U.S. Missile Defense Programs at a Glance

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Wade Boese

President George W. Bush announced December 17, 2002, that the United States would field initial elements of a limited national missile defense system by September 2004.

The United States has researched and worked on the development of missile defenses to counter ballistic missiles for more than five decades. Bush's declaration marks the second time that the United States has moved to deploy a system against long-range missiles following negotiation of the 1972 Anti-Ballistic Missile Treaty, from which the United States withdrew June 13, 2002. The first effort, Safeguard, was shut down within a few months of being declared operational in October 1975. Under Safeguard, the United States deployed missile interceptors in North Dakota to protect an ICBM field.

The Bush administration inherited seven main missile defense programs, including the strategic ground-based interceptor system, and two related satellite programs from the Clinton administration. For the most part, despite increased spending the Bush administration has not been able to accelerate the various programs' development. A sea-based system has also been canceled, and another system, the space-based laser, has been dramatically scaled back to a general research program.

The following factfile provides a brief look at each major U.S. missile defense program. It contains information on what type of ballistic missile each defense is intended to counter. Also included are Pentagon estimates on when each defense may have an initial, rudimentary capability as well as when it may be fully operational.

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, with a range less than 1,000 kilometers (approximately 620 miles)
- Medium-range ballistic missiles, with a range of 1,000–3,000 kilometers (approximately 620-1,860 miles)
- Intermediate-range ballistic missiles, with a range of 3,000–5,500 kilometers (approximately 1,860-3,410 miles)
- Intercontinental ballistic missiles (ICBMs), with a range of 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.

Short- and medium-range ballistic missiles may or may not exit the atmosphere. They also may stay in one piece instead of deploying a separating warhead, and are less likely to employ countermeasures that could accompany an ICBM.

Ground-Based Midcourse Defense	
Program & Key Elements	• The key element of the ground-based mid defense is a ground-based missile interce consisting of a powerful multistage booste exoatmospheric kill vehicle (EKV), which s from the booster in space and seeks out i through radar updates and use of its onbo and infrared sensors. • The EKV destroys its target by colliding w process is referred to as hit-to-kill.
Designed to Counter	• The projected system's goal is to intercep ballistic missile warheads in the midcours
Status	• To date, the system has had five successf intercept attempts in eight developmenta • After four straight successes, the system hit its target in the most recent test Dece 2002. Another intercept attempt is not pla until at least late 2003 following the selec multistage booster. • The development of the multistage booste than two years behind schedule. Early Pe testing plans called for the booster to be i into an actual intercept attempt during th months of 2001, but that will not occur un late 2003. Two companies are currently w separate booster models, both of which w flight-tested twice in the summer of 2003 may keep both or select one of the booste in future intercept testing.
Capability/Schedule	• Lieutenant General Ronald Kadish, directo Pentagon's Missile Defense Agency, decla October 31, 2002, that "[o]ne of my great disappointments has been not being able

	produce a booster for this ground-based s • The Pentagon is currently planning to dep missile interceptors, which are to incorpor new booster, at Fort Greely, Alaska, and f interceptors at Vandenberg Air Force Base California, by September 2004. Another 1 interceptors are to be deployed at Fort Gr during 2005. • There are no plans to fire interceptors fro Greely for testing purposes. • Clinton's missile defense plans called for deployment of 20 missile interceptors in A 2005. • The interceptors under the Clinton plan w have been supported by a land-based X-b radar, but the Bush administration annou plans August 31, 2002, to develop a sea-b band radar instead. • Pentagon plans call for the new radar, wh put on a mobile sea platform, to be comp September 2005. • Bush's plans also call for the missile inter be supported by an upgraded, although le capable, early-warning radar on Shemya I the western tip of the Aleutian Islands cha radar, known as the Cobra Dane radar, wi able to track missiles fired from the direct Asia because the radar is fixed to face no

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-b defense are a ship-based missile (Stand Missile-3, or SM-3) and the Aegis comba advanced system that can detect and t than 100 targets simultaneously while c ship's weapons to counter incoming air and submarine threats. • The SM-3 is a hit-to-kill missile comprise stage booster with a kill vehicle. • Two Pentagon reports have declared th combat system, particularly its radar, is of supporting a strategic missile defens • The SM-3 is also considered too slow to strategic ballistic missile.
Designed to Counter	• Initially, the Aegis BMD is geared towar against short-, medium-, and intermedi ballistic missiles during their midcourse an emphasis on the ascent phase. • Eventually, the Pentagon wants the def capable of countering strategic ballistic possi-bly in the boost phase. • A senior Pentagon official announced M that the Pentagon would also explore w system can be adapted to counter shor

	medium-range ballistic missiles in their stage.
Status	• In a January 25, 2002, test, the system a target for the first time, but the flight interceptor and target had been plotted way that an intercept was expected. A in June, which was described as "identi first, also succeeded. • The third and latest test, which took pla November 21, 2002, also resulted in th being destroyed. In this test, the target ascending, whereas in the previous two descending. • The target used in the three intercept t reflective of what the system is expecte in a real-world situation. The target use and slower-moving than what the defen expected to counter. • Clinton administration plans called for f tests to be completed by September 20 Pentagon has only conducted three so f
Capability/Schedule	• As part of its initial missile defense capa Bush administration announced Decem 2002, that it will try to deploy up to 20 interceptors on three ships during 2004 Another 15 ships are to receive upgrade improve their missile tracking capabiliti • Kadish estimated in July 2001 that testi system against long-range ballistic miss begin in 2007 or 2008.

Airborne Laser (ABL)

Program & Key Elements	• The key element of the proposed ABL s modified Boeing 747 plane equipped wi chemical oxygen-iodine laser. • The laser beam is produced by a chemi
Designed to Counter	• Although the Pentagon originally aimed ABL against theater ballistic missiles, th now contends the ABL may have an inh capability against strategic ballistic mis • The expanded ABL objective is to shoot ranges of ballistic missiles in their boost
Status	• The first ABL test plane made its inaugu July 18, 2002. The plane was not equipp laser, which is still under development. • The first attempt to intercept a ballistic target is supposed to occur in late 2004 mid-2005. But Kadish indicated in April the estimated heavy weight of the laser troublesome and could delay the progra added, "We are right on the edge of ma very revolutionary technology either pr

	fail. And we just don't know the answer question yet." • The Clinton administration planned for intercept attempt to take place in 2003
Capability/Schedule	• The Pentagon said in 2002 that it wante one ABL available for emergency use in two or three ABL aircraft operational be and 2008. At this time, the earliest an A available for any use is 2005.

Theater High Altitude Area Defense (THAAD)

Program & Key Elements	• THAAD's main components are a missile of a single rocket booster with a separati vehicle that seeks out its target with the specifically designed THAAD radar. • The THAAD kill vehicle is hit-to-kill. • THAAD missiles are fired from a truck-mo launcher.
Designed to Counter	• THAAD's mission is to intercept short- ar range ballistic missiles at the end of thei stage and in the terminal stage. Intercep take place inside or outside the atmosph
Status	• The system had two successful intercept the summer of 1999 after experiencing s failures between April 1995 and March 1 • The THAAD missile is currently being red • THAAD flight tests are scheduled to resu Intercept attempts against threat-repres targets are set for 2006.
Capability/Schedule	• Current Pentagon plans call for THAAD te through at least 2008, although the Pent envisions deploying THAAD interceptors between 2006 and 2008.

Patriot Advanced Capability-3 (PAC-3)

Program & Key Elements	• PAC-3 consists of a one-piece, hit-to-kill interceptor fired from a mobile launching which can carry 16 PAC-3 missiles. • The missile is guided by an independent sends its tracking data to the missile thr mobile engagement control station.
Designed to Counter	• PAC-3 is designed to defend against shor medium-range ballistic missiles in their t stage at lower altitudes than the THAAD
Status	• During earlier developmental testing, the struck nine out of 10 targets. • In four, more difficult operational tests b February and May 2002 that involved mu interceptors and targets, seven PAC-3s w fired at five targets. Of the seven PAC-3s destroyed their targets, one hit but did n its target, one missed its target, and thre

	not launch. • PAC-3s destroyed two Iraqi short-range b missiles in the latest conflict and reporte down a U.S. fighter jet.
Capability/Schedule	• By the end of 2002, more than 50 PAC-3 delivered to the U.S. Army for deploymer • Kadish projected in March 2003 that abo PAC-3s should be available for use by the 2005.

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 constellation could expand to as many a satellites.
Designed to Counter	• STSS satellites are expected to support U defense systems by providing tracking d missiles during their entire flight.
Status	• The two STSS satellites are to be launch year 2007. The SBIRS-low program had c first launch of a satellite a year earlier.
Capability/Schedule	• The first next-generation STSS satellite launched in 2011. • Two satellites would provide little, if any capability. The Pentagon estimates that satellites would need to be deployed to p coverage of key regions of concern. Wor coverage could require up to 30 satellite

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

Program & Key Elements	• SBIRS-high will be comprised of four sat geosynchronous orbit and sensors on tw satellites in a highly elliptical orbit.
Designed to Counter	• SBIRS-high's primary objective is to prov warning of global ballistic missile launch
Status	• A geosynchronous satellite launch was s year 2005, but it is now slated for Octob • The first payload for the two satellites in elliptical orbit was supposed to be delive 2003, but a U.S. Air Force spokesperson 2003 that the payload "encountered iss final testing" and that it is now schedule later in the summer.
Capability/Schedule	• The first geosynchronous satellite is to initial operational capability in fiscal yea

	operation of multiple satellites is suppos tested in fiscal year 2009.

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