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Time for a New Missile Defense Review and a Space-Based Missile Defense Overlayer

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KEY TAKEAWAYS

The United States' current missile defense architecture is inadequate to respond to the threats posed by North Korea, Russia, and China.

The United States must conduct a new Missile Defense Review that includes a space-based overlayer capable of intercepting missile threats from multiple adversaries.

An integrated, multilayered missile defense architecture is possible today due to private-sector innovations that did not exist 40 years ago.

Since the 1950s, the United States has pursued missile defenses designed to reduce the threat from nuclear attacks. From the rudimentary nuclear-armed surface-to-air missiles of Project Nike to the Sentinel anti-ballistic missile program of the 1960s, the United States sought, not always successfully, to develop and field systems that could interdict adversary weapons launched at the American homeland.[1]

In 1972, the United States and the Soviet Union signed the Anti-Ballistic Missile (ABM) Treaty, which allowed each party to field only a limited number of interceptors around a single site.[2] For three decades, the United States explored various missile defense concepts, including space-based and ground-based systems, but missile defenses never matured due in large part to the ABM Treaty.[3]

In the period when the ABM Treaty was in force, many believed that missile defenses were inherently destabilizing, as states (so the theory went) may be tempted to carry out a nuclear first strike on the other if they believed they were completely protected by an impenetrable missile defense shield. According to such a theoretical, the United States and the Soviet Union refraining from building ballistic missile defenses contributed to strategic stability by ensuring that both sides would be unprotected from a nuclear attack.[4] Such was the logic of the Cold War.

In 2002, the United States withdrew from the ABM Treaty, citing the threats posed by rogue states, particularly North Korea, which many feared would not be inhibited by the mutual vulnerability afforded by a lack of a missile defense architecture.[5] The treaty withdrawal removed any limits to U.S. fielding of missile defenses. When withdrawing from the treaty, the United States explicitly noted that future missile defenses would purposefully not be designed to counter the threats posed by Russian or Chinese ballistic missiles, which were already fast enough to penetrate U.S. ballistic missile defenses.

In 2004, the U.S. initially deployed only a few ground-based interceptors (GBIs), ultimately growing to 44 GBIs stationed in Alaska and California. These interceptors are capable of shooting down modest numbers of relatively primitive ballistic missiles, such as those developed by North Korea. Other missile defenses, including shorter-range Patriot batteries, Aegis missile destroyers and cruisers, and Terminal High Altitude Area Defense (THAAD), were developed over the coming years, each providing additional, layered support against missile defenses across smaller areas.[6]

During the 2000s, various Nuclear Posture Reviews and Missile Defense Reviews (MDRs) posited that the 21st century would be a time of cooperation among the United States, Russia, and China, where the three countries would work together to counter terrorist threats and mutually shrink their nuclear stockpiles.[7] In this sense, the ABM system was optimized to threats posed by rogue nations.

The relatively benign security environment of the 2000s, however, is gone.

The World Today

For the past 20 years, North Korea and Iran have slowly but steadily expanded their missile capabilities and nuclear programs.[8] Today, the United States government estimates that North Korea has between 80 and 200 nuclear weapons.[9] North Korea's missile force continues to modernize and diversify, such that it can now likely strike targets across North America.

Iran, according to the Defense Department's 2023 "Strategy for Countering Weapons of Mass Destruction," can now produce enough fissile material to build a nuclear weapon within a two week stretch of time. Meanwhile, it too has expanded its missile program, being able to target much of Europe, the Middle East, and Central Asia.[10]

At the same time, China and Russia have become increasingly emboldened and aggressive, effectively negating the assumptions on which missile defense systems were designed two decades ago. From Russia's invasion of Ukraine to its nuclear coercion of its neighbors to its abandonment of nuclear arms control, there is little evidence that Moscow seeks to engage in any kind of mutual relationship-building with the West. Indeed, Russia shows no evidence of shedding its nuclear arsenal, which is 2,000 weapons larger than the American stockpile.[11]

Similarly, China under Xi Jinping has, instead of becoming a "responsible stakeholder" in the U.S.-led international order, become the bully of East Asia. In addition to threatening its neighbors—including repeated statements to unify with Taiwan by force, increasingly brazen and irresponsible behavior in the South China Sea, and an unprecedented military buildup—China has the fastest-growing nuclear arsenal in the world. According to the Defense Department's "China Military Power" report released earlier this year, China has doubled the size of its nuclear arsenal over the past three years and is on track to reach numerical parity with the United States sometimes in the early 2030s.[12]

Despite the degrading security environment, the MDRs for the past 15 years have by and large portrayed the missile threats as static, apart from the need for the Missile Defense Agency (MDA) to develop defenses against certain hypersonic missiles. More fundamentally, however, the various MDRs continue to focus on the threats posed by rogue states, such as Iran and North Korea.[13] Indeed, a close reading of the MDRs make it clear that missile defenses are not designed to counter threats by Russia and China, as such missile defenses are still seen in many quarters as destabilizing.

Given, however, how Russia and China actively seek to destabilize the world order, invade their neighbors, and engage in both nuclear expansion and coercion, it is high time to move past this concern that missile defenses in and of themselves are the primary or even a meaningful driver of strategic instability vis-a-vis Russia and China.

As such, the United States must change how it approaches missile defenses. The next MDR should examine the evolving security environment and identify the requirements for a suitable missile defense architecture for the next 30 years to 40 years. Such an architecture should consider not only the growing missile threats from North Korea and Iran, but it must

be designed and produced to deter—and if necessary, defeat—at least a significant salvo of intercontinental ballistic missiles (ICBMs) fired at North America from China and Russia.[14]

Understanding Emerging Adversary Escalatory Pathways

While unlikely, it is possible that in a conflict with the United States, either China or Russia may employ a limited number of theater-range nuclear weapons to stave off defeat or to achieve operational advantage that will enable battlefield victory. Such a limited theater nuclear war has never been fought—and even during the Cold War little thought was given to how to end such a conflict. It is very possible that China or Russia, finding themselves in a limited theater nuclear war that neither side knows how to end, but fearing a limited attack on their homelands using strategic weapons, could launch a limited number of nuclear weapons at critical sites in the American homeland.

Such a limited launch at key nodes that may have a significant impact on the United States' ability to prosecute a conflict (such as critical infrastructure sites or key ports of embarkation) could, in China's and Russia's calculations, communicate to American policymakers that they have more stake in the conflict than the United States, and that a strategic nuclear war between the two powers is imminent. In that logic, a limited nuclear strike on the American homeland—particularly if it did not cause significant civilian casualties—could, in the adversary's mind, end a conflict without precipitating a general nuclear exchange.[15]

Put another way, Beijing or Moscow may believe that a low-escalation strike of a handful of nuclear weapons delivered against the American homeland may be a pathway to victory. Building missile defenses that can intercept up to a hundred Russian or Chinese ICBMs would deny them that pathway—and may force them to choose between "going big or not going at all."

The logic is this—if the United States can intercept up to a hundred adversary ICBMs, China or Russia may be forced to fire 110 to 130 ICBMs at the United States to achieve the same effect as six to 12 nuclear ICBMs absent an advanced missile defense architecture. A Putin or a Xi who may be willing to risk firing six to 12 ICBMs might blanche at the prospect of firing more than hundred weapons at the United States. They would correctly believe that such a large salvo would almost assuredly trigger the kind of overwhelming nuclear response from the U.S. that they are otherwise trying to deter—for little to no benefit.

In that sense, a modernized, advanced missile defense architecture that can intercept a significant but still finite amount of the Chinese and Russian ICBM force could be a highly stabilizing capability for America.

The Case for an Integrated, Layered Missile Defense Architecture

An integrated, layered global missile defense requires integrated battle management and command-and-control architecture—all of which the MDA is pursuing—but more importantly, such a missile defense requires more capabilities to be deployed across three layers: (1) a space-based overlayer, (2) an enhanced current GBI layer, and (3) an underlayer for protecting critical sites.

1. A Space-based Overlayer. The "overlayer" is a proposed capability that would put around 1,000 networked microsatellites in orbit that would serve as both sensors and communication relays, as well as platforms for launching interceptors.

Such microsatellites' networked sensors would automatically share launch and targeting data with each other and with ground-based command-and-control networks. They would carry small kinetic, non-explosive kill vehicles that can engage targets across multiple stages of flight, including the boost phase and during their midcourse or coasting phase.

The technology to share launch and targeting data among the sensors exists today. Similar to how Uber uses networked artificial intelligence (AI) to identify which vehicles are closest to a customer's location, networked satellites can identify a threat and identify which interceptors are best positioned to engage and destroy an enemy's launched missile.

A constellation of 1,000 satellites in orbit can engage enemy missiles far sooner than a ground-based system, particularly those that are located thousands of miles away in North America. And because they are closer to the target in mass, they can get not only multiple shots at enemy missiles during their trajectory, but the satellites can engage some targets while the targets are still in their ascent phase—thereby increasing the chances that interceptors may destroy inbound targets.

In addition, an orbital sensor and engagement capability addresses many of the challenges posed by terrestrial-based engagement, particularly its ability to surveil huge portions of the Earth's surface from orbit. This expanded sensor coverage, coupled with redundant interceptors, increases the likelihood of a successful interception before the missile strikes its intended target.

Critics may argue that an overlayer would be prohibitively expensive. SpaceX's StarLink has more than 4,000 microsatellites in orbit—for a cost of around $11 billion.[16] While an overlayer would indeed be costly, it would almost certainly be far cheaper than the almost $18 billion that the Defense

Department has allocated to develop and field 21 NGIs.[17] And a space-based overlayer may only cost a few tens of billions of dollars over the lifetime of the system.[18]

Given the revolution in AI and how SpaceX has shown that it can put kilograms in space in a way that is not cost prohibitive, the overlayer may be more cost-efficient than is currently projected. Indeed, SpaceX now advertises that it can put microsatellites in orbit for as little as $1 million.[19] This can be done in relatively short order, if the Office of the Secretary of Defense gives the proper guidance to the MDA.

2. Expansion of the Current GBI Layer. The current missile defense layer comprises 44 ground GBIs at sites in Alaska and California. They are optimized for targets coming from North Korea and were built when North Korea had a very modest ability to target North America with missiles. Later this decade, the next-generation interceptors (NGIs) will augment the existing GBIs on the West Coast.

The fielding of NGIs is a necessary step, but one that is inadequate for the current threat. A modest expansion of missile interceptors is necessary to contain not only the expanding North Korean and Iranian missile threats, but also threats posed by Russia and China. To that end, the United States should look to expand the number of NGIs it purchases from 44 to roughly 100 and look to station a significant portion of the new interceptors on a new missile defense site on the East Coast to better target incoming adversary missiles from Eurasia.

3. An Effective Underlayer for Protecting Critical Sites. As noted in a recent study, current off-the-shelf missile defenses, such as Patriot PAC-3s, Aegis Afloat, and THAAD systems, can provide robust missile defenses around a limited number of key locations.[20] By putting such systems near key bases, ports of embarkation, and command-and-control nodes, defenses can get additional shots at enemy missiles targeting critical, high-value nodes.

Benefits of an Integrated Missile Defense Architecture. A key benefit of an integrated, multilayered missile defense system is that the layers become mutually reinforcing. An integrated command-and-control system can more effectively coordinate the tracking and interception of enemy missile launches—and by integrating shots from the various layers, missile defenses can get more shots at incoming missiles, thereby increasing the likelihood of a successful interception. Put another way, if the overlayer misses the interception, GBIs have the opportunity to engage the incoming target. If the GBIs miss, the underlayer can have some utility in potentially intercepting inbound missiles or warheads at a limited number of critical sites. (See Figure 1.)

FIGURE 1

A Layered Missile Defense System

To more effectively defend the U.S. against missile attacks, key sites should be protected with an integrated defense system that consists of multiple layers of protection. If one layer is unable to neutralize a threat, another layer can be deployed. Here is how such a system might look.

1 OVERLAYER:
Networked Satellites

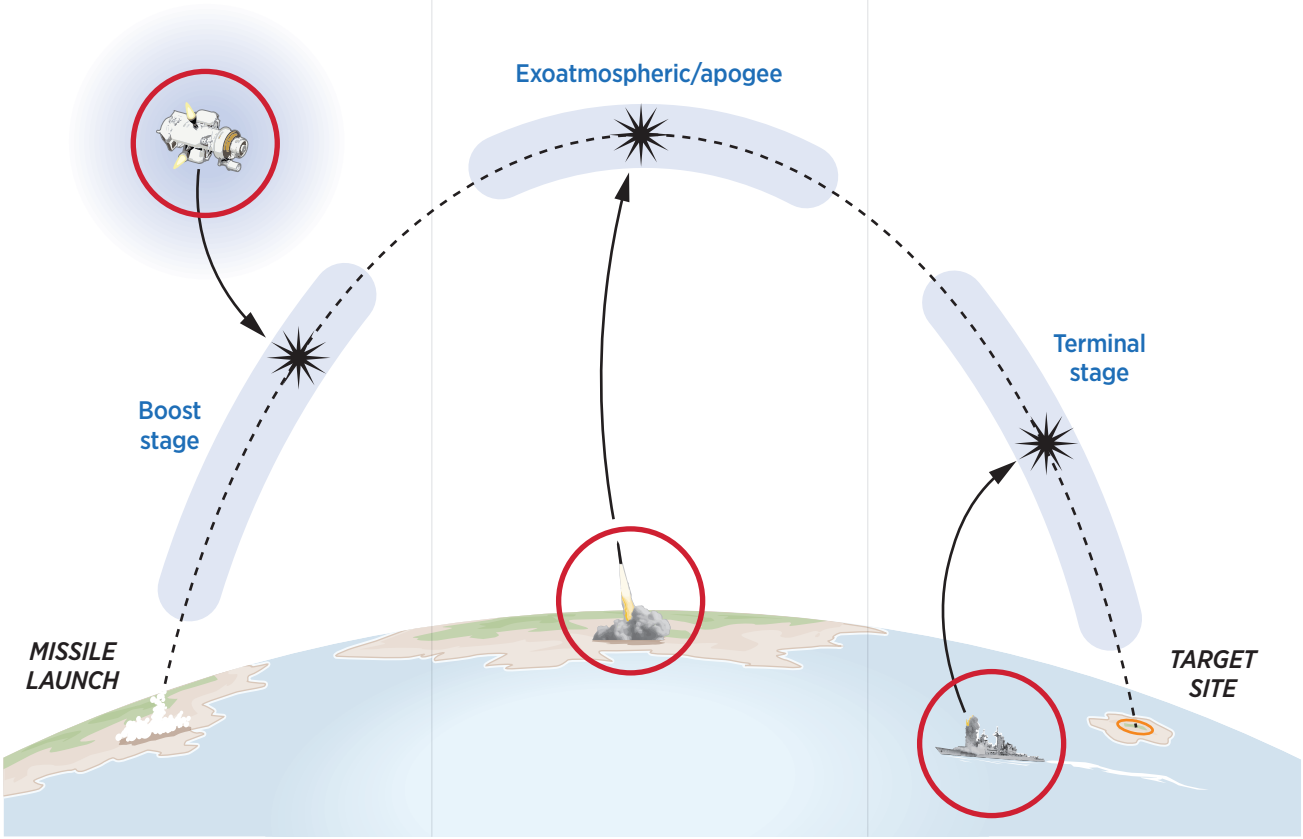
A network of 1,000 satellites would share launch and targeting data with each other and the command center. Satellites would engage targets with kinetic, non-explosive kill vehicles while the missile is still in boost phase.

2 CURRENT LAYER:
Ground-Based Interceptors

Missiles that exit the atmosphere, or are near apogee, would be targeted by the current arsenal of ground-based interceptors and next-generation interceptors stationed in Alaska and on the East and West Coasts of the U.S.

3 UNDERLAYER:
Short-Range Missile Defenses

Incoming missiles at their terminal phase would be targeted by existing systems, such as Patriot PAC-3, Aegis Afloat, and THAAD. These systems would be positioned near key locations, such as bases, ports, and command centers.



SOURCE: Authors' analysis.

In this way, an integrated architecture that employs different interceptor capabilities can serve as a mutually reinforcing system that is more effective against a greater number and types of missile threats by presenting multiple opportunities to destroy inbound targets at different stages of attack, from boost phase, to apogee, to the terminal phase.

The Deteriorating Security Environment Requires Multilayered, Integrated Missile Defenses

Critics have and will argue that missile defenses are destabilizing—but, in fact, this is far from the case.[21] Russia's 2,000 nonstrategic nuclear weapons and its threatening its neighbors with a nuclear first strike is destabilizing. China's breathtaking expansion of nuclear weapons is destabilizing. North Korea's slow but steady advancement of both its nuclear arsenal and its ICBM force is destabilizing. The Islamic Republic of Iran being weeks away from having weapons grade nuclear material is anything but stabilizing.

An American integrated, multi-layered missile defense capability that includes an orbital overlayer is stabilizing by denying the enemy the benefits of an ever-increasing reliance on missiles. As such, the United States should:

1. **Conduct a new Missile Defense Review** that examines the cost, operational control, timelines, and feasibility of developing and fielding an integrated, multilayered missile defense architecture. That new MDR should also explicitly abandon the long-standing U.S. policy of not aiming missile defenses toward Russia and China. The new MDR should put heavy emphasis on the utility of an integrated architecture against hypersonic missiles.

2. **Field an underlayer at Guam within 24 months** with existing capabilities as a proof of concept for a broader underlayer approach.

3. **Conduct a feasibility and cost study for an overlayer.** Such a study would identify the costs and requirements for a linked microsatellite constellation, leveraging a maximal amount of commercial off-the-shelf technologies.

Conclusion

The Ukraine war and the crisis in Israel have shown how missile defenses can be incredibly effective. And an integrated missile defense architecture

that incorporates an overlayer is the only way to stay ahead of the ever-growing North Korean and Iranian missile threat while still allowing the U.S. the opportunity to close off the low-escalation pathway to Russia and China.

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