COUNCIL on FOREIGN RELATIONS

Backgrounders

Ballistic Missile Defense

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Introduction

U.S. ballistic missile defense systems are designed to protect the U.S. homeland, deployed military forces, and allies from limited attacks. The Pentagon originally sought development of ballistic missile defense (BMD) technology to counter the Soviet nuclear threat during the Cold War, but its focus in the twenty-first century has shifted to defending against potential strikes from regional actors, particularly Iran and North Korea. Proponents of BMD stress its role in the projection of U.S. power and its value as a deterrent, while critics question its reliability and high costs. In recent years, some military analysts have said that the planned expansion of U.S-NATO missile defense systems in the former Soviet bloc has unnecessarily frayed relations with Moscow.

How does ballistic missile defense work?

Ballistic missiles can be launched from a variety of platforms, including silos, trucks, trains, submarines, and warships. There are four general classifications based on the maximum distance the missile can travel: short range (less than 1,000 kilometers); medium range (1,000–3,000 kilometers); intermediate range (3,000–5,500 kilometers); and intercontinental (more than 5,500 kilometers).

Ballistic missiles have three stages of flight: **boost phase**, which begins at launch and lasts until rocket engines finish; **midcourse phase**, the longest stage, when the projectile is on its parabolic path to the target; and **terminal phase**, when the detached warhead reenters the atmosphere, often traveling less than a minute to impact. (**Cruise missiles**, by contrast, are jet-engine powered weapons that fly low and level to the ground, often avoiding enemy radar, before striking their target.)

Defeating a ballistic missile involves **four functions**: detection, discrimination (separating the missile from everything else), fire control (determining exactly where to intercept), and killing (hitting the missile with some type of interceptor). However, the effectiveness of BMD systems in test trials has been mixed, and critics continue to question their value in realistic battle conditions.

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What is the history of U.S. missile defense?

The Pentagon launched an intensive effort to counter the threat of Soviet intercontinental ballistic missiles (ICBMs) in the mid-1950s, when a number of competing programs was initiated by the U.S. Army, Air Force, and Navy. But by 1972, with U.S. and Soviet arsenals growing exponentially, Washington and Moscow signed the **Antiballistic Missile Treaty** (ABM), limiting to two the

number of missile defense sites each could maintain.

In the early 1980s, the Reagan administration expanded research and development of space- and ground-based defensive systems, and unveiled the **Strategic Defense Initiative** [PDF], later nicknamed "Star Wars." The next year, the army tested its Homing Overlay Experiment, the first successful demonstration of a hit-to-kill vehicle.

Meanwhile, tactical systems, or theater missile defense, continued to develop. U.S. Patriot missile batteries, originally designed to intercept Soviet intermediate-range ballistic missiles in Western Europe, were deployed to the Middle East during the Persian Gulf War. While they **proved ineffective** at defending against Scud attacks on Israel and Saudi Arabia in 1991, the concept drew increased attention and funding during the 1990s. By the latter part of the decade, BMD advocates pushed for a full-blown national missile defense system, citing nascent North Korean, Iraqi, and Iranian threats.

Leading defense officials in the George W. Bush administration envisioned an integrated, layered defense capable of defeating enemy missiles on a global scale. Early in his first term, Bush withdrew the United States from the ABM treaty and instructed the Pentagon to "proceed with fielding an initial set of **missile defense capabilities**." The first ground-based missile interceptor was installed at an army base in central Alaska in July 2004.

What are the primary missile defense systems?

The U.S. Missile Defense Agency (MDA) is developing a number of systems that could offer multiple opportunities to defeat limited ballistic missile attacks. These systems are not designed to shield against large-scale nuclear attacks from Russia and China. MDA has spent roughly $100 billion on missile defense since 2002, and plans to spend roughly $8 billion per year through 2017—around two percent of the Pentagon's base budget.

There are four primary BMD programs:

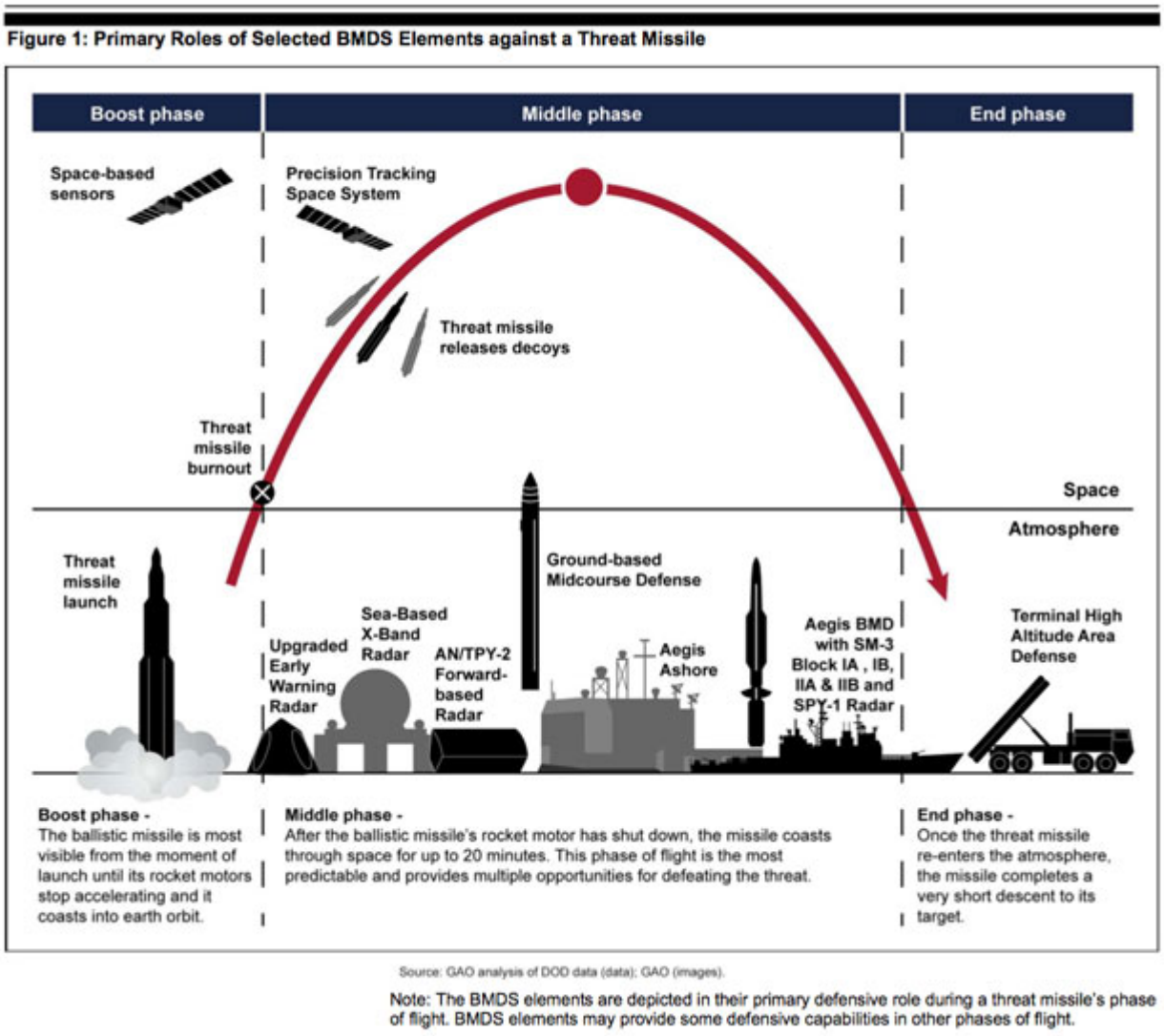
Ground-Based Midcourse Defense: The most complex and costly component of the U.S. missile defense system is designed to destroy intermediate- and long-range ballistic missiles in space. As of summer 2014, twenty-six interceptors were located at Fort Greely, Alaska, and four at Vandenberg Air Force Base, California, with plans to increase this arsenal to forty-four by 2017. In a June 2014 test, an interceptor launched from Vandenberg destroyed a target missile launched from the Marshall Islands, marking the first successful hit (out of four tries) since 2008. But experts say the technology is still unreliable and needs further testing. Meanwhile, some U.S. officials are advocating for the construction of a third interceptor site on the Eastern seaboard, and the MDA is assessing prospective locations.

Aegis Ballistic Missile Defense: Considered the most reliable component of missile defense, this traditionally sea-based system is designed to intercept short- and medium-range ballistic missiles. The Missile Defense Agency and the Navy plan to increase the number of BMD-capable Aegis warships from 33 in 2014 to 43 by 2019. As of June 2014, the Pentagon said the system had twenty-eight successful intercepts out of thirty-four tests.

Terminal High Altitude Area Defense: THAAD is a rapidly deployable, truck-mounted system capable of intercepting short- and medium-range ballistic missiles inside and just outside the atmosphere. Three THAAD systems were operational as of mid-2014, but the Pentagon is expected to

expand this to seven. In April 2013, the Army deployed a THAAD battery to Guam to help defend the U.S. territory from North Korean intermediate-range ballistic missiles.

Patriot Advanced Capability–3: The PAC-3 is the successor to the systems deployed in the Persian Gulf War and the most mature system in the U.S. missile defense arsenal. Rapidly deployable, the system is vehicle-mounted and employs sensors to track and intercept incoming missiles in their terminal phase, at lower altitudes than THAAD systems. The PAC-3 was used during combat missions in Iraq in 2003 with **mixed success**. PAC-3 batteries have been deployed to several nations including South Korea, Afghanistan, and Turkey, among others, and more than a dozen nations have purchased variants of the system.



Source: GAO, *Missile Defense: Opportunity to Refocus on Strengthening Acquisition Management*, 2013

What is the threat from North Korea?

North Korea has several hundred short-range and medium-range ballistic missiles, and is developing an intermediate-range missile (Taepo Dong–2) that analysts say would be able to hit the continental United States should it become operational. The TD-2 succeeded in placing a satellite in orbit in December 2012—the first successful space launch after repeated failures in the years prior. However, experts say the feat does not translate into a reliable missile, and that further testing is needed. North Korea's missiles are capable of delivering conventional warheads and, potentially, biological and

chemical munitions.

U.S. intelligence officials say that TD-2 missiles could, in theory, deliver a nuclear payload to the United States, but noted that without further testing, the potential for this was low in the near term. Experts suspect Pyongyang has four to ten plutonium-based nuclear weapons, but analysts continue to speculate whether the regime has mastered the miniaturization technology required to mount a nuclear warhead on its missiles. Several **UN Security Council resolutions** passed in recent years prohibit North Korea from developing nuclear or ballistic missile technology.

What is the threat from Iran?

Experts say Iran has the largest **ballistic missile arsenal** in the Middle East, having obtained most of this from its allies, particularly North Korea. The majority of Iran's ballistic missile inventory consists of Scud missiles with a range of up to approximately 500 kilometers. Tehran views these as important tactical weapons, but experts say their ability to strike U.S. and allied targets in the region is limited because they would need to be launched from vulnerable positions along the Persian Gulf. Furthermore, analysts say these missiles are not very accurate and serve more as a psychological threat to large urban and economic centers in the region.

The Islamic Republic is also building a stockpile of longer-range ballistic missiles that are able to hit any target in the Middle East, including Israel, but analysts say these weapons suffer from significant inaccuracy.

U.S. intelligence officials have warned in recent years of Iran's potential to deliver weapons of mass destruction with these missiles. In the **2014 U.S. Worldwide Threat Assessment** [PDF], Director of National Intelligence James Clapper said Iran has "the means and motivation to develop longer-range missiles, including an intercontinental ballistic missile." Tehran claims its controversial nuclear program is intended solely for peaceful applications, but Western analysts continue to speculate whether the regime has decided to pursue a nuclear weapon. Pursuant to **UN Security Council Resolution 1929** [PDF], Iran is forbidden from developing ballistic missiles capable of delivering nuclear warheads.

How does the United States collaborate with allies?

A major component of U.S. military strategy is partnering with allies around the globe to expand their ballistic missile defense capabilities. The Aegis BMD system is the linchpin of the Obama administration's plan for a phased deployment of a missile defense umbrella in Europe, which is intended to protect U.S. forces and **NATO allies** from regional threats like Iran. NATO leaders adopted missile defense as a principal alliance objective at their 2010 Lisbon Summit and approved the integration of U.S. and allied BMD efforts. In February 2014, the USS Donald Cook arrived in the port of Rota, becoming the first of four Aegis warships to be based in Spain. The first land-based versions of the system, so-called Aegis Ashore sites, are expected to be operational in Romania by 2015 and in Poland by 2018.

In Asia, Japan is the Pentagon's closest collaborator in this arena. Tokyo has procured a layered missile defense system from Washington, including Aegis-equipped destroyers and Patriot missile batteries. Analysts say the two longtime allies partner in a way that is highly interoperable, and note they are

working to jointly develop future BMD systems. The United States has also provided BMD technology to South Korea, which bought Aegis warships and Patriot missile batteries. But while all three nations are wary of the looming ballistic missile threat from North Korea, analysts note that deep-seated tensions between Tokyo and Seoul have kept them from cooperating on BMD and other military matters.

The United States is also assessing ways for Australia, which is building several Aegis-equipped destroyers, to contribute to missile defense in the Asia-Pacific region.

In the Middle East, missile defense cooperation is a major component of Israel's strategic relationship with the United States, experts say. In recent years, the United States and Israel have jointly funded and developed several rocket and missile defense systems, including the so-called Iron Dome, which was first deployed in 2011 to guard against very short-range rocket attacks (under 90 km) from potentially hostile neighbors; David's Sling; and the Arrow I, II, and III systems, designed to counter strikes from regional actors, particularly Iran. Although there is some debate surrounding Iron Dome's effectiveness, many analysts say the system hits the vast majority of its intended targets and, as a result, has altered Israel's military strategy in **recent conflicts with Hamas**. Many believe that without the system Israel would have been forced to carry out more intense military assaults.

What are the tensions with Russia?

Missile defense has aggravated U.S.-Russian relations in recent years, particularly with U.S.-NATO plans to deploy BMD assets in the former Soviet bloc. Former U.S. defense secretary Robert M. Gates **writes in his 2014 memoir** that the missile defense issue dominated the U.S.-Russia relationship during his stints in both the George W. Bush and first Obama administrations.

The Pentagon has stated repeatedly that the system is only designed to guard against limited attacks from regional actors like Iran, but the Kremlin believes the technology could be updated to intercept their missiles and may eventually tip the strategic balance toward the West. "The military people realize missile defense is part of the strategic arsenal of the United States," **Russian foreign minister Sergei Lavrov** said in February 2014. "When a nuclear shield is added to a nuclear sword, it is very tempting to use this offensive defense capability."

Additional Resources

This 2014 fact sheet from the Arms Control Association lists **ballistic missile inventories** for 31 countries, including information on type of missile, operational status, and public estimates of missile range and payload.

This 2014 report from the Congressional Research Service examines the U.S. intelligence community's assessment of ballistic missile cooperation between **Iran, North Korea, and Syria** [PDF].

This 2013 report from the U.S. National Air and Space Intelligence Center characterizes the current global **ballistic and cruise missile threat** [PDF] environment.

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