**Missile Defense Programs at a Glance**

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The Obama administration’s missile defense policy presents both elements of change and continuity with the plans set out by the Bush administration. President Obama announced September 17, 2009 that the United States would adopt a “Phased Adaptive Approach” to missile defense in Europe. This approach will primarily use the currently sea-based Aegis Ballistic Missile Defense (BMD) system to address the threat posed by short- and intermediate-range ballistic missiles from Iran. The Aegis system’s Standard Missile-3 (SM-3) will also eventually be placed on land in Romania and Poland. Obama’s approach is intended to be more flexible than the Bush administration plan to place Ground-Based Midcourse interceptors in Poland and radar in the Czech Republic and thus more responsive to emerging threats.

Despite these changes, the Obama administration is continuing the deployment of Ground-Based Midcourse interceptors in Fort Greely, Alaska, and Vandenberg Air Force Base, California, intended to defend the continental United States from future threats from North Korea or Iran. This system will continue to rely on four fixed radar facilities at Shemya, Alaska; Beale Air Force Base, California; Fylingdales in the United Kingdom; and Thule, Greenland. The network also includes six **mobile** X-band radars and a sea-based X-band radar (SB-X), currently deployed in the Pacific Ocean.

Ballistic missile defense ranked high among the priorities of the George W. Bush administration, which withdrew the United States from the 1972 Anti-Ballistic Missile (ABM) Treaty so that it could develop and deploy a nationwide defense against a limited number of long-range ballistic missiles. Still, missile defense technology remains largely unproven. Intercept tests have involved substitute components in highly scripted scenarios. For the Ground-Based Midcourse System, for example, the Missile Defense Agency (MDA) **claims** seven successful tests in fourteen attempts since 2000. The two most recent tests, both in 2010, failed. The last successful test was in 2008.

For more than five decades, the United States has intermittently researched and worked on missile defenses. The current deployments mark the second time that the United States has moved to deploy a defense against long-range ballistic missiles. The first effort, Safeguard, was shut down within a few months of being declared operational in October 1975 because Congress concluded the defense was too expensive and ineffectual. Safeguard was allowed under the ABM Treaty since it was limited to no more than 100 interceptors protecting an intercontinental ballistic missile (ICBM) base in North Dakota.

The Obama administration inherited six main missile defense programs; it has expanded some and recast or cut others. The Kinetic Energy Interceptor (KEI) program was cancelled due to cost and the Airborne Laser program was mothballed in February 2012. The Aegis SM-3 system has been expanded and is now central to the U.S. BMD system as a whole. Technical difficulties and setbacks have continued to define the programs with most of them behind schedule and costing much more than originally anticipated.

The Obama administration continues to oversee missile defense programs through the Missile Defense Agency. The system as a whole is organized in terms of boost, mid-course and terminal defense segments and the Pentagon maintains individual program offices for each system, albeit with an eye toward sharing **technology** among the systems and exploring how they might operate together. Integrated operation plays a more extensive role in the new plans especially in terms of space, sea and land-based sensors.

The following chart provides a brief look at each of the major missile defense programs inherited by the Obama administration. It contains information on what type of ballistic missile each defense would be intended to counter and at which stage of the enemy missile’s flight an attempted intercept would take place. Also included are Pentagon estimates on when each defense may have an initial, rudimentary capability as well as when it could be fully operational.

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| **Ballistic Missile Basics**Ballistic missiles are powered by rockets initially but then follow an unpowered, parabolic trajectory toward the target. They are classified by the maximum distance that they can travel, which is a function of how powerful the missile’s engines (rockets) are and the weight of the missile’s warhead. To add more distance to a missile’s range, rockets are stacked on top of each other in a configuration referred to as staging. There are four general classifications of ballistic missiles:* Short-range ballistic missiles, traveling less than 1,000 kilometers (approximately 620 miles)
* Medium-range ballistic missiles, traveling between 1,000–3,000 kilometers (approximately 620-1,860 miles)
* Intermediate-range ballistic missiles, traveling between 3,000–5,500 kilometers (approximately 1,860-3,410 miles)
* Intercontinental ballistic missiles (ICBMs), traveling more than 5,500 kilometers (approximately 3,410 miles)

Short- and medium-range ballistic missiles are referred to as “theater” ballistic missiles, whereas ICBMs or long-range ballistic missiles are described as “strategic” ballistic missiles. The now-discarded ABM Treaty prohibited the development of large-scale, nationwide strategic defenses, but permitted development of theater missile defenses, as well as single-site strategic defenses.Ballistic missiles have three stages of flight:* The **boost phase** begins at launch and lasts until the rocket engines stop firing and pushing the missile away from Earth. Depending on the missile, this stage lasts between three and five minutes. During much of this time, the missile is traveling relatively slowly, although toward the end of this stage an ICBM can reach speeds of more than 24,000 kilometers per hour. Most of this phase takes place in the atmosphere (endo-atmospheric).
* The **midcourse phase** begins after the rockets finish firing and the missile is on a ballistic course toward its target. This is the longest stage of a missile’s flight, lasting up to 20 minutes for ICBMs. During the early part of the midcourse stage, the missile is still ascending toward its apogee, while during the latter part it is descending toward Earth. During this stage the missile’s warhead(s), as well as any decoys, separate from the delivery platform, or "bus." This phase takes place in space (exoatmospheric).
* The **terminal phase** begins when the missile’s warhead re-enters the Earth’s atmosphere (endo-atmospheric), and it continues until impact or detonation. This stage takes less than a minute for a strategic warhead, which can be traveling at speeds greater than 3,200 kilometers per hour.
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| **Ground-Based Midcourse Defense** |
| **Program & Key Elements** | * The key element of the ground-based midcourse defense is a ground-based missile interceptor consisting of a powerful multistage booster and an exoatmospheric kill vehicle (EKV), which separates from the booster in space and seeks out its target through radar updates and use of its onboard visual and infrared sensors.
* The EKV destroys its target by colliding with it. This process is referred to as "hit-to-kill" or "kinetic kill."
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| **Designed to Counter** | * The system’s goal is to intercept strategic ballistic missile warheads in the midcourse stage.
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| **Status** | * To date, the MDA claims that the system has had seven successful intercepts in fourteen tests, not counting a partial system test in 1999 and a “no-test” in 2007.
* A new EKV, called CE-II, failed its first two tests on Jan. 31 and Dec. 15, 2010.
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| **Capability/Schedule** | * All the intercept tests to date have involved substitute components in highly scripted scenarios. A C-band transponder on the target provides tracking data used to formulate the system’s initial intercept plan; the target and interceptor fly the same trajectories in every test; the intercepts take place at slower speeds and lower altitudes than what would be expected in a real attack; the interceptor is preprogrammed with information on what the target looks like before the intercept attempt; and the tests do not involve realistic decoys that a potential adversary might use to trick the system into hitting the wrong object.
* The Pentagon currently deploys 30 interceptors in California and Alaska. This includes 26 interceptors at Fort Greely, Alaska and four at Vandenberg Air Force Base, California. A second missile field at Fort Greely is planned, consisting of 14 silos, taking the total number there to 40.
* The interceptors are supported by land- and sea-based radar. Early Warning Radar are being upgraded to support the system. Upgrades have been carried out at Beale Air Force Base, California and at Fylingdales, UK. Upgrade work is also underway at Thule Air Force Base, Greenland and is scheduled to take place at Clear, Alaska. The less powerful, west-facing, COBRA Dane radar on Shemya Island, the Aleutian Islands also completed an upgrade in February 2010.
* A sea-based X-band radar (SBX) is currently based in the Pacific and mounted on a modified mobile oil rig. SBX was used on December 5, 2008, to help provide tracking data to an interceptor during the last successful test, but failed during the test on January 31, 2010.
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| **Aegis Ballistic Missile Defense (BMD)** |
| **Program & Key Elements** | * The Aegis system is central to the Obama administration’s Phased Adaptive Approach (PAA) to missile defense in Europe. It is currently a sea-based system, with missile launchers and radars mounted on cruisers and destroyers. Future phases in the PAA envisage taking Aegis on land in Europe in the form of “Aegis-Ashore.”
* The key elements of the currently sea-based defense system are a ship-based missile (Standard Missile- 3, or SM-3) and the Aegis combat system, an advanced system that can detect and track more than 100 targets simultaneously while directing a ship’s weapons to counter incoming air, surface, and submarine threats.
* The SM-3 is a hit-to-kill missile comprised of a three-stage booster with a kill vehicle.
* The current SM-3 Block I is considered too slow to intercept a strategic ballistic missile.
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| **Designed to Counter** | * Initially, the Aegis BMD is geared toward defending against short-, medium-, and intermediate-range ballistic missiles during their midcourse phase with an emphasis on the ascent stage.
* The Aegis system is capable of *tracking* ICBMs, but is not yet configured to intercept them.
* A faster SM-3 is being developed that is intended to have some capability to intercept ICBMs. The upgraded SM-3, known as the Block IIB, is not expected until 2020.
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| **Status** | * MDA claims that the SM-3 has a test record of 21 intercepts in 26 attempts which were carried out in 24 flight tests (some of the tests were double tests.) The two most recent tests were conducted on April 14 and September 1, 2011. The April test was successful while the September test failed.
* The system is currently deployed at sea on 24 ships: 5 Aegis Class Cruisers and 19 Arleigh Burke Class Destroyers.
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| **Capability/Schedule** | * Under current MDA and Navy plans the number of BMD capable Aegis ships will rise from 24 in 2012 to 38 by 2015.
* Of the 24 ships, 16 are assigned to the Pacific Fleet and 8 to the Atlantic Fleet.
* All Arleigh Burke Class Destroyers being built in the future are to be built with BMD capabilities.
* Land based SM-3 deployments are currently scheduled to take place in Romania in 2015 and Poland in 2018.
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| **Theater High Altitude Area Defense (THAAD)** |
| **Program & Key Elements** | * THAAD’s main components are a missile comprised of a single rocket booster with a separating kill-vehicle that seeks out its target with the help of a THAAD radar. Each missile contains eight interceptors.
* The THAAD kill vehicle is hit-to-kill.
* THAAD missiles are fired from a truck-mounted launcher.
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| **Designed to Counter** | * THAAD’s mission is to intercept short- and medium-range ballistic missiles at the end of their midcourse stage and in the terminal stage. Intercepts could take place inside or outside the atmosphere.
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| **Status** | * The system had two successful intercept attempts in the summer of 1999 after experiencing six test failures between April 1995 and March 1999.
* The THAAD missile was redesigned, and testing resumed in November 2005.
* THAAD has tested successfully nine times since being redesigned. Three other THAAD tests have been classed as “no-tests.”
* The most recent test, a successful dual intercept, was conducted on Oct. 4, 2011.
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| **Capability/Schedule** | * Still in testing and development, the first THAAD battery was activated in May 2008 at Fort Bliss, Texas. A second was also activated there in October 2009.
* Production of the first interceptors began in March 2011
* The 3rd and 4th batteries are scheduled to be fielded in 2013.
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| **Patriot Advanced Capability-3 (PAC-3)** |
| **Program & Key Elements** | * PAC-3 consists of a one-piece, hit-to-kill missile interceptor fired from a mobile launching station, which can carry 16 PAC-3 missiles.
* The missile is guided by an independent radar that sends its tracking data to the missile through a mobile engagement control station.
* A blast fragmentation kills the target.
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| **Designed to Counter** | * PAC-3 is designed to defend against short- and medium-range ballistic missiles in their terminal stage at lower altitudes than the THAAD system.
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| **Status** | * During earlier developmental testing, the system struck nine out of 10 targets.
* More challenging operational tests between February and May 2002 involved multiple interceptors and targets. Seven PAC-3s were to be fired at five targets; of the seven, two destroyed their targets, one hit but did not destroy its target, one missed its target, and three others did not launch.
* PAC-3s destroyed two Iraqi short-range ballistic missiles during the 2003 conflict and shot down a U.S. fighter jet. Earlier Patriot models also deployed to the region shot down nine Iraqi missiles and a British combat aircraft.
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| **Capability/Schedule** | * PAC-3 is now considered operational and has been deployed to several countries including South Korea, Afghanistan, Bahrain, Kuwait, Qatar and UAE. In June 2010 Polish armed forces were trained on Patriots in Morag.
* As of early 2010, 483 MIM-104 Patriot launchers of all types were in the possession of the US army.
* Over 13 countries have purchased different variants of the Patriot system.
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| **Space Tracking and Surveillance System (STSS)** |
| **(Previously referred to as Space-Based Infrared System-low (SBIRS-low))** |
| **Program & Key Elements** | * STSS will initially comprise two satellites, but the constellation could expand to as many as 30 satellites.
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| **Designed to Counter** | * STSS satellites are expected to support U.S. missile defense systems by providing tracking data on missiles during their entire flight.
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| **Status** | * A “demonstration capability” of two satellites was launched in September 2009.
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| **Capability/Schedule** | * The first of the next-generation of STSS satellites is scheduled to be launched between 2013 and 2015, although 2016 – 2019 may be a more realistic estimate.
* The two satellites currently in orbit provide little, if any, operational capability. The Pentagon estimates that at least 18 satellites would be needed to provide coverage of key regions of concern. Worldwide coverage could require up to 30 satellites.
* In 2011, the satellites provided missile tracking data in real time and transmitted tracking data for Aegis remote engagement.
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| **Space-Based Infrared System-high (SBIRS-high)** |
| **Program & Key Elements** | * SBIRS-high will be comprised of a number of satellites in geosynchronous orbit and sensors on host satellites in a highly elliptical orbit.
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| **Designed to Counter** | * SBIRS-high’s primary objective is to provide early warning of global ballistic missile launches.
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| **Status** | * Currently there are two SBIRS sensors mounted on host satellites in highly elliptical orbit (HEO-1 and HEO-2). A contract for a third was awarded in June 2009.
* As of July 2010, there are no SBIRS geosynchronous (GEO) satellites orbiting the Earth due to the project running behind schedule. The GAO reported in April 2009 that the launch of GEO-1 is seven years behind schedule.
* The program has also cost at least $6 billion more than expected.
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| **Capability/Schedule** | * The first sensor in highly elliptical orbit—HEO-1—was certified for operations by U.S. Strategic Command in December 2008, followed by the second, HEO-2 in July 2009.
* The latest estimate on the launch of GEO-1 is late 2010, followed in 2013 by GEO-2.
* A contract has been awarded for GEO-3.
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| **Airborne Laser (ABL)** |
| **Program & Key Elements** | * The key element of the proposed ABL system is a modified Boeing 747 plane equipped with a chemical oxygen-iodine laser (COIL) and two tracking lasers.
* The laser beam is produced by a chemical reaction.
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| **Designed to Counter** | * Although the Pentagon originally aimed to field the ABL against theater ballistic missiles, the Pentagon also contended that the ABL may have an inherent capability against strategic ballistic missiles as well.
* The expanded ABL objective is to shoot down all ranges of ballistic missiles in their boost phase.
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| **Status** | * The first ABL test plane made its inaugural flight on July 18, 2002. The plane was not equipped with the laser.
* By 2007, an ABL test plane had successfully tracked a target and hit it with a low-power laser. The target was not a ballistic missile, however, but was mounted on another aircraft. This was followed by an in flight firing of the COIL on August 18, 2009.
* The ABL test plane successfully engaged and destroyed a research rocket on February 3, 2010. This was followed by two intercept tests on boosting ballistic missiles on February 11, 2010. The first of these was successful, the second was not.
* The ABL system has failed its two most recent tests, both of which were conducted in the fall of 2010. The first took place on September 1, and the second on October 21.
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| **Capability/Schedule** | * Due to a combination of technological difficulties, potential operational limitations and high cost, the program has been significantly scaled back. The second test bed plane was cancelled in May 14, 2009.
* The program has been described as a “technology demonstrator” by Defense Secretary Robert Gates. It has also been down-classed by the MDA as a “Supporting Effort” as opposed to an “Element” of the BMD system.
* The program ended in February 2012, when the Airborne Laser Test Bed aircraft was moved into long term storage. According to the MDA, the decision to end the program was made after the information for the knowledge points was met.
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| **Kinetic Energy Interceptor (KEI)** |
| **Program & Key Elements** | * KEI was to be comprised of three powerful boosters and a separating kill vehicle. The booster was expected to travel at least six kilometers per second, which is comparable to an ICBM.
* The kill vehicle was not designed to carry an explosive warhead but to destroy its target through the force of a collision.
* The Pentagon was developing mobile land- and sea-based versions of KEI, as well as fixed land-based units.
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| **Designed to Counter** | * KEI was intended to destroy strategic ballistic missiles in “boost phase” during their first minutes of flight when their rocket engines are still burning.
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| **Status** | * On Dec. 3, 2003, the Pentagon awarded Northrop Grumman a contract worth up to $4.5 billion to develop KEI over eight years.
* KEI was revealed to have been scrapped by the MDA on May 7, 2009.
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| **Capability/Schedule** | * It is possible that the program may be revived in the future.
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**Category and Description**

Missile Defense

Fact Sheet, February 2009

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President George W. Bush announced Dec. 17, 2002 that the United States would begin fielding the initial elements of a limited ballistic missile defense system in 2004. As of February 2009, the U.S. Missile Defense Agency (MDA) reports having deployed 28 ground-based missile interceptors, divided between Fort Greely, Alaska, and Vandenberg Air Force Base, California. The United States also possesses 18 warships equipped with Aegis Ballistic Missile Defense, a system intended to counter short- and intermediate-range ballistic missiles as of January 2009. The U.S. missile defense system relies on four fixed radar facilities at Shemya, Alaska, Beale Air Force Base, California, Fylingdales in the United Kingdom, and Thule, Greenland. The network also includes four mobile X-band radars, and a sea-based X-band radar (SB-X), currently deployed in the Pacific Ocean.

Developing and deploying ballistic missile defenses ranked high among the priorities of the George W. Bush administration. In June 2002, Bush withdrew the United States from the 1972 Anti-Ballistic Missile (ABM) Treaty, which had barred Washington and Moscow from deploying nationwide defenses against long-range ballistic missiles. The administration also aggressively sought foreign partners for the U.S. program and, during Bush’s last year in office, reached deals to deploy missile interceptors in Poland and a radar installation in the Czech Republic.

Still, the technology remains unproven .Intercept tests have involved substitute components in highly scripted scenarios. In thirteen tests, the Pentagon has hit a mock warhead eight times. In the most recent test, conducted on December 5, 2008, the interceptor successfully destroyed the mock warhead; however, the incoming missile failed to deploy countermeasures meant to fool the interceptor into missing its target.

Pentagon officials acknowledge that the initial system will be rudimentary. But they argue that some defense is better than none at all. In addition, they assert that the only way to conduct more strenuous and realistic testing of the system is to deploy it.

For more than five decades, the United States has intermittently researched and worked on missile defenses. The planned deployment this fall will mark the second time that the United States has moved to deploy a defense against long-range ballistic missiles. The first effort, Safeguard, was shut down within a few months of being declared operational in October 1975 because Congress concluded the defense was too expensive and ineffectual. Under Safeguard, which Washington deployed in a configuration to comply with the ABM Treaty, the United States sought to protect an offensive U.S. missile base located in North Dakota.

The Bush administration inherited seven main missile defense programs, including the ground-based missile interceptor system and two related satellite programs. For the most part, the Bush administration continued work on these same programs, although it recast some, cut others, and added new projects. It canceled one sea-based system—the Navy Area Theater Ballistic Missile Defense System—and significantly down-sized a space-based laser initiative, while commencing new efforts to develop interceptors to attack multiple targets and to strike enemy missiles early in their flights.

During the Clinton administration, Republicans repeatedly asserted that the development of working missile defenses was being hindered by a lack of political will, not scientific or engineering challenges. However, several missile defense programs have fallen further behind schedule and suffered setbacks due to technical difficulties under the Bush administration. An aircraft designed to be armed with a powerful laser—known as the Airborne Laser—is now more than two years behind schedule and may be shelved. One of the two inherited satellite programs has been overhauled and renamed, while the other has far exceeded cost and schedule estimates. In addition, the Pentagon’s ground- and sea-based missile interceptors have experienced schedule and testing delays due to problems with their kill vehicles, which are the components intended to seek out and collide with enemy warheads.

In general, the Bush administration reorganized missile defense programs, placing all of them under one big tent (the Missile Defense Agency) rather than working on each one in isolation. And, whereas previous administrations drew a distinction between theater defenses (those designed to hit short- and medium-range ballistic missiles) and strategic defenses (those intended to intercept long-range missiles/ICBMs), the Bush administration did not, claiming to pursue a general research and development program for a layered missile defense comprised of many different types of systems and capabilities. Nevertheless, the Pentagon maintains individual program offices for each system, albeit with an eye toward sharing technology among the systems and exploring how they might operate together. In addition, the Pentagon is actively pushing to expand some of the earlier theater missile defense programs to try and tackle the strategic mission. ICBMs travel farther, faster, and are more likely to employ countermeasures intended to fool defenses than shorter-range missiles. The ABM Treaty permitted the development of theater missile defense systems but prohibited work on nationwide strategic defenses.

At this time, only the ground-based interceptor system has been tested against strategic ballistic missile targets, although the Pentagon has started to investigate whether some radars and sensors used in theater systems might also be capable of tracking a strategic ballistic missile. Preliminary findings are encouraging, according to the Pentagon, which has declined to provide specific test results.

The Obama administration has expressed general support for the idea of national missile defense, but indicated that some Bush-era programs may be up for review. According the to White House website, the administration “will support missile defense, but ensure that it is developed in a way that is pragmatic and cost-effective; and, most importantly, does not divert resources from other national security priorities until we are positive the technology will protect the American public.” This sentiment has been echoed by Vice President Joe Biden and Secretary of State Hillary Clinton.

The following chart provides a brief look at each of the Pentagon’s major missile defense programs. It contains information on what type of ballistic missile each defense would be intended to counter and at which stage of the enemy missile’s flight an attempted intercept would take place. Also included are Pentagon estimates on when each defense may have an initial, rudimentary capability as well as when it could be fully operational.

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| **Ballistic Missile Basics**Ballistic missiles are powered by rockets initially but then they follow an unpowered, free-falling trajectory toward the target. They are classified by the maximum distance that they can travel, which is a function of how powerful the missile’s engines (rockets) are and the weight of the missile’s warhead. To add more distance to a missile’s range, rockets are stacked on top of each other in a configuration referred to as staging. There are four general classifications of ballistic missiles:* Short-range ballistic missiles, traveling less than 1,000 kilometers (approximately 620 miles)
* Medium-range ballistic missiles, traveling between 1,000–3,000 kilometers (approximately 620-1,860 miles)
* Intermediate-range ballistic missiles, traveling between 3,000–5,500 kilometers (approximately 1,860-3,410 miles)
* Intercontinental ballistic missiles (ICBMs), traveling more than 5,500 kilometers

Short- and medium-range ballistic missiles are referred to as theater ballistic missiles, whereas ICBMs or long-range ballistic missiles are described as strategic ballistic missiles. The ABM Treaty prohibited the development of nationwide strategic defenses, but permitted development of theater missile defenses.Ballistic missiles have three stages of flight:* The **boost phase** begins at launch and lasts until the rocket engines stop firing and pushing the missile away from Earth. Depending on the missile, this stage lasts between three and five minutes. During much of this time, the missile is traveling relatively slowly, although toward the end of this stage an ICBM can reach speeds of more than 24,000 kilometers per hour. The missile stays in one piece during this stage.
* The **midcourse phase** begins after the rockets finish firing and the missile is on a ballistic course toward its target. This is the longest stage of a missile’s flight, lasting up to 20 minutes for ICBMs. During the early part of the midcourse stage, the missile is still ascending toward its apogee, while during the latter part it is descending toward Earth. It is during this stage that the missile’s warhead, as well as any decoys, separate from the delivery vehicle.
* The **terminal phase** begins when the missile’s warhead re-enters the Earth’s atmosphere, and it continues until impact or detonation. This stage takes less than a minute for a strategic warhead, which can be traveling at speeds greater than 3,200 kilometers per hour.

Short- and medium-range ballistic missiles may not leave the atmosphere, have separating warheads, or be accompanied by decoys or other countermeasures. |

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| **Ground-Based Midcourse Defense** |
| **(Referred to as National Missile Defense by the Clinton administration)** |
| **Program & Key Elements** | * The key element of the ground-based midcourse defense is a ground-based missile interceptor consisting of a powerful multistage booster and an exoatmospheric kill vehicle (EKV), which separates from the booster in space and seeks out its target through radar updates and use of its onboard visual and infrared sensors.
* The EKV destroys its target by colliding with it. This process is referred to as hit-to-kill.
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| **Designed to Counter** | * The projected system’s goal is to intercept strategic ballistic missile warheads in the midcourse stage.
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| **Status** | * To date, the system has had eight successful intercept attempts in twelve developmental tests.
* The most recent test, on Dec. 5, 2008, was successful; however, the target missile failed to deploy countermeasures meant to fool the interceptor into tracking the wrong target.
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| **Capability/Schedule** | * All the intercept tests to date have involved substitute components in highly scripted scenarios. A C-band transponder on the target provides tracking data used to formulate the system’s initial intercept plan; the target and interceptor fly the same trajectories in every test; the intercepts take place at slower speeds and lower altitudes than what would be expected in a real attack; the interceptor is preprogrammed with information on what the target looks like before the intercept attempt; and the tests do not involve realistic decoys that a potential adversary might use to trick the system into hitting the wrong object. Lt. General Henry Obering, until November 21, 2008, the Director of the MDA, testified before Congress on April 1, 2008 that missile defense tests are “increasing in operational realism.”
* The Pentagon is currently planning to deploy six missile interceptors, at Fort Greely, Alaska, and four more interceptors at Vandenberg Air Force Base, California, by early 2005. Another 10 interceptors are to be deployed at Fort Greely before the end of 2005.
* There are no plans to fire interceptors from Fort Greely for testing purposes. .
* The interceptors under the Clinton plan were to have been supported by a land-based X-band radar, but the Bush administration also developed a sea-based X-band radar (SBX). There is currently one SBX radar mounted on a mobile modified oil rig in the Pacific Ocean. SBX was used on Dec. 5, 2008, to help provide tracking data to an interceptor during a successful missile defense test.
* Bush’s plans also called for the missile interceptors to be supported by an upgraded, although less capable, early-warning radar on Shemya Island at the western tip of the Aleutian Islands chain. This radar, known as the Cobra Dane radar, is only be able to track missiles fired from the direction of Asia because the radar is fixed to face northwest.
* MDA is also exploring the construction of a third missile defense site in Europe. The Bush administration signed a deal with Poland on August 20, 2008, to place ten missile interceptors on Polish territory. The Bush administration also won the approval of the Czech government on April 3, 2008, to build a tracking radar facility in the Czech Republic.
* The United States is upgrading two foreign-based, early-warning radars to help track ballistic missiles launched from the direction of the Middle East. One radar (Fylingdales) is located in the United Kingdom and the other is at Thule Air Base in Greenland. Fylingdales has been upgraded and is operational, while the Thule-based radar will be integrated into the missile defense system by the end of fiscal year 2009.
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| **Aegis Ballistic Missile Defense (BMD)** |
| **(Referred to as Navy Theater Wide by the Clinton administration)** |
| **Program & Key Elements** | * The key elements of the proposed sea-based defense are a ship-based missile (Standard Missile- 3, or SM-3) and the Aegis combat system, an advanced system that can detect and track more than 100 targets simultaneously while directing a ship’s weapons to counter incoming air, surface, and submarine threats.
* The SM-3 is a hit-to-kill missile comprised of a three-stage booster with a kill vehicle.
* The SM-3 is considered too slow to intercept a strategic ballistic missile.
 |
| **Designed to Counter** | * Initially, the Aegis BMD is geared toward defending against short-, medium-, and intermediate-range ballistic missiles during their midcourse phase with an emphasis on the ascent stage.
* The Aegis system is capable of *tracking* ICBMs, but is not configured to intercept them.
* A faster SM-3 is being developed that is intended to have some capability to intercept ICBMs. The upgraded SM-3, known as the Block IIA, is not expected until 2015.
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| **Status** | * The system has a record of fourteen intercepts in eighteen flight tests. The two most recent tests, both in November 2008, were failures. In a November 1 test, two target missiles and two interceptors were launched from Aegis-equipped destroyers in the Pacific Ocean. One interceptor hit its target, but the other did not. In another test, on November 19, 2008, the interceptor lost track of its target seconds before impact.
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| **Capability/Schedule** | * As of January 2009, the U.S. Navy has eighteen ships outfitted with the Aegis BMD system. Sixteen of these ships are deployed in the Pacific Ocean, leaving two in the Atlantic.
* Between 2011 and 2021, the Navy hopes to build an Aegis force of 84 ships: 22 cruisers and 62 destroyers.
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| **Airborne Laser (ABL)** |
| **Program & Key Elements** | * The key element of the proposed ABL system is a modified Boeing 747 plane equipped with a chemical oxygen-iodine laser.
* The laser beam is produced by a chemical reaction.
 |
| **Designed to Counter** | * Although the Pentagon originally aimed to field the ABL against theater ballistic missiles, the Pentagon now contends the ABL may have an inherent capability against strategic ballistic missiles as well.
* The expanded ABL objective is to shoot down all ranges of ballistic missiles in their boost phase.
 |
| **Status** | * The first ABL test plane made its inaugural flight on July 18, 2002. The plane was not equipped with the laser.
* By 2007, an ABL test plane had successfully tracked a target and hit it with a low-power laser. The target was not a ballistic missile, however, but was mounted on another aircraft.
* Although Clinton administration plans first projected an ABL intercept attempt to take place in 2003, development delays have led the Pentagon to push back such a test several times. It is now expected to take place in 2009.
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| **Capability/Schedule** | * The Government Accountability Office estimates that ABL will be operational sometime in 2016-2017.
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| **Terminal High Altitude Area Defense (THAAD)** |
| **Program & Key Elements** | * THAAD’s main components are a missile comprised of a single rocket booster with a separating kill-vehicle that seeks out its target with the help of a specifically designed THAAD radar.
* The THAAD kill vehicle is hit-to-kill.
* THAAD missiles are fired from a truck-mounted launcher.
 |
| **Designed to Counter** | * THAAD’s mission is to intercept short- and medium-range ballistic missiles at the end of their midcourse stage and in the terminal stage. Intercepts could take place inside or outside the atmosphere.
 |
| **Status** | * The system had two successful intercept attempts in the summer of 1999 after experiencing six test failures between April 1995 and March 1999.
* The THAAD missile was redesigned, and testing resumed in July 2006.
* THAAD has tested successfully five times since being redesigned. In two other tests the interceptor was not launched due to malfunctions of the target missiles.
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| **Capability/Schedule** | * Still in testing and development, however, the first THAAD battery was activated in May 2008.
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| **Patriot Advanced Capability-3 (PAC-3)** |
| **Program & Key Elements** | * PAC-3 consists of a one-piece, hit-to-kill missile interceptor fired from a mobile launching station, which can carry 16 PAC-3 missiles.
* The missile is guided by an independent radar that sends its tracking data to the missile through a mobile engagement control station.
 |
| **Designed to Counter** | * PAC-3 is designed to defend against short- and medium-range ballistic missiles in their terminal stage at lower altitudes than the THAAD system.
 |
| **Status** | * During earlier developmental testing, the system struck nine out of 10 targets.
* In four, more difficult operational tests between February and May 2002 that involved multiple interceptors and targets, seven PAC-3s were to be fired at five targets. Of the seven PAC-3s, two destroyed their targets, one hit but did not destroy its target, one missed its target, and three others did not launch.
* PAC-3s destroyed two Iraqi short-range ballistic missiles during the 2003 conflict and shot down a U.S. fighter jet. Earlier Patriot models also deployed to the region shot down nine Iraqi missiles and a British combat aircraft.
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| **Capability/Schedule** | * PAC-3 is now considered operational.
* As of July 2004, 175 PAC-3 interceptors had been delivered to the Army.
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| **Space Tracking and Surveillance System (STSS)** |
| **(Previously referred to as Space-Based Infrared System-low (SBIRS-low))** |
| **Program & Key Elements** | * STSS will initially comprise two satellites, but the constellation could expand to as many as 30 satellites.
 |
| **Designed to Counter** | * STSS satellites are expected to support U.S. missile defense systems by providing tracking data on missiles during their entire flight.
 |
| **Status** | * Two developmental STSS satellites are to be launched in fiscal year 2009. The SBIRS-low program had called for the first launch of a satellite in 2006.
 |
| **Capability/Schedule** | * The first next-generation STSS satellite is to be launched in 2011.
* Two satellites would provide little, if any, operational capability. The Pentagon estimates that at least 18 satellites would need to be deployed to provide coverage of key regions of concern. Worldwide coverage could require up to 30 satellites.
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| **Space-Based Infrared System-high (SBIRS-high)** |
| **Program & Key Elements** | * SBIRS-high will be comprised of four satellites in geosynchronous orbit and sensors on two host satellites in a highly elliptical orbit.
 |
| **Designed to Counter** | * SBIRS-high’s primary objective is to provide early warning of global ballistic missile launches.
 |
| **Status** | * Currently there are two SBIRS geosynchronous satellites orbiting the Earth, along with two SBIRS sensors mounted on host satellites in highly elliptical orbit.
* The program has cost at least $6 billion more than expected, and is several years behind schedule.
 |
| **Capability/Schedule** | * The first sensor in highly elliptical orbit—HEO-1—was certified for operations by U.S. Strategic Command in December 2008. The second sensor—HEO-2—is expected to come online in the first quarter of 2009.
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| **Kinetic Energy Interceptor (KEI)** |
| **Program & Key Elements** | * KEI will be comprised of three powerful boosters and a separating kill vehicle. The booster is expected to travel at least six kilometers per second, which is comparable to an ICBM.
* The kill vehicle will not carry an explosive warhead but is designed to destroy its target through the force of a collision.
* The Pentagon is developing mobile land- and sea-based versions of KEI, as well as fixed land-based units.
 |
| **Designed to Counter** | * KEI is intended to destroy strategic ballistic missiles during their first minutes of flight when their rocket engines are still burning.
 |
| **Status** | * On Dec. 3, 2003, the Pentagon awarded Northrop Grumman a contract worth up to $4.5 billion to develop KEI over eight years.
 |
| **Capability/Schedule** | * The first KEI booster flight is planned for 2009.
* The Pentagon awarded the KEI contract several months after the independent American Physical Society released a study asserting that boost-phase intercepts would be technically possible under very limited circumstances.
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