Mitchell Institute Policy Papers present new thinking and policy proposals to respond to the emerging security and aerospace power challenges of the 21st century. These papers are written for lawmakers and their staffs, policy professionals, business and industry, academics, journalists, and the informed public. The series aims to provide in-depth policy insights and perspectives based on the experiences of the authors, along with studious supporting research. This Policy Paper was written in conjunction with Hudson Institute.

For media inquiries, email our publications team at [publications.mitchellaerospacepower@afa.org](mailto:publications.mitchellaerospacepower@afa.org)

Copies of Policy Papers can be downloaded under the publications tab on the Mitchell Institute website at <https://www.mitchellaerospacepower.org>

For more about Hudson Institute visit: <https://www.hudson.org>



## About the Authors

**Mark Gunzinger** serves as the Director of Future Concepts and Capability Assessments at the Mitchell Institute. Col (USAF Ret.) Gunzinger was a command pilot with more than 3,000 hours in the B-52. He served as both Director for Defense Transformation, Force Planning and Resources on the National Security Council staff developing strategic plans focused on offsetting emerging of anti-access and area-denial (A2/AD) challenges in the Western Pacific and as Deputy Assistant Secretary of Defense for Forces Transformation and Resources with oversight of DoD's conventional capabilities. Mr. Gunzinger's recent studies have focused on future directed energy capabilities, operational concepts and technologies needed to maintain the U.S. military's dominance in the electromagnetic spectrum, and capabilities to create new advantages in precision strike salvo competitions with China and Russia. He has led multiple U.S. and international wargames and workshops to assess future concepts and systems-of-systems for joint and combined military operations in contested environments

**Lukas Autenried** is a Senior Analyst at the Mitchell Institute for Aerospace Studies. Mr. Autenried was previously an Analyst at CSBA, where his work focused on the development of new operational concepts, force planning, operations research, and defense budgeting and resourcing. Previously, he was a Research Assistant for the Finance and Private Sector Development team at the World Bank. Mr. Autenried holds a Bachelor of Arts in Government and History from Georgetown University and a Master of Arts in Strategic Studies and International Economics from the Johns Hopkins University School of Advanced International Studies.

**Bryan Clark** is a senior fellow and director of the Center for Defense Concepts and Technology at Hudson Institute. He is an expert in naval operations, electronic warfare, autonomous systems, military competitions, and wargaming. From 2013 to 2019, Mr. Clark was a senior fellow at the Center for Strategic and Budgetary Assessments (CSBA). Prior to joining CSBA in 2013, Mr. Clark was special assistant to the Chief of Naval Operations and director of his Commander's Action Group, where he led development of Navy strategy and implemented new initiatives in electromagnetic spectrum operations, undersea warfare, expeditionary operations, and personnel and readiness management. Mr. Clark also served in the Navy headquarters staff leading studies in the Assessment Division and participating in multiple Quadrennial Defense Reviews. Prior to retiring from the Navy in 2008, Mr. Clark was an enlisted and officer submariner.