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Defense Primer: U.S. Ballistic Missile Defense

Ballistic missiles fielded by China, Iran, North Korea, and Russia could threaten the U.S. homeland, U.S. forces abroad, and U.S. allies and partners. These missiles constitute one subset of the diverse array of aerial threats facing the United States, including crewed aircraft, uncrewed aircraft systems (UAS), and cruise missiles. Since the late 1940s, the U.S. government has invested in developing ballistic missile defense (BMD) capabilities to counter ballistic missile threats.

Since the start of an enhanced BMD effort under the Reagan Administration, Congress has identified BMD as a national security interest. Congress passed the Ballistic Missile Defense Act of 1995 (P.L. 104-106), which declared U.S. commitment to developing theater and national missile defense systems. In 2017, Congress directed the Secretary of Defense to establish a unified major force program for "missile defense and defeat," to prioritize these and related activities in the Department of Defense (DOD) budget. The House Armed Services Subcommittee on Strategic Forces holds annual hearings on missile defense and defeat, and the Senate Armed Services Subcommittee on Strategic Forces has held similar hearings. In the fiscal year 2025 National Defense Authorization Act (FY2025 NDAA; P.L. 118-159), Congress directed that DOD build a third ballistic missile interceptor site on the U.S. East Coast and began requiring an annual briefing on the missile defense of Guam.

U.S. BMD capabilities are not designed to counter the full range of ballistic missile threats. They are designed to deter and defend against (1) ballistic missile attacks on U.S. forces abroad, as well as allies and partners, and (2) attacks against the homeland from rogue states, like North Korea and Iran. U.S. BMD is neither intended for or capable of defending the homeland against the ballistic missiles of peer competitors Russia and China; instead, the United States relies on its nuclear forces to deter these threats. If deterrence fails, U.S. strategy describes missile defense as a tool for "damage limitation."

Ballistic Missile Threats

Ballistic missiles vary in launch platform, range, and payload. Short-range ballistic missiles (SRBMs) strike targets from 300 to 1,000 km away. Medium-range ballistic missiles (MRBMs) strike targets from 1,000 to 5,500 km away. The longest-range ballistic missiles, intercontinental ballistic missiles (ICBMs), strike targets greater than 5,500 km away. Shorter-range missiles are generally considered tactical capabilities for regional conflicts, while ICBMs are considered strategic deterrent forces, or forces meant to deter a strategic attack.

The ballistic missile threat is evolving and growing. One Army official testified in May 2024 that increasingly, "Competitors' ballistic missiles are more mobile, survivable, reliable, and accurate with longer ranges." To complicate targeting and evade missile defenses, U.S. competitors have developed missiles with multiple warheads (known as MIRVs or multiple independently targetable reentry vehicles), maneuverable warheads, decoys, and jammers. Additionally, recent conflicts show how large, diverse missile and UAS salvos can be used to overwhelm missile defenses and exhaust interceptor stores.

BMD in U.S. Strategy

The Biden Administration published a Missile Defense Review (MDR) as a subordinate document to its congressionally-mandated National Defense Strategy in 2022. The Trump Administration also published an MDR in 2019. These two most recent MDRs describe the missile threat environment as well as U.S. missile defense capabilities, strategy, and cooperation with allies and partners. The two MDRs are not identical, but both emphasize the necessity of BMD system integration, resilient sensor networks, and affordability, as well as the unequivocal inclusion of Guam in the definition of the U.S. homeland.

In its assessment of the ballistic missile threat, the 2022 MDR distinguishes between U.S. homeland and regional threats, and focuses on four nations—China, Iran, North Korea, and Russia. Of these, China, North Korea, and Russia have nuclear ICBM capabilities that could reach the U.S. homeland. All four countries have SRBMs and MRBMs that allow them to threaten various regions where U.S. forces, allies, and partners are located.

The 2022 MDR describes missile defense as part of a holistic deterrence strategy, complementary to U.S. nuclear capabilities. The authors write that "U.S. nuclear weapons present a credible threat of... cost imposition, while missile defenses contribute to deterrence by denial." They explain that missile defense deters by "introducing doubt and uncertainty into [adversary] strike planning and execution, reducing the incentive to conduct small-scale coercive attacks, decreasing the probability of attack success, and raising the threshold for conflict." Additionally, missile defenses "reassure allies and partners that the United States will not be deterred from fulfilling its global security commitments," "offer military options," "and may be less escalatory than employing offensive systems."

Major Elements of the U.S. BMD System

The United States has deployed a global array of networked ground-, sea-, and space-based sensors for target detection and tracking, a number of ground- and sea-based interceptors, and a global network of command, control, and battle management capabilities to link sensors to interceptors. The hit-to-kill (also called kinetic energy or

direct impact) systems that dominate modern U.S. BMD capabilities are designed intercept a missile at a particular stage in its flight – the initial boost phase, the post-boost phase, the midcourse phase, or the terminal phase.

The Missile Defense Agency (MDA), in the Office of the Secretary of Defense, is responsible for developing the U.S. Ballistic Missile Defense System (BMDS). BMDS seeks to integrate all U.S. BMD capabilities into "an evolving, integrated, and interoperable system ... that provides a capability to intercept ballistic missiles in all phases of their flight... against all ranges of threats." MDA and the armed services share responsibility for procurement and sustainment of BMD systems, while servicemembers operate them at home and abroad.

Ground-Based Midcourse Defense (GMD)

The Ground-based Midcourse Defense system (GMD) is the United States' sole hit-to-kill defense against ICBMs. It is designed to deter or defend against a limited attack in the mid-course phase from North Korea or Iran. The 2022 MDR states that "GMD is neither intended for, nor capable of, defeating the large and sophisticated ICBM, air, or sea-launched ballistic missile threats from Russia and [China]." Since 2004, the United States has deployed a force that currently comprises 44 Ground-based Interceptors (GBI) at Fort Greely, AK, and Vandenberg Air Force Base, CA. Congress has directed that MDA build a third interceptor site on the U.S. East Coast by 2030.

GMD has a mixed flight test record. Next Generation Interceptors (NGI) may augment and possibly replace GBIs. MDA may receive the first NGI delivery as soon as 2027.

Terminal High Altitude Area Defense (THAAD)

The Terminal High-Altitude Area Defense System (THAAD) is a highly mobile, rapidly deployable system designed to shoot down SRBMs and MRBMs during their terminal phase of flight. It is designed to provide broad area coverage against threats to population centers and industrial resources as well as military forces. In 2022, the United Arab Emirates used THAAD to intercept ballistic missiles from the Houthi militant group, marking THAAD's first operational use in a combat environment.

The U.S. Army has seven THAAD batteries and is scheduled to receive an eighth in 2025. Four of these are deployed in Guam, South Korea, the Persian Gulf, and—as of October 2024—Israel. THAAD radars are exceptionally powerful and are deployed in Turkey, Israel, and Japan.

Aegis BMD

The Aegis BMD is operated from Navy Aegis cruisers and destroyers, and defends against short- to intermediate-range ballistic missile attacks in the midcourse phase of flight, using SM-3 and SM-6 interceptors. SM-3s saw their first use in combat in April 2024 against an Iranian attack on Israel.

The land-based variant of Aegis BMD, Aegis Ashore, uses the SM-3 interceptor. MDA has been developing another land-based Aegis-derived system for the defense of Guam. In December 2024, MDA announced the first successful ballistic missile intercept test from this system.

Patriot Advanced Capability-3 (PAC-3)

The Army Patriot system is a mobile, transportable system designed to defend areas such as military bases and air fields from advanced aircraft, cruise missiles, and tactical ballistic missiles. Patriot works with THAAD to provide an integrated and overlapping defense against attacking missiles in the terminal phase.

The Patriot system is the most mature element of the BMDS. It was used in combat in the 1991 and 2003 Iraq wars and is fielded around the world by the United States and others. Since February 2022, the United States has provided Ukraine three Patriot batteries and munitions to support Ukraine's efforts to repel the Russian invasion.

Cooperation with Allies and Partners

The United States has missile defense cooperative programs with allies and contributes to NATO's efforts to develop an integrated BMD capability through the European Phased Adaptive Approach (EPAA). This effort includes the deployment of a THAAD radar in Turkey, Aegis BMD ships in the Mediterranean Sea, and Aegis Ashore in Romania and Poland.

The 2010 Ballistic Missile Defense Review explored challenges and benefits of applying the phased adaptive approach to East Asia and the Middle East. Many BMD elements of a potential cooperative system are in place in these regions. In November 2024, the United States, Japan, and South Korea announced the establishment of a Trilateral Secretariat, condemned North Korean ballistic missile programs, and committed to strengthening ballistic missile defense capabilities. Congress has requested additional information on this trilateral partnership.

The United States has invested significantly in Israel's missile defense capabilities, including Iron Dome, David's Sling, and Arrow. MDA requested $500 million for FY2025 to support cooperative missile defense with Israel, consistent with a Memorandum of Understanding between the United States and Israel that spans FY2019 to FY2028.

Potential Oversight Questions for Congress

- Are the current capabilities, stockpiles, and rates of interceptor and launch platform procurement sufficient to meet the evolving ballistic missile threat?
- Are current efforts sufficient to achieve the resilient sensor network and associated data transport systems needed for an integrated and effective BMDS?
- What steps, if any, can the United States take to support or better leverage BMD alliances and partnerships? What steps, if any, might U.S. officials consider to streamline information and data sharing?
- What steps, if any, are needed to strengthen mutual transparency and predictability with potential adversaries regarding defensive systems to reduce the risk of conflict?

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