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Defense Primer: Ballistic Missile Defense

The United States has been developing and deploying ballistic missile defenses (BMD) to defend against enemy missiles continuously since the late 1940s. In the late 1960s and early 1970s, the United States deployed a limited nuclear-tipped BMD system to protect a portion of its U.S. land-based nuclear ICBM (intercontinental ballistic missile) force in order to preserve a strategic deterrent against a Soviet nuclear attack on the Homeland. That system became active in 1975 but shut down in 1976 because of concerns over cost and effectiveness. In the FY1975 budget, the Army began funding research into hit-to-kill or kinetic energy interceptors as an alternative—the type of interceptor technology that dominates U.S. BMD systems today.

In 1983, President Reagan announced an enhanced effort for BMD. Since the start of the Reagan initiative in 1985, BMD has been a key national security interest in Congress, which has appropriated well over \$200 billion for a broad range of BMD research and development programs and deployment of BMD systems here and abroad.

The Missile Defense Agency (MDA) is charged with the mission to develop, test, and field an integrated, layered, BMD system (BMDS) to defend the United States, U.S. deployed forces, and U.S. allies and partners against ballistic missiles of all ranges and in all phases of flight. The FY2023 budget request is \$24.7 billion for missile defense, \$9.6 billion of which is for MDA.

Ballistic Missile Threats

After an initial powered phase of flight, a ballistic missile leaves the atmosphere and follows an unpowered trajectory or flight path before reentering the atmosphere toward a predetermined target. Ballistic missiles have an effective range from a few hundred kilometers (km) to more than 10,000 km. Short-range ballistic missiles (SRBMs) range from 300-1,000 km and are generally considered for tactical military use. Medium-range ballistic missiles (MRBMs) have a range from 1,000-5,500 km, although most are armed with conventional warheads and range less than 3,500 km. ICBMs range further than 5,500 km and are generally considered as strategic deterrent forces.

Most of the world's ballistic missiles belong to the United States and its allies and partners; however, China and, in particular, Russia also have significant numbers of ICBMs. Russia continues to possess intermediate-range ballistic and cruise missiles (3,500-5,500 km), which led to the U.S. withdrawal from the 1987 Intermediate Nuclear Forces (INF) Treaty. The 2022 Missile Defense Review additionally identifies ballistic missile threats from North Korea and Iran.

North Korea likely has an arsenal of hundreds of SRBMs that can reach all of South Korea and perhaps dozens of MRBMs (whose reliability at this point remains uncertain), capable of reaching Japan and U.S. bases in the region. North Korea has flight-tested two types of road-mobile ICBMs that have the range to strike the U.S. homeland. The Defense Intelligence Agency (DIA) has assessed that “North Korea’s continued development of ICBMs, IRBMs, and [submarine-launched ballistic missiles] demonstrates its intention to bolster its nuclear delivery capability.”

The intelligence community assesses that Iran has the largest inventory of ballistic missiles in the Middle East. Those missiles are armed with conventional warheads; Iran does not have a nuclear weapons capability. Most of Iran’s ballistic missile force consists of SRBMs with ranges less than 500 km, which it views as a tactical warfighting force. Iran also has a growing and significant number of MRBMs capable of striking targets throughout the region, which it views as a deterrent force. Iran does not appear to have a dedicated ICBM program.

Almost all of China’s SRBMs are deployed at bases opposite Taiwan. China’s MRBMs can reach U.S. bases, as well as U.S. allies and partners in the region. China’s missile forces could also target U.S. naval ships in Northeast Asia. Additionally, China is working on a range of technologies to attempt to counter U.S. and other countries’ BMD systems. China’s ICBM and some nuclear-armed MRBM forces are intended for strategic and regional deterrence.

The Major Elements of the U.S. BMDS

The United States has deployed a global array of networked ground, sea, and space-based sensors for target detection and tracking, an extensive number of ground- and sea-based hit-to-kill (direct impact) and blast fragmentation warhead interceptors, and a global network of command, control, and battle management capabilities to link those sensors with those interceptors.

Ground-Based Midcourse Defense (GMD)

Since 2004, the United States has deployed a force of 44 (expanding now to 64) Ground-based Interceptors (GBI) at Fort Greely, AK, and Vandenberg Air Force Base, CA. The GMD system is designed to destroy a limited attack in space from ICBMs aimed at the United States, to include from North Korea and Iran. Although the GMD system has been praised by senior military leaders, it does have a somewhat mixed flight test record, having failed 8 out of 18 intercept attempts between 1999 and 2018.

Terminal High Altitude Area Defense (THAAD)

THAAD is a highly mobile, rapidly deployable BMD system designed to shoot down incoming short- and

medium-range missiles during their final or 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.

THAAD was initially proposed in 1987 and its first flight test occurred in April 1995. It had a very poor test record—failing its first six flight tests—until the first successful intercept in 1999, following the program’s restructuring. In recent years, THAAD’s test record has demonstrated high effectiveness and reliability, succeeding in 15 out of 15 intercept attempts between 1999 and 2018. Many now consider it the most advanced BMD system in the world. The United States has delivered seven THAAD batteries to the U.S. Army. U.S. THAAD batteries are now deployed in Guam, South Korea, and the Persian Gulf. THAAD radars are exceptionally powerful and are currently deployed in Turkey, Israel, and Japan. Any future THAAD batteries produced will be for Foreign Military Sales.

Aegis BMD

The Aegis BMD program gives Navy Aegis cruisers and destroyers a capability for providing regional defense against short- and medium-range ballistic missile attacks. Under the FY2023 budget submission, the number of BMD-capable Navy Aegis ships is projected to increase from 44 to 50 at the end of FY2023. Aegis BMD ships and Aegis Ashore (land-based) capabilities in Romania (and Poland by 2023) contribute to NATO’s territorial defense mission. Aegis BMD succeeded in 40 out of 49 intercept attempts between 1999 and 2018.

Patriot Advanced Capability-3 (PAC-3)

The Army 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 many others that have purchased the system. Patriot 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 their final phase of flight.

Foreign BMD Participation

The United States has missile defense cooperative programs with multiple allies. MDA actively participates in NATO activities to develop an integrated NATO BMD capability. Patriot systems have been purchased by allies, acquisition of THAAD is in various stages of contract negotiation and acquisition, and countries such as Japan have acquired Aegis BMD capabilities. The Kingdom of Saudi Arabia is on contract to receive seven THAAD batteries.

European Phased Adaptive Approach (EPAA)

At the 2010 Lisbon Summit, NATO agreed to develop a missile defense capability to protect European NATO populations, territory, and forces against the threats posed by the proliferation of ballistic missiles. The U.S. contribution to that NATO effort is the EPAA, which includes the deployment of a THAAD radar in Turkey, Aegis BMD ships in Europe, and Aegis Ashore in Romania and Poland.

Other Regional BMD Cooperative Efforts

Similar to the EPAA, the United States has sought since 2010 to formalize a regional cooperative BMD capability both in Northeast Asia (with Japan, Korea, and Australia) and in the Persian Gulf. Although many of the BMD elements of a potential cooperative system are in place in these regions, wariness between likely foreign partners and opposition from countries such as China have prevented a formal agreement and participation from going forward.

Cooperation with Israel

Since 1986, the United States has invested significantly in Israel’s missile defense programs and systems designed to protect against missile and rocket attacks. The United States also provided a THAAD radar to Israel in 2008. Between FY2006 and FY2021, the United States provided about \$7.6 billion for Israeli BMD programs, which include the Arrow systems designed to counter short- and medium-range ballistic missiles, Iron Dome (to counter short-range rockets), and David’s Sling (designed to counter longer-range rockets).

Legislative Issues

BMD has broad support across the political spectrum and within the military as evidenced by the high degree of funding support for the program regardless of which party controls the White House and Congress, especially since the early 2000s.

Where Congress has cut programs tends to fall in three areas: where program delays allow for opportunistic program cuts, cuts for long-lead procurement of components with still questionable test results, and newer programs not likely to come to fruition in the short or medium term. Congress has also thus far been unwilling to fund programs that might lead to emplacing interceptor capabilities in space.

CRS Products

CRS In Focus IF10472, *North Korea’s Nuclear Weapons and Missile Programs*, by Mary Beth D. Nikitin and Samuel D. Ryder.

CRS Report R42849, *Iran’s Ballistic Missile and Space Launch Programs*, by Steven A. Hildreth.

CRS Report RL33745, *Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress*, by Ronald O’Rourke.

Other Resources

Defense Department. *2022 Missile Defense Review*. October 2022.

This In Focus was initially authored by Stephen M. McCall, former Analyst in Military Space, Missile Defense, and Defense Innovation.

Kelley M. Sayler, Coordinator, Analyst in Advanced Technology and Global Security

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