

U.S. Missile Defense Programs at a Glance

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For the past five decades, the United States has debated, researched, and worked on the development of defenses to protect U.S. territory against long-range ballistic missile attack. Yet, today, the United States remains far from being able to deploy effective and reliable strategic missile defenses.

The Bush administration inherited seven U.S. missile defense programs and two key satellite

programs from the Clinton administration, but it has not been able to accelerate their development despite making missile defense a top priority and budgeting billions of additional dollars for the programs. In fact, most of the programs have experienced additional delays; and one, a sea-based system has been canceled and another system, the space-based laser, has been dramatically scaled back to a general research program. The Bush administration has reorganized missile defense programs, placing the separate programs under one big tent. And, whereas previous U.S. 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 is pursuing what it calls a general research and development program. Nevertheless, for the most part the Pentagon continues to work on each program individually, as it did during the Clinton administration, albeit with an eye toward sharing technology among the systems and expanding some theater programs to tackle a strategic mission.

Although the Bush administration singled out the 1972 Anti-Ballistic Missile (ABM) Treaty as the primary impediment to development of U.S. missile defense systems, the June 13 U.S. withdrawal from the accord is unlikely to hasten missile defense

deployment. Lieutenant General Ronald Kadish, who is director of the Pentagon's Missile Defense Agency, has said there are three key benefits of the U.S. treaty withdrawal. Kadish claims that the United States will now have greater freedom to explore international cooperation on missile defenses, more flexibility to test various sensors and basing modes for missile defense missions,

and the right to deploy strategic missile defenses when they are available. (The treaty banned Moscow and Washington from fielding nationwide strategic defenses but places no restrictions on theater missile defense systems.)

At this time, only one U.S. missile defense program—the national missile defense program initiated by the Clinton administration—is being tested against strategic ballistic missiles and the only “deployment” plan is for five missile interceptors to be fielded in Alaska by 2004, ostensibly for testing purposes. This represents a scaling back of the Clinton plan that called for an initial deployment of 20 operational missile interceptors in Alaska by 2005.

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. (For a brief description of ballistic missiles, how they are classified, and their three stages of flight, see the “Ballistic Missile Basics” below.)

Also included are Pentagon estimates on when each defense may have an initial, rudimentary capability as well as when it may be fully operational. Information on the status of each program, including testing delays, is also detailed.



The sole U.S. missile defense program being tested against ballistic missiles today is the ground-based system being initiated by President Clinton. Pictured above is the system's interceptor is a July 2000 attempt that failed. To date, the system has scored two hits in six intercept attempts, although the tests do not replicate operational conditions.

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Ground-Based Midcourse Defense

(Referred to as National Missile Defense by the Clinton administration)

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| Program & Key Elements | <ul style="list-style-type: none">• 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. |
| Designed to Counter | <ul style="list-style-type: none">• The projected system's goal is to intercept strategic ballistic missiles in their midcourse stage. |
| Status | <ul style="list-style-type: none">• To date, the system has five successful intercept attempts in eight developmental tests. After a string of four straight successes, the system failed to hit its target in the most recent test December 11, 2002.• Another intercept attempt is not planned until late 2003 following the selection of a multistage booster.• The development of the multistage booster is more than two years behind schedule. Early Pentagon testing plans called for the booster to be integrated into an actual intercept attempt during the first few months of 2001, but that will not occur until at least late 2003.• Two companies are currently working on separate booster models, both of which will be flight-tested in the late spring or early summer of 2003. MDA will select one of the boosters for use in future intercept testing.• Kadish declared October 31, 2002, that "One of my greatest disappointments has been not being able to produce a booster for this ground-based system." |
| Capability/Schedule | <ul style="list-style-type: none">• The Pentagon is currently planning to deploy five test missile interceptors at Fort Greely in Alaska by September 2004.• Although not considered an actual deployment, the five interceptors could provide an "emergency -capability" if needed, according to Pentagon officials.• Currently, there are no plans to use the missiles from Fort Greely in tests because of safety concerns.• Clinton's missile defense plans called for deployment of 20 missile interceptors in Alaska by 2005.• The interceptors under the Clinton plan would have been supported by a land-based X-band radar, but the Bush administration announced plans August 31, 2002 to develop a sea-based X-band radar instead. Pentagon plans call for the new radar to be completed by September 2005.• Bush's plans also call for the missile interceptors to be supported by an upgraded, though less capable, early-warning radar on Shemya Island at the western tip of the Aleutian Island chain. |

Sea-Based Midcourse Defense

(Referred to as Navy Theater Wide by the Clinton administration)

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| Program & Key Elements | <ul style="list-style-type: none">• 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.• Two Pentagon reports have declared that the Aegis combat system, particularly its radar, is not capable of supporting a strategic missile defense mission.• The SM-3 is also considered too slow to intercept a strategic ballistic missile. |
| Designed to Counter | <ul style="list-style-type: none">• Initially, the sea-based midcourse defense is geared toward defending against short-, medium-, and intermediate-range ballistic missiles during their midcourse stage with an emphasis on the ascent phase.• Eventually, the Pentagon wants the defense to be capable of countering strategic ballistic missiles, possibly in the boost phase.• A senior Pentagon official announced May 2 that the Pentagon would also explore whether the system can be adapted to counter short- and medium-range missiles in their terminal stage. |
| Status | <ul style="list-style-type: none">• In a January 25 test, the system intercepted a target for the first time, but the flight paths of the two objects had been plotted in such a way that an intercept was expected. A second test in June, which was described as "identical" to the first, also succeeded. |

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- Status (Continued)** ● The third and latest test, which took place on November 21, 2002, also resulted in the target being destroyed. In this test the target was still ascending, whereas in the last two it was descending.
- Capability/Schedule** ● Clinton administration plans called for five intercept attempts to be completed by September 2002.
- The Bush administration has stated it would like to have a sea-based system available by 2004 as part of a rudimentary, emergency capability against short- and medium-range ballistic missile threats.
- The Pentagon is seeking to deploy four ships outfitted with a midcourse defense between 2006 and 2008.
- Lieutenant General Ronald Kadish, who is director of the Pentagon's Missile Defense Agency, estimated in July 2001 that testing the system against long-range ballistic missiles could begin in 2007 or 2008.

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, which is still under development.
- Capability/Schedule** ● First attempt to intercept a ballistic missile target is scheduled for the fall of 2004, but Kadish publicly raised doubts October 31, 2002 about whether the test would happen on time because of possible flight problems stemming from the heavy weight of the laser in the plane's rear. Kadish said it isn't a problem of too much weight, but one of weight distribution.
- The Clinton administration planned for the first ABL intercept attempt to take place in 2003.
- The Pentagon is seeking to have one ABL available by 2004 for use in emergencies.
- The Pentagon aims to have two or three ABLs between 2006 and 2008.
- The Pentagon's ultimate goal is a fleet of seven aircraft by 2011.

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 specifically designed THAAD radar.
- The THAAD kill vehicle is hit-to-kill.
- Designed to Counter** ● THAAD missiles are fired from a truck-mounted launcher.
- THAAD's mission is to intercept short- and medium-range ballistic missiles during their terminal stage.
- 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 is currently being redesigned.
- Capability/Schedule** ● THAAD flight tests are scheduled to resume in 2004.
- The Pentagon initially aims to field the system in 2007 or 2008.

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.

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- Status**
- A March 21 operational test, the second, resulted in a PAC-3 hitting its target, though a second PAC-3 missile did not fire as called for in the test.
 - An April 25 operational test, the third, was initially reported as a success, but the Army later announced that the PAC-3 missile did not destroy the target. A second PAC-3 missile failed to launch.
 - In a fourth, and reportedly final, operational test in this testing series, a PAC-3 missile hit its target on May 30, but a second PAC-3 missile failed to fire as planned.
 - During earlier developmental testing, the system struck nine out of 10 targets.
- Capability/Schedule**
- As of the end of October 2002, 38 PAC-3 missiles had been delivered to the Army for deployment and another 15 are scheduled for delivery by the end of 2002.
 - The Army has a projected inventory of 2,200 PAC-3 missiles.
 - Despite the problems in operational testing, Kadish described PAC-3 on October 31, 2002 as a “useful military system” and recommended purchasing them “as rapidly as we can afford to buy them.”

Navy Area Theater Ballistic Missile Defense (NATBMD)

- Program & Key Elements**
- NATBMD was a ship-based system consisting of the Standard Missile-2 (SM-2) and Aegis combat system.
 - Unlike other U.S. missile defense programs the SM-2 was armed with a blast fragmentation warhead and was not a hit-to-kill system.
- Designed to Counter**
- The system was intended to intercept short- and medium-range ballistic missiles in their terminal stage.
- Status**
- The Bush administration canceled the program on December 14, 2001, because of poor performance, projected cost overruns, and schedule delays.
 - A senior Pentagon official announced May 2, 2002, that the Pentagon would not pursue development of a new naval terminal system.
 - As an alternative to a new program, the Pentagon will study whether the sea-based midcourse defense can be modified so that it can also deal with theater missiles in their terminal stage.

Space-Based Laser (SBL)

- Program & Key Elements**
- The proposed system's main element would be a satellite armed with a hydrogen-fluoride chemical laser.
- Designed to Counter**
- The SBL is being developed to counter all ranges of ballistic missiles in their boost phase.
- Status**
- The Pentagon closed the program office dedicated to developing the laser in September 2002.
 - Pentagon plans during the Clinton administration called for a first space test in 2012, but a MDA spokesperson said November 7, 2002 that there are no planned experiments.

Space-Based Infrared System-low (SBIRS-low)

- Program & Key Elements**
- SBIRS-low is to be comprised of approximately 30 satellites in low-Earth orbit.
- Designed to Counter**
- The SBIRS-low satellites are expected to support U.S. missile defense systems by providing tracking and discrimination data on warheads and decoys during their midcourse stage.
- Status**
- The first launch of a SBIRS-low satellite was to take place in fiscal year 2006, but the program is currently being restructured because of high costs and schedule delays.
 - A senior Pentagon official said May 2, 2002, that a launch of a SBIRS-low payload could occur in 2006 or 2007.
 - During the Clinton administration, Pentagon plans called for full deployment by fiscal year 2010.
 - No official estimate exists on a possible deployment date.

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Space-Based Infrared System-high (SBIRS-high)

- Program & Key Elements** • SBIRS-high will be comprised of four satellites in geosynchronous Earth 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** • The first launch of a geosynchronous satellite was scheduled to occur in fiscal year 2005, but it is now scheduled for fiscal year 2007.
 - The first payload for the two satellites in a highly elliptical orbit is to be ready by 2003.
- Capability/Schedule** • An Air Force spokesperson reported May 21 that current expectations are that the full SBIRS-high system will be operational "on or about 2011."

Ballistic Missile Basics

Ballistic missiles 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.

All 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.