Missile Defense-

Worldwide

BMDS BOOKLET FIFTH EDITION

"We are gaining widespread international support and cooperation... to close the gaps and improve our capability to keep pace with growing threats...

Moving ahead strongly with our allies in building missile defenses, we can send a strong message to our enemies: investing in ballistic missiles is just not worth it. We can and will destroy them if used against us or our allies."

– Lieutenant General Henry A. Obering III
Director, Missile Defense Agency

Executive Summary

The United States, in active partnership with its allies, has fielded an initial layered integrated Ballistic Missile Defense System (BMDS). The United States has come a long way since President Ronald Reagan first delivered his challenge to the defense community 25 years ago—to develop anti-ballistic missile technologies to improve our national security and lessen our reliance on nuclear deterrence. Although the nature of the threat has changed substantially since he envisioned the Strategic Defense Initiative, the harsh realities of today's global security environment push the United States to field missile defenses as soon as possible.

Ballistic missile technology and associated threats have proliferated in recent years. The continuing development of chemical, biological, and nuclear weapons poses considerable danger, especially when paired with ballistic missiles. State and non-state actors could use WMD carried on ballistic missiles to blackmail and intimidate the United States and our allies, by potentially holding hostage hundreds of thousands of people. Iran's pursuit of ballistic missiles poses a grave, evolving threat to the United States, our allies, and friends. Meanwhile, the combination of its recent nuclear and long-range missile tests makes North Korea a real threat to international peace and security.

Ballistic missile defense is one of the most complex and challenging missions in the Department of Defense (DoD). A ballistic missile's altitude, speed, and range leave a defender little time to react. To meet this challenge, the Missile Defense Agency (MDA) is developing a layered, integrated system capable of destroying a ballistic missile in each of three distinct phases of flight—boost, midcourse, and terminal. The system requires accurate missile identification and tracking with advanced sensors; advanced interceptor missiles or directed energy weapons (e.g., lasers); and reliable Command and Control, Battle Management, and Communications (C2BMC) to integrate the system and direct the engagement.

With the initial fielding of the BMDS in July 2006, the United States now has a limited defense against ballistic missile attack. This initial capability provides a defense against short- and medium-range ballistic missiles using PATRIOT Advanced Capability-3 (PAC-3) missiles and Aegis Ballistic Missile Defense (BMD) Standard Missile-3 (SM-3). The initial capability also enables engagement of intermediate-range and intercontinental ballistic missiles in the midcourse phase using Ground-Based Interceptors (GBIs). These layers are integrated through an advanced C2BMC network.

MDA continues its strong research and development program to improve and upgrade existing capabilities. MDA continues to develop, test, and field an increasingly capable system of interceptors, sensors, and command and control systems to improve the depth, range, and reliability of our defenses. In 2008, MDA will work to broaden and deepen the initial capability by expanding our missile defense cooperation with allies and friends. In addition we will add more networked, forward-deployed sensors and increasingly capable interceptors at sea and on land.

The Agency's mission—to develop and field an integrated, layered BMDS to defend the United States, its deployed forces, allies, and friends against all ranges of missiles in all phases of flight—is more relevant now than ever before. The years ahead will be demanding as MDA continues the tough task of developing, testing, and enhancing our worldwide ballistic missile defenses.

COL Thom Besch explains the Hit-to-Kill technology of the Ground Based Interceptor

GBI being emplaced at Fort Greely, Alaska

Mobile Assets: (from top to bottom)
the Airborne Laser, Aegis BMD, and THAAD

Worldwide Missile Defense

The Arrow System is a US-Israeli cooperative effort

Japanese Destroyer JS Kongo completed Japan's first successful intercept using the Aegis BMD system on December 17, 2007

Early Warning Radars: RAF Fylingdales and the Sea-Based X-Band Radar

Protecting Our Friends and Allies

Introduction and Goals

Background

The possession of weapons of mass destruction and ballistic missiles by potential adversaries is an urgent security issue for the United States and our allies. The United States strives to prevent further proliferation of these weapons and roll back these capabilities in potentially hostile nations. We also must be prepared to defeat ballistic missile attacks, should they occur.

The United States is fielding the BMDS to provide such protection.The BMDS is a collection of elements and components integrated to achieve the best possible performance against a full range of potential threats. Formerly, some of these elements had been developed to act as independent missile defense systems. Once the United States withdrew from the Anti-Ballistic Missile Treaty in 2002, MDA was able to leverage the benefits of integrating complementary, layered systems.

Fielding missile defense capabilities requires the combined efforts of MDA, the Office of the Secretary of Defense, the U.S. Combatant Commands, the Military Services, the Joint Chiefs of Staff, other federal agencies, more than 17 major defense contractors, the Congress, and, increasingly, our allies and friends.

Mission

MDA's mission is to develop and field an integrated, layered BMDS to defend the United States, our deployed forces, allies, and friends against all ranges of enemy ballistic missiles in all phases of flight. A ballistic missile trajectory is divided into three distinct phases. In the boost phase, the ballistic missile's rocket engine ignites and thrusts the missile into space. Following boost, the missile coasts in the midcourse phase and may deploy a Reentry Vehicle (RV) and countermeasures. In the terminal phase, the missile reenters the atmosphere and proceeds to the intended target.

As directed by the President, the United States has fielded Ballistic Missile Defense assets to demonstrate missile defense technologies and provide a limited defense against long-range ballistic missile attacks aimed at any of our 50 states. MDA is expanding the breadth and depth of this initial capability by adding and networking mobile and forward-deployed sensors and interceptors at sea and on land.

Flight test FTT08

Goals

MDA's current activities are focused on several critical areas including: organizational excellence, an effective core competency, capability enhancement, and productive partnerships. In these areas, MDA simultaneously pursues seven strategic goals:

1. Retain, recruit, and develop a high-performing and accountable workforce
2. Deliver near-term additional defensive capability in a structured Block approach to close gaps and improve the BMDS
3. Establish partnerships with the Services to enable their operations and support of the BMDS components for the Combatant Commanders
4. Substantially improve and demonstrate the military utility of the BMDS through increased system integration and testing
5. Execute a robust BMDS technology and development program to address the challenges of the evolving threat through the use of key knowledge points
6. Expand international cooperation through a comprehensive strategy to support our mutual security interests in missile defense
7. Maximize mission assurance and cost effectiveness of MDA's management and operations through continuous process improvement

Integrated System Development

The Initial Capability and Beyond

In December 2002 President George W. Bush directed the DoD to begin fielding limited missile defense capabilities to meet near-term ballistic missile threats to our homeland, deployed forces, allies, and friends. MDA responded to this direction and by late 2004 fielded a system to provide a limited defense capability to intercept and destroy a ballistic missile launched from North Korea or Iran before it can strike the United States.

MDA continues an aggressive development program that will yield over the long-term a system having multiple sensors and interceptors integrated by a centralized Command, Control, Battle Management, and Communications network. This network will enable the sharing of missile tracking data from any BMDS sensor to all system components.

MDA also plans to increase the breadth and depth of our missile defenses by adding more forward-deployed, networked sensors, and additional interceptors based at sea and on land. In 2007 MDA began negotiations with Poland and the Czech Republic to deploy long-range defenses in Europe. An integrated, layered BMDS will complicate any attack by the adversary and thereby reduce the military utility of ballistic missiles, discourage the proliferation of such technology, and bolster deterrence.

Success in missile defense operations depends on developing and integrating technologies and capabilities into sensor and weapon components to perform critical missile defense functions, such as acquisition, discrimination, and target selection. The effective integration of the system requires a sophisticated Command and Control, Battle Management, and Communications architecture, which must be able to accommodate enhanced capabilities as they are integrated into the system over the years. MDA must be ready to provide operational capability while continuing to develop and test the BMDS. To make this possible, we have added a concurrent test, training, and operations (CTTO) capability.

Our Acquisition Strategy

In January 2002, the Secretary of Defense set forth the following missile defense priorities for DoD:

- Defend the United States, deployed forces, allies, and friends
- Employ a layered BMDS to intercept missiles of all ranges in all phases of flight
- Develop and test technologies, use prototype and test assets to provide early BMDS capability, and improve the effectiveness of deployed capability by inserting new technologies as they become available or when the threat warrants an accelerated capability
- Field elements of the overall BMDS as soon as practicable

To implement these priorities, MDA established a single development program for all work required to design, develop, and test the elements and components of an integrated BMDS. MDA uses an evolutionary acquisition approach to develop an initial capability and then evolve that capability through technology upgrades and the addition of new layers. The missile defense program was initially structured to deliver capability in two-year "Blocks," each providing capability upgrades and new fielding opportunities. The first period, Block 2004, represented calendar years 2004-2005; Block 2006, 2006-2007; and Block 2008, 2008-2009 deliveries. Despite MDA's considerable success to date, Congressional and other stakeholders have called on the Agency to revise its block structure to enhance transparency, accountability and oversight. In response, the MDA Director approved a new block structure approach in June 2007. Blocks will capture fielded capabilities to address particular threats--not structured to reflect biennial time periods. Each Block now represents a discrete program of work.

A capability-based acquisition approach, which includes a capability based planning and spiral development, is central to MDA's acquisition strategy. This approach does not respond to an a priori defined threat, which could change during development and leave us with an inadequate capability. Instead, a capabilities-based approach relies on the development of capabilities and objectives based on technological feasibility, disciplined engineering analyses of warfighter desires and capability gaps, and our understanding of the current and future threat environments. This approach allows the Agency to exploit technical opportunities sooner, add capabilities with demonstrated military utility, and adapt to emerging threats.

The foundation of MDA's program of work is an aggressive research, development, test and evaluation effort guided by capability-based planning and spiral development. Spiral development is an iterative process. It allows the Agency to refine program objectives as technology matures through experimentation and risk management. It incorporates continuous feedback derived from regular interaction among developers, the warfighters, and the test community. Spiral development supports an evolutionary acquisition approach to missile defense in which there is no fixed or final architecture for the system. Rather, it emphasizes improving the effectiveness of defensive capabilities over time as resources allow. The spiral development approach allows planning for these incremental improvements in capability and focuses on integration activities.

MDA uses knowledge-based decision making to implement capability-based acquisition. Knowledge-based decisions allow for incremental financial commitment to a development effort based on achieving planned knowledge points. Each added commitment of funding hinges on knowledge gained from a specifically demonstrated event (rather than analysis or review), and the Agency maintains flexibility to make adjustments when planned knowledge points or program milestones are not achieved. Planned knowledge points allow the Agency to manage risk systematically and get the most out of research and development efforts.

The benefit of this approach, called knowledge-based funding, is the ability to pursue multiple promising programs, assess progress towards achieving development goals, and retain flexibility to make decisions to redirect, stop, or accelerate any one program based on actual performance. Knowledge-based funding allows MDA to use budgetary resources efficiently and responsibly.

Systems Engineering

MDA's Systems Engineering Directorate defines, manages, and integrates all engineering development for the BMDS. A comprehensive and collaborative systems engineering process defines required system-wide behavior, validates element system designs, and assesses and verifies system capabilities.

Success for the single, integrated system depends not only on developing the right technologies to perform numerous missile defense functions (e.g., target detection, discrimination, and acquisition), but also on achieving a high level of synergy among multiple geographically dispersed sensor and weapon components. Systems Engineering provides an integrated and layered architecture; writes technical definitions; and develops element and/or component requirements, schedules, verification strategies, and other products required to execute the missile defense program.

Engagement Sequences

MDA identifies desired BMDS capabilities, architectures, and element contributions to counter specified threats and then organizes them by Engagement Sequence Groups (ESG). These Engagement Sequence Groups describe a combination of sensors, weapons, and Command and Control, Battle Management, and Communications capabilities that must work together to detect, track, and intercept an enemy missile or its payload. ESGs enhance functional and engineering analysis, simplify allocation of system capabilities, provide a structure to assess system performance, and assist the warfighters in developing concepts of operations (CONOPS).

BMDS Capability Through 2007

Over the past few years, the United States has fielded an initial BMDS and is enhancing the system with additional capabilities in the form of deployed sensors, interceptors, and enhanced command and control. Current system architecture consists of the following:

- 24 GBI emplaced in silos in Alaska and California
- 21 SM-3 sea-based interceptors
- Three Navy Aegis BMD Cruisers and seven Destroyers capable of engaging short- to intermediate-range missiles and able to perform the Long-Range Surveillance & Track (LRS&T) mission.
- 505 PAC-3 missiles.
- A Sea-Based X-Band (SBX) radar capable of providing robust discrimination to the system.
- Active Upgraded Early Warning Radar (UEWRs) in California and the United Kingdom and an upgraded Cobra Dane radar in Alaska
- Two Forward-Based X-Band Radars (AN/TPY-2) delivered (one deployed to Shariki, Japan)
- Initial Global Integrated Fire Control (GIFC) capability
- A C2BMC system on line at three COCOMs with situational nodes within the National Capital Region and the UK.

Integrated Ballistic Missile Defense System

MDA International Strategy and Current International Programs

In order to protect national territories, deployed forces and our friends and allies most effectively, the BMDS must be worldwide. As a result, international partners are critical to the success of our mission. The MDA International Strategy was approved by the Director in August 2007. This establishes the vision, goals, and strategic objectives for strengthening BMD efforts with our international partners and guides our international engagement to those relationships, which are mutually beneficial, effective, and efficient.

The MDA International Strategy goals direct all international cooperative efforts, ensuring that each effort advances the Agency towards accomplishment of its mission. These top-level goals are supported by strategic objectives that further define the goals and provide the foundation for implementation activities. While not all goals and objectives will be appropriate with each partner, the following goals lay out the general approach we intend to take. The MDA International Strategy goals are:

Outreach: Build relationships as enablers to achieve international missile defense goals and communicate the importance of missile defense by promoting worldwide BMDS through the sharing of information with allies and partners.

Capability and Interoperability: Promote missile defense capability and interoperability through appropriate means such as: the fielding of missile defense assets, identification and integration of U.S. and partner assets and systems to create a global ballistic missile defense system, and the promoting of interoperability among U.S. and partner systems on both bilateral and multilateral bases.

Technology: Identify and evaluate international technology in support of improved worldwide ballistic missile defense system capabilities.

Investment: Identify and execute investment opportunities with allies and partners.

Workforce: Shape a qualified and capable workforce to execute the MDA International Strategy.

International Programs

MDA continues to aggressively build on a very successful program to involve more countries and forge international partnerships. These partnerships span the globe and address all elements of the international strategy. To date, MDA has successfully negotiated five "framework" agreements, signed by the Secretary of Defense, to facilitate BMD cooperation with Japan, the United Kingdom, Australia, Denmark, and, most recently, Italy. Many cooperative activities are also ongoing or under consideration with several other nations.

Negotiations are currently underway to locate up to ten silo-based long-range missile defense interceptors in Poland and a midcourse tracking and discrimination radar in the Czech Republic to provide an improved capability to defend the United States and our European allies against ballistic missile attack from the Middle East. The deployment of U.S. missile defense assets in Europe represents a major U.S. initiative that will provide the capability to extend defensive coverage to Europe against longer-range ballistic missiles, enhance the collective security of the North Atlantic Treaty Organization (NATO) Alliance, and strengthen trans-Atlantic unity.

In December 2007 Japan became the first ally to successfully intercept a ballistic missile target with the Aegis BMD system. Japan will continue to upgrade its remaining KONGO Class Aegis Destroyers through 2010. Japan also is upgrading its PATRIOT System fire units with PATRIOT Advanced Capability-3 (PAC-3) missiles and improved ground support equipment. In 2008, Japan is expected to begin co-production of the PAC-3 missile.

The upgraded Royal Air Force Fylingdales early warning radar in the United Kingdom will soon receive final certification and undergo operational testing that will enable the radar to provide the BMDS critical early warning, tracking and cueing data. MDA is also working closely with Denmark to upgrade the Thule early warning radar in Greenland to improve its capability to detect and track ballistic missiles.   These two activities represent significant contributions to our ability to defeat threat missiles coming out of Iran.

MDA conducted satellite-to-ground experiments recently and will conduct satellite-to-satellite communication experiments with a German-built Laser Communications Terminal installed in the Near Field Infrared Experiment (NFIRE) satellite. Together with an identical terminal on a German satellite, the United States and Germany will perform joint experiments to validate the use of laser technology for high-speed space communications.

Forward Based X-Band Radar (AN/TPY-2)

The United States and The Netherlands have been working together to modify Dutch frigates with a combat system to enable ballistic missile detection and tracking.

MDA is also continuing to work with Israel to implement the Arrow System Improvement Program to enhance Israel's capability to defeat longer-range ballistic missile threats. In addition, MDA is currently working with Israel to address options for countering very short-range threats.

Multilaterally, MDA has supported the establishment of NATO's Active Layered Theater Ballistic Missile Defense (ALTBMD) Program Office, and MDA supports the ALTBMD Program Office's efforts to develop a capability to protect deployed forces by 2010. MDA continues to be very active in supporting NATO partners in advancing the dialogue on the political-military implications of defending European population centers against longer-range missile threats. MDA is also exploring potential cooperation with several countries with whom MDA has had long-standing dialog, such as France, Russia, and Turkey. in addition, MDA is working to establish relationships with new partners, including Ukraine, India, South Korea, and the United Arab Emirates.

Airborne Laser Aircraft

As MDA moves forward with its international strategy and program initiatives, it will continue to identify new opportunities for cooperation. Key to this process will be continued cooperation with U.S. industry, which can often lead the way with regard to international collaboration through its partnerships with international industry.

No single Service can engage ballistic missiles of all ranges and through all phases of flight. To provide such capability, the U.S. Armed Forces, with the support of a coalition of friends and allies, must conduct ballistic missile defense warfare through integrated, multi-layered defense. Truly robust worldwide ballistic missile defense capabilities can only be achieved through enhanced international engagement and partnerships. MDA is committed to working with international partners and welcomes continued collaboration in the global community. MDA also continues to work in concert with Combatant Commanders and the warfighters to support its mission and international goals.

BMDS Elements and Components

Cumulative Quantities	2006	2007	2008
Weapons			
Ground-Based Interceptors (Long-Range Threat, Midcourse Defense)	14 Interceptors	24 Interceptors	up to 30 Interceptors
Patriot Advanced Capability-3 (Short- & Medium-Range Threat, Terminal Defense)	427 Interceptors	505 Interceptors	up to 646 Interceptors
Standard Missile-3 Sea-Based Interceptors (Short- to Intermediate-Range Threat, Midcourse Defense)	14 Interceptors	21 Interceptors	up to 38 Interceptors
Aegis Ballistic Missile Defense (Aegis Ballistic Missile Defense Ships with LRS&T Capability)	3 Destroyers 3 Cruisers	7 Destroyers 3 Cruisers	up to 15 Destroyers up to 3 Cruisers
Sensors			
Existing Defense Support Program Satellites			
Upgraded Existing Early Warning Radars	1 (Beale AFB, CA) 1 (Shemya, AK) 1 (Fylingdales, UK)	1 (Beale AFB, CA) 1 (Shemya, AK) 1 (Fylingdales, UK)	1 (Beale AFB, CA) 1 (Shemya, AK) 1 (Fylingdales, UK)
Aegis Ballistic Missile Defense Ships (Long Range Surveillance and Track Only)	10 Destroyers	7 Destroyers	
Sea-Based X-Band Radar	1 Forward Operating Base (Adak, AK)	1 Forward Operating Base (Adak, AK)	1 Forward Operating Base (Adak, AK)
AN/TPY-2	1 AN/TPY-2	2 AN/TPY-2	2 AN/TPY-2
Command and Control Battle Management Communications	Combat Commanders:	U.S. Strategic Command (USSTRATCOM) U.S. Northern Command (USNORTHCOM) U.S. Pacific Command (USPACOM) National Military Command Center (NMCC)	AN/TPY-2 Sensor Management, Japan Host Nation Interface

BMDS Test Strategy

The fielded BMDS will support continued development and testing of new and evolving technologies. The ability to test and operate concurrently allows MDA to pursue a wide range of flight and ground test scenarios in diverse basing modes and to collect an increasing amount of data. The MDA test program will increase the complexity and operational realism as the BMDS spiral development progresses.

Concurrent Test, Training, and Operations

A concurrent test, training, and operations capability is designed to meet the simultaneous requirements of defending the United States from ballistic missile attack while continuing to develop system capabilities through spiral upgrades. Concurrent test, training, and operations require MDA to collaborate closely with Combatant Commanders to ensure mission success. The MDA Operations Center works in harmony with the Combatant Commands to reserve and apportion test assets through a formal Asset Management process. An effective training program is critical to system operational readiness, combat effectiveness, and overall performance. MDA is fielding a Distributed Multi-Echelon Training System to enable crews, staffs, supporting headquarters, and command authorities to maintain proficiency in the challenges facing them as they operate the BMDS while supporting training from worldwide operating locations.

System-Level Testing Process

With the evolution of the BMDS, testing needs have expanded beyond those of the individual elements into a system-wide approach. System-level test events, documented in the Integrated Master Test Plan, involve one or more elements acting to verify the capability of the system in one or more of the Engagement Sequence Groups.

Planning for each system test begins with an outline of test objectives and requirements, developed cooperatively with the systems engineers, program elements, and the BMDS Operational Test Agency (OTA) Team. The mission of the BMDS OTA Team is to provide independent operational assessments of the BMDS.

System test objectives and requirements are tailored to factor in the needs of participating elements, the availability and capabilities of test tools, and the configuration constraints imposed by the test venues. From these system test objectives and requirements, test planners consider a collection of testing and simulation events and scenarios (e.g., modeling and simulation, war games, ground tests, and flight tests) to determine which event would be most suitable to meet the objectives and requirements. BMDS test managers design component test programs to support the Integrated Master Test Plan and their participation in the overall system-level test program.

Warfighter Participation

The U.S. Combatant Commanders and the Military Services have a critical leadership role in the development, integration, and operational employment of existing and future missile defense capabilities. Therefore, MDA works in close collaboration with the Combatant Commanders and the Military Services through a Warfighter Involvement Process and various other venues such as exercises, war games, and seminars. This process is structured to generate opportunities to collaborate with the warfighters in defining, advocating, and prioritizing requirements for additional system capabilities. The process also allows MDA to have a standard approach for documenting, assessing, and implementing modifications to fielded system capabilities and configurations, as well as requirements for training, logistical support, and long-term sustainment of fielded capabilities. This collaboration helps warfighters develop operational concepts, formulate logistical sustainment policies and procedures, conduct training, and facilitate timely fielding of missile defense capability.

Summary




In 2004 the United States fielded the BMDS Test Bed that could be used for limited defense operations to intercept and destroy a ballistic missile before it could strike any of our 50 states. Through the dedicated efforts of many people, The United States now has a limited layered integrated system of defenses against enemy ballistic missile threats. This initial capability will continue to evolve over time.

In 2007, MDA successfully passed a number of milestones. The GMD program successfully completed ten more interceptor emplacements and an interceptor flight test. The Sea-Based X-Band radar was completed, achieved satellite tracking, accomplished sea trials and participated in a September 2007 test involving a long-range interceptor. The Terminal High Altitude Area Defense completed three successful flight tests and a tracking exercise after six years of intensive reengineering. The PATRIOT Advanced Capability-3 Program achieved another successful intercept test with the PAC-3 interceptor. The Aegis BMD Program successfully conducted an unprecedented four flight tests. Each flight test resulted in historic accomplishments and involved participation of not only other Ballistic Missile Defense System Elements, but also allied navies. The ABL program concluded initial flight tests of its aircraft and the first phase of laser testing, culminating in a full duration lase at operational power of the main engagement laser. Finally, MDA has developed an approved international strategy to guide engagements with partners as an essential foundation for the Agency's wider strategic vision of a worldwide, integrated BMDS. Evidencing this strategy is Japan's successful flight test, becoming our first ally to successfully intercept a ballistic missile target with the sea-based midcourse engagement capability provided by Aegis Ballistic Missile Defense.

In 2008 MDA will continue to expand this limited capability by adding networked, forward-deployed sensors; additional interceptors at sea and on land; and additional C2BMC assets.

Ballistic Missile Defense System Element and Component Details

Command and Control, Battle Management and Communications

MISSION

The Command and Control, Battle Management, and Communications (C2BMC) Program is the centerpiece of an integrated, layered missile defense. It ensures the flow of information critical to the defense of our nation, friends, and allies. It provides warfighters at both the strategic and tactical levels of command the capability to plan the BMD fight, while concurrently tracking all potential ballistic missile threats; directing weapons to engage on a distributed network; and pairing any sensor with the best available weapon system to defeat ballistic missile threats at any range, in any phase of flight, in all theaters of battle, and with coalition partners.

PROGRAM DESCRIPTION

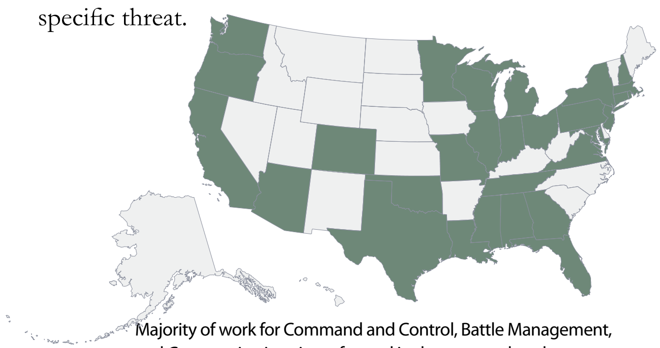
The C2BMC program puts the "System" in the Ballistic Missile Defense System. It is a force multiplier, leveraging element capabilities to make the BMDS greater than the sum of its parts. The C2BMC Program balances the development of four product lines, BMD Planner, Combatant Commander Command and Control (COCOM C2), Global Engagement Manager (GEM), and BMD Network, so that mature capabilities can be integrated and incrementally delivered to the warfighter. Each incremental delivery, or spiral, represents an improvement in capability and functionality over the previous spiral and includes the software, hardware, network connectivity, and support needed to operate an integrated system.

C2BMC provides a planning capability to locate sensors and weapons systems to counter identified threats; situational awareness at all leadership levels of the evolving battle and status of defensive assets; sensor netting to detect, identify, track, and discriminate threats; global integrated fire control to pair the right sensors and weapons systems against multiple threats for the highest probability of kill and most efficient management of a relatively limited shot magazine; and global communications networks to manage and distribute essential data efficiently.

CONTRIBUTIONS TO THE BMDS

The C2BMC Program participates in all the planned ground-, flight-, and Hardware-in-the-Loop tests scheduled for the BMDS in order to test and exercise all their current and future capabilities. They are building an infrastructure that will allow for Concurrent Test, Training, and Operations (CTTO) of the BMDS which will increase the warfighters' proficiency without interfering with system's daily operations.

The planned C2BMC spirals will strengthen the BMDS by providing the ability to correlate threat tracks from multiple sensors via the network, create and distribute an engagement quality system track for the BMDS fire control systems and the engagement planning and processing that optimizes the BMDS sensor resources and shot magazine by selecting engagement sequence groups best suited to a specific threat.



Majority of work for Command and Control, Battle Management, and Communications is performed in the green colored states.

2007 ACCOMPLISHMENTS

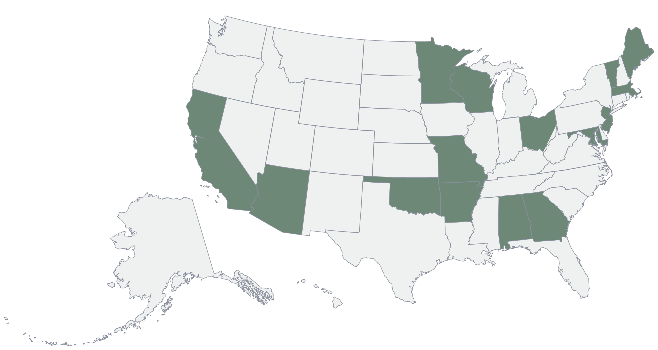
- Fielded redundant C2BMC capability at United States Pacific Command (U.S. PACOM), enabling PACOM's ability to communicate with and manage the AN/TPY-2 radar
- Delivered host nation interface with Japan to meet agreements associated with the deployment of the AN/TPY-2 radar
- Fielded parallel staging network capability to allow network upgrades to occur without interrupting ongoing operations
- Established a direct C2BMC connection to Space Based Infrared System (SBIRS) early warning
- Established communications lines to Juneau, Alaska for AN/TPY-2 participation in BMDS flight tests
- Established Extremely High Frequency (EHF) Satellite Communications (SATCOM) teleport and connectivity with Aegis
- Updated situational awareness displays to consolidate – in one screen – essential information for command authority discussions
- Enabled AN/TPY radar to accept focused search plans and precision cues from other BMDS sensors

Aegis Ballistic Missile Defense

MISSION

The role of Aegis Ballistic Missile Defense (BMD) continues to evolve as the BMDS matures. In 2005 - 2006, we introduced the first engagement capable ships. Presently, there are three Aegis cruisers and seven Aegis destroyers equipped with the certified, operational BMD-capable weapon system and armed with SM-3 missiles. These ships are capable of intercepting short- to intermediate-range ballistic missiles. Today another seven destroyers have the Long Range Surveillance and Track (LRST) capability installed. During 2008 these LRST assets, plus one additional Aegis destroyer, will be converted to engagement capable ships.

Aegis BMD serves as a forward-deployed sensor by extending the battlespace and providing early warning of an intercontinental ballistic missile launch. This Long Range Surveillance and Track capability assists in the defense of the United States, including Hawaii and Alaska, by providing tracking data to cue other system sensors and initiate a Ground-Based Midcourse Defense engagement. This capability is resident on all BMD-equipped Aegis ships.



Majority of work for Aegis Ballistic Missile Defense is performed in the green colored states.

PROGRAM DESCRIPTION

Currently, Aegis ships, manned by the U.S. Navy are engaged in a series of intercept flight tests designed to validate the operational effectiveness of the Aegis BMD capability against a progressively more complex set of targets and scenarios. To date, Aegis BMD has achieved 12 successful intercepts in 14 attempts against short-to-intermediate range, unitary, and separating ballistic missile targets. All 18 Aegis ships will have the engagement capability installed by the end of 2008.

In 2009–2010 the Aegis BMD capability will be expanded to cover a different defense segment, the terminal phase, to engage short- and medium-range ballistic missiles. Improved midcourse discrimination and firepower will also be developed to defeat sophisticated, longer-range ballistic missiles.

The United States and Japan plan to upgrade all four of Japan's KONGO Class Destroyers to the Aegis BMD Operational Combat System. These installations are scheduled for 2007 - 2010. Japan and the United States are jointly engaged in the SM-3 Cooperative Development Program. This program focuses on joint development of a 21 inch diameter SM-3 variant, SM-3 Block IIA, with a unitary kinetic warhead to intercept longer-range ballistic missiles.

Additionally, U.S. has initiated a Multiple Kinetic Vehicle (MKV) development program. It is invisioned the MKV may be integrated into the SM-3 missile at a future date, which will be the SM-3 Block IIB variant.

CONTRIBUTIONS TO THE BMDS

Aegis BMD operates as part of the integrated BMDS supporting or being supported by other elements of the deployed BMDS. In the near future, midcourse (Aegis BMD) and terminal missile defense systems (Patriot, THAAD, TPY-2 and Aegis BMD) will coordinate engagements of short and medium range ballistic missiles. Integrated, layered defense will be realized as tracking information is shared among these systems, enabling a midcourse engagement opportunity followed by coordinated terminal engagements.

Aegis BMD also searches, detects and tracks ballistic missiles of all ranges - including ICBMs, and transmits the track data to the BMDS. This tracking data cues other BMDS sensors to acquire the hostile missile, and assist in the fire control solutions of the GMD system.

2007 ACCOMPLISHMENTS

- Successfully completed four flight tests, all with Allied participation, demonstrating the Aegis Destroyer BMD engagement capability, simultaneous anti-air warfare and ballistic missile engagements, and multiple, simultaneous ballistic missile engagements
- First Japanese Aegis Destroyer upgraded to BMD capability and successfully demonstrated an intercept of a ballistic missile target in December 2007
- Commenced development of near term Sea-Based Terminal capability
- Continued spiral development of the next Aegis BMD configuration, containing enhanced system discrimination and firepower

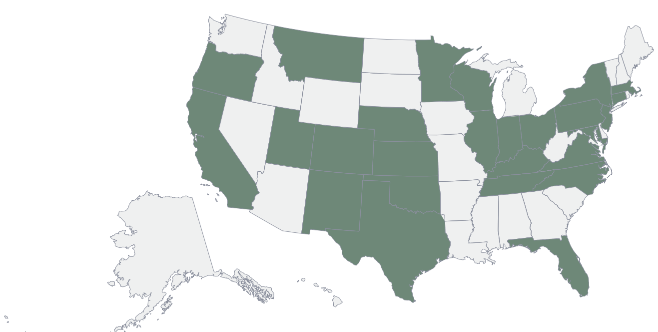
Airborne Laser

MISSION

The Airborne Laser (ABL) is a developmental boost-phase element of MDA's BMDS. Its role will be to defend the United States, its allies, and American forces deployed around the globe by detecting, tracking, and destroying hostile ballistic missiles soon after they are launched.

The Airborne Laser will represent the world's first use of a directed energy airborne weapon system. The Chemical Oxygen Iodine Laser (COIL) system is capable of producing a megawatt-class beam with a range of several hundred kilometers. To ensure the laser beam hits its target with sufficient destructive power, the system uses adaptive optics to compensate for beam distortion caused by atmospheric disturbance.

An Airborne Laser engagement begins when one or more of its six infrared sensors detect the heat from the plume of a hostile-launched missile. One laser swings to the compass bearing indicated by the sensors and locks on to the missile to provide preliminary tracking data. The aircraft's onboard computer system processes and refines the data, triggering the firing of a second laser that finds the missile, settles on the aim point for the high-energy laser, and measures the amount of atmospheric disturbance between the aircraft and its target. Finally, the COIL fires to hit the target missile with sufficient energy to heat up its skin, causing it to self-destruct.



Majority of work for Airborne Laser is performed in the green colored states.

PROGRAM DESCRIPTION

The ABL program is designing, building and testing an airborne laser system with unique capabilities to provide boost-phase defense against ballistic missile threats by acquiring, tracking and destroying ballistic missiles and to support the multi-tiered BMDS concept. ABL integrates three major subsystems (High Energy Laser [HEL]; Beam Control/Fire Control [BC/FC]; and Battle Management, Command, Control, Communications, Computers, and Intelligence [BMC4I]) into a modified commercial 747 aircraft. ABL also includes ABL-specific ground support equipment. The program achieved its latest knowledge point on December 31, 2007 when ABL program managers concluded the aircraft and support system are ready for High Power System Integration. The next planned knowledge point will involve the passage of the first light into Laser Calorimeter through the BC/FC. The first system-level Lethal Demonstration Flight is set for 2009.

CONTRIBUTIONS TO THE BMDS

When fielded, the ABL will be the first line of defense in the BMDS. The primary mission of ABL is to destroy hostile missiles during their boost phase of flight before they can deploy countermeasures or multiple re-entry vehicles. This significantly increases the overall capability of the BMDS by reducing the number of targets faced by the other BMDS elements. ABL will also provide threat protection and enhance the performance of the other elements by providing early ballistic missile launch warning, launch and impact point prediction, and cueing to other BMDS elements via Command and Control, Battle Management, and Communications (C2BMC). Additionally, ABL's ability to detect launches and their launch points will increase the probability of successful counterstrikes against aggressor missile launchers.

2007 ACCOMPLISHMENTS

- Completed refurbishment of the Optical Diagnosis Subsystem in preparation for installation onto the aircraft
- Completed aircraft structural modifications in preparation for the COIL installation
- Completed installation and ground testing of the two illuminator lasers– Tracking Illuminator and Beacon Illuminator
- Demonstrated ability to deliver scaled lethal laser fluence on target
    - Successfully demonstrated first-ever active tracking of target and atmospheric compensation between non-cooperative aerial platforms
    - Successfully tracked vertically dynamic target
    - Began COIL installation

Ballistic Missile Defense System Sensors

MISSION

MDA is developing and executing a layered sensors architecture to provide continuous sensor track and discrimination of ballistic missiles in all phases of flight. The program includes acquiring, fielding, testing, and operating BMDS sensors and using data from non-MDA sensors, such as overhead non-imaging infrared (IR) sensors. Together these sensors increase the probability of successful intercept by expanding the engagement window of opportunity and enabling additional engagements.

PROGRAM DESCRIPTION

The BMDS Sensors program responsibilities include the AN/TPY-2 radars (configured for forward-based or terminal missions), the SBX radar, and BMDS-related operations for upgraded Air Force UEWRs, and the upgraded Air Force Cobra Dane (CDU) radar. Future sensors will include the European Midcourse Radar. Sensor activities include research, development, testing and evaluation; planning for sensor deployment; life cycle support; and operating sensors as part of the BMDS.

AN/TPY-2 Radars: The forward-based AN/TPY-2 radars provide improved homeland and regional defense. The first forward-based radar was declared operational at Shariki, Japan. A second forward-based radar is undergoing testing at Vandenberg, AFB, CA. Two other radars will be delivered in FY08 and FY09, respectively. The terminal mission radars are integrated into the THAAD Weapon System. One THAAD radar is at the Pacific Missile Range Facility (PMRF), Kauai, HI to support THAAD flight tests. A second radar is at White Sands Missile Range (WSMR), NM

for Limited Environment Testing and New Equipment Training prior to fielding THAAD Fire Unit #1. Additional AN/TPY-2 radars are being procured for the THAAD program.

Sea-Based X-Band Radar (SBX): The SBX radar is mounted on a mobile, ocean-going platform that can be repositioned worldwide. The radar will provide a unique capability to detect, track, and discriminate complex and challenging threats. The radar is currently undergoing BMDS-level testing to demonstrate operational capability.

Upgraded Early Warning Radar (UEWR): Three Air Force Early Warning Radars (EWRs) are being upgraded to modernize radar hardware and software and to integrate the radars into the BMDS. The upgrades will improve midcourse BMDS sensor coverage while retaining legacy missile warning and space track missions. Radar systems at Beale, CA, and Shemya, AK, have already been upgraded and incorporated into the BMDS. The upgrade to the Fylingdales, UK radar will be completed in FY08. The Thule, Greenland site will be integrated into the BMDS in FY10.

External Sensors: MDA established the External Sensors Laboratory (ESL) at the Missile Defense Integration and Operations Center in Colorado Spring, CO to evaluate the benefits of incorporating external sensors into the BMDS framework. Initial efforts are focused on space assets, which could contribute to improved tracking, cueing, discrimination, and situational awareness.

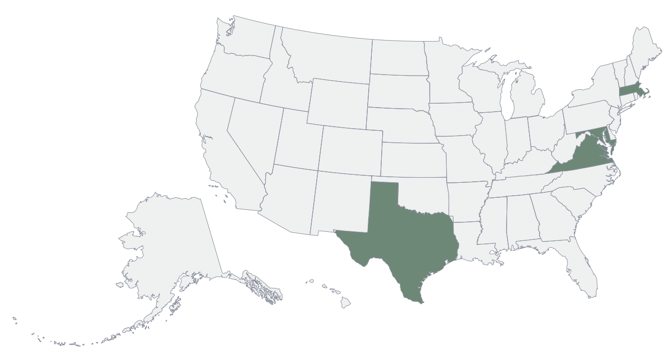
European Midcourse Radar (EMR): The EMR upgrade will replace obsolete hardware and firmware with proven components used in AN/TPY-2 and SBX radars, substantially increasing commonality across the MDA X-band radars. The upgrade will start in FY09 with the EMR being incorporated into the BMDS in FY12.

CONTRIBUTIONS TO THE BMDS

BMDS sensor architecture results in an increased probability of successful engagement and allows advanced concepts that preserve interceptor inventory. Future initiatives include fielding improved discrimination algorithms, fusing sensor data, and providing improved kill assessments. These efforts will conserve sensor resources and improve the track and discrimination data provided to BMDS weapon systems and reduces the number of target engagements. Sensor-to-shooter functionality is verified through BMDS-level testing.

2007 ACCOMPLISHMENTS

- Continued operations of the forward-based AN/TPY-2 radar in Japan as part of the BMDS
- Supported successful THAAD intercepts on two flight tests
- Supported Aegis interoperability testing with AN/TPY-2 (Terminal Mode)
- Completed upgrade to Beale Early Warning Radar
- Completed SBX winter shakedown testing
- Demonstrated ability of ESL to provide precision cue to forward-based AN/TPY-2 radar



Majority of work for BMDS Sensors is performed in the green colored states.

Ballistic Missile Defense Space Sensors

MISSION

The MDA Space Applications Product Center of Excellence is responsible for leading a multi-agency Department of Defense and industry team in developing, testing, and deploying space systems to detect and track ballistic missiles from launch through midcourse flight and eventual intercept or reentry. Mission objectives include developing space technologies that support MDA's space assets, including sensors, space qualified components, optics, and algorithms. The Space Applications Center of Excellence will play a lead role in any future space initiatives undertaken by MDA and facilitate the integration of external Overhead Non-Imaging Infrared (ONIR) sensors.

PROGRAM DESCRIPTION

The Space Tracking and Surveillance System (STSS) involves the launch of two low earth orbit research and demonstration satellites with infrared and visible sensors to track missile launches, midcourse travel, and atmospheric reentry. Each satellite uses an acquisition sensor for missile launch detection and a movable tracking sensor to follow midcourse objects in space. The STSS demonstration satellites will demonstrate the ability to pass missile tracking data to system interceptors with the accuracy and timeliness necessary to enable them to successfully intercept missile targets. MDA will be able to make more informed decisions regarding the fielding of satellites for the operational architecture from the data obtained from these satellites.

The Missile Defense Space Experimentation Center (MDSEC) in Colorado Springs, CO is the integration center for MDA's Space Applications Center of Excellence. It provides a single location for operating STSS and Near-Field Infrared Experiment (NFIRE) satellites and for conducting space-related Research Development Test and Evaluation (RDT&E) activities in support of the missile defense mission.

The NFIRE satellite was launched in April 2007. It will reduce the risk to next-generation BMDS interceptors on land, at sea, and in space by collecting signature data on boosting ballistic missiles at close range in real-world conditions. The data collected will anchor design tools for future interceptor hardware, software, and algorithm development. NFIRE also will provide MDA with early experience coordinating space assets with BMDS flight tests.

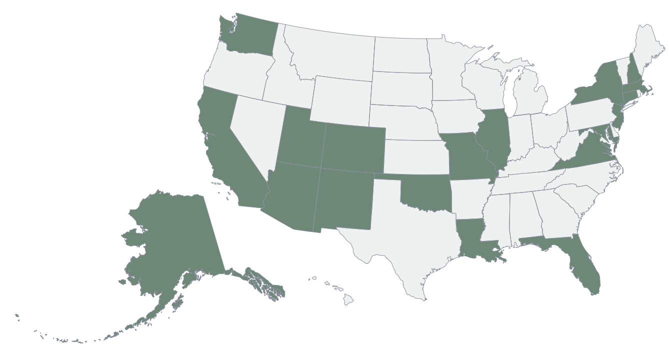
The objective of the Space Test Bed is to evaluate the utility and cost-effectiveness of enhancing missile defense by adding a comprehensive space layer to overcome basing and geographical limitations of land, sea, and airborne defenses. The evaluation would include multi-use sensors and C2BMC.

CONTRIBUTIONS TO THE BMDS

MDA Space Sensors will play a significant role in a global missile defense capability by providing continuous tracking of ballistic missiles and passing tracking information to BMDS radars and interceptors. Accurate tracking data provided by space sensors will increase the robustness of the BMDS, allow additional and earlier intercept opportunities, and provide coverage in locations inaccessible to BMDS radars.

2007 ACCOMPLISHMENTS

- Completed NFIRE satellite integration and ground testing
- Launched NFIRE satellite and began operating from the MDSEC
- Continued integration and testing of two Space Tracking and Surveillance System Demonstration satellites.
  - Delivered payload #2 to space vehicle integration
  - Completed thermal vacuum testing on both satellites
  - Completed final acceptance of ground software



Majority of work for BMDS Space Systems in the green colored states.


USA

Ground-Based Midcourse Defense

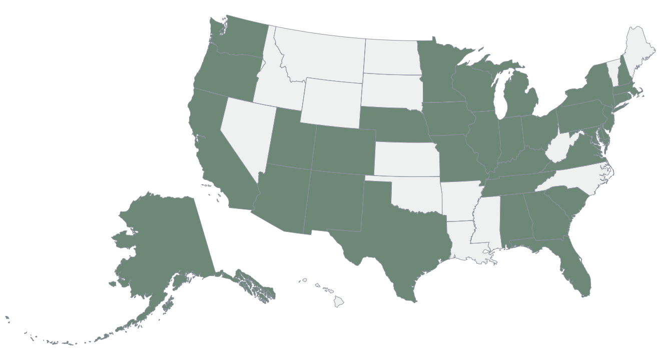
MISSION

The Ground-Based Midcourse Defense (GMD) program is developing and fielding a capability to defend the United States against intermediate- and long-range ballistic missile attacks in the midcourse phase of flight.

PROGRAM DESCRIPTION

GMD uses a variety of satellites and radars (Cobra Dane Radar, Upgraded Early Warning Radars, Sea-Based X-Band Radar, Forward-Based AN/TPY-2 Radar, and the Aegis AN/SPY-1 Radar) to obtain information on launch warning, tracking, targeting, and discrimination via the Command and Control, Battle Management, and Communications system and the Ground-Based Midcourse Defense Fire Control and Communications component. This information enables the Ground-Based Interceptor (GBI) to locate, identify, and destroy the incoming ballistic missile warhead.

Fire Control and Communications enables the warfighter crew to understand and assess the threat situation, make informed decisions, feed information to interceptors to find and destroy incoming ballistic missile warheads, and evaluate mission success. The Fire Control and Communications component consists of the hardware, software, and communications systems necessary for planning, tasking, and controlling the GMD components during threat engagements. It collects data from all missile defense sensors, interconnects communications among all components, connects GMD to the overall BMDS, and allows military and civilian authorities to mount a defense against a limited ballistic missile attack.



Majority of work for Ground-based Midcourse Defense in the green colored states.

The GBI, comprised of a booster vehicle and an exoatmospheric kill vehicle, launches into space based on threat identification and command authority. The booster flies to a projected intercept point and releases the exoatmospheric kill vehicle, which uses on-board sensors with assistance from ground-based assets, to acquire the target. The exoatmospheric kill vehicle performs final discrimination and steers itself to collide with the enemy warhead, destroying it by sheer force of impact.

CONTRIBUTIONS TO THE BMDS

GMD engages long range threats in the midcourse battlespace using data from the suite of BMDS and external sensors. Internal GMD sensor data is relayed to the C2BMC for other BMDS missions. GMD is contributing to the development of advanced BMDS capabilities with increased data sharing across the system to more effectively manage BMDS assets and prepare the BMDS to engage next generation threats. GMD is participating in a BMDS test program that is demonstrating midcourse hit-to-kill in a series of ground and flight tests with increasing operational realism and BMDS integration complexity.

2007 ACCOMPLISHMENTS

- Initiated integration of Sea-Based X-Band Radar
- Completed integration of Fylingdales Upgraded Early Warning Radar
- Accelerated GBI builds and emplacements achieving 24 interceptor emplacement
- Commenced improved System Discrimination demonstration employing Forward-Based AN/TPY-2 Radar discrimination data
- Initiated European site preparations
- Completed successful BMDS flight test resulting in a GBI hit-to-kill intercept of a target launched from Kodiak Launch Complex
- Fielded and demonstrated improved Simultaneous Test and Operations capability
- Initiated Missile Field 2 construction at Fort Greely, Alaska
- Initiated construction of a third operational launch facility at Vandenberg Air Force Base, California

Terminal High Altitude Area Defense

MISSION

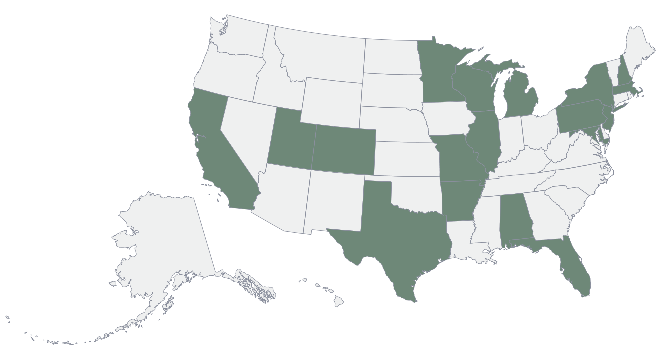
As part of the integrated, layered BMDS, the Terminal High Altitude AreaDefense (THAAD) element will provide rapidly deployable ground-based missile defense components that deepens, and extends, the BMDS battle-space. THAAD has the capability to engage and negate short- to medium- range ballistic missiles, both inside and just outside the atmosphere, providing regional or limited area terminal defense. THAAD also has surveillance sensor that provide data to other elements to enhance BMDS discrimination and engagement capabilities.

PROGRAM DESCRIPTION

THAAD fire units consist of four principal components: truck-mounted launchers, interceptors, radar, and fire control/communications. The launcher can rapidly fire and reload the interceptors and provide storage and transportation of the interceptors. The THAAD radar supports the full range of surveillance, tracking the target and guiding the interceptor during flight. THAAD's Fire Control and Communications component provides the element's battle planning, fire control, and communication backbone, linking THAAD to the BMDS and other air and missile defense networks used by the Armed Services.

THAAD is transportable via airlift worldwide within hours. This rapid deployment capability enables the system to respond quickly to hostile developments around the world, providing effective missile defense coverage on short notice.

Like all other system elements, THAAD will evolve through spiral development, to keep pace with rapidly maturing missile defense technologies and ballistic missile threats.



Majority of work for THAAD is performed in the green colored states.

CONTRIBUTIONS TO THE BMDS

The THAAD element contributes to the BMDS by providing the engagement sequence identified as THAAD Interceptor Engage on AN/TPY-2 (THAAD Mode) Mod 1 (Cobra Dane, UEWR, SBX). THAAD engages a threat ballistic missile using the fire unit radar and cueing from other BMDS sensors, such as the Cobra Dane sensor, UEWRs, or the SBX. When integrated into the BMDS with the BMDS C2BMC, AEGIS BMD and PATRIOT Systems, the rapidly deployable THAAD element improves the BMDS overall effectiveness by engaging threat ballistic missiles both inside and just outside the atmosphere.

2007 ACCOMPLISHMENTS

- Successfully completed component and element integration in the system integration laboratory and flight test range
- Completed activation of the THAAD sites at the Pacific Missile Range Facility (PMRF), Kauai, HI
- Completed a successful soldier tactical move of THAAD hardware to PMRF at Kauai, Hawaii
- Executed two successful intercept flight tests at PMRF and conducted final flight test at the White Sands Missile Range (WSMR), NM in FY07
- Participated in three integrated BMDS flight tests, two major GMD Ground Tests, and four wargames and exercises
- Continued soldier flight test participation with soldiers successfully operating the Battle Manager and Radar to engage a SCUD-like target
- Continued component software development to improve functionality for all components
- Continued to explore international interest and involvement
- Received Office of the Secretary of Defense approval for the THAAD Annex to the BMDS Transition and Transfer Plan
- Continued component hardware build-up including delivery of test interceptors and the second program radar (AN/TPY-2)

Multiple Kill Vehicle

MISSION

The Multiple Kill Vehicle (MKV) mission is to negate medium and intercontinental-range ballistic missiles equipped with multiple warheads and/or countermeasures (threat clusters) in midcourse attack phase with a single engaging interceptor missile. The MKV payload intercepts the threat clusters with kill vehicles launched from this single engaging interceptor missile. The objective is to provide MKV capability to all midcourse interceptor elements, such as Ground-Based Interceptors, Standard Missile-3 interceptors and Kinetic Energy Interceptors. Using data from existing and planned ground-based, sea-based, air, and space-based sensors, the BMDS interceptors equipped with MKV payloads are capable of attacking and negating the potentially large number of inbound warheads in multiple threat clusters. MKV does not require the Ballistic Missile Defense System to pinpoint a single lethal object within a threat cluster. Instead of pairing one kill vehicle with one interceptor missile, the Multiple Kill Vehicle payloads allow a single interceptor missile to deliver several kill vehicles that can attack multiple threat objects within the BMDS designated cluster. Therefore, the MKV capability dramatically alters the battle space in favor of the United States, its allies, and friends.

PROGRAM DESCRIPTION

The MKV program is MDA's transformational kill vehicle development program. MDA's strategy is to manage all future kill vehicle development under a single program element by employing parallel path acquisition of alternative multiple kill vehicle configurations. This strategy allows the Agency to evaluate viable designs and maximize opportunities to incorporate common, modular components.

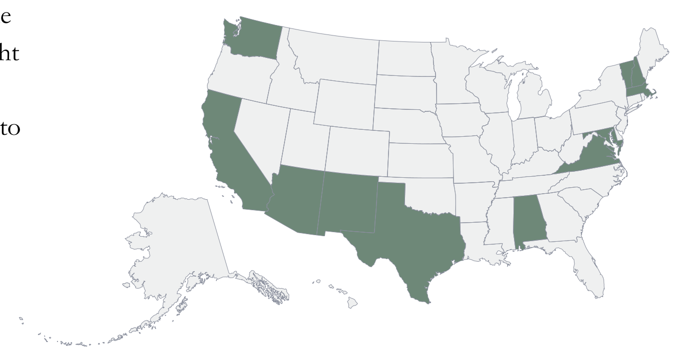
The MKV program includes kill vehicle payload development, integration, test, demonstration, and deployment throughout the BMDS by 2017. The MKV test program will progress from modeling and simulation, to hardware-in-the-loop testing, to payload hover and flight testing, and finally system-level flight tests in the Pacific test ranges.

CONTRIBUTIONS TO THE BMDS

Multiple kill vehicle capability is an integral component of a broad Ballistic Missile Defense System strategy for defeating our adversaries. In this strategy, the multiple kill vehicle payload will receive the best available targeting data in flight through the Ballistic Missile Defense System Command, Control, Battle Management and Communication system to attack and destroy a large number of objects in the threat cluster. This strategy reduces the number of interceptors required to engage all potential threat objects.

2007 ACCOMPLISHMENTS

- Began BMDS level system trade studies to establish payload requirements for integration across multiple midcourse elements
- Developed a Joint Systems Engineering Management Plan to integrate the MKV payload into the BMDS midcourse elements.
- Performed Multiple Kill Vehicle payload system trade studies to establish and balance carrier vehicle and kill vehicle performance parameters
- Developed all digital simulation and hardware-in-the-loop test-bed development to demonstrate key target identification and engagement management capabilities
- Developed medium fidelity digital simulation
- Conducted divert and attitude control system static hot fire test



Majority of work for Multiple Kill Vehicle is performed in the green colored states.

Patriot Advanced Capability-3 & Medium Extended Air Defense System

MISSION

The PATRIOT System ulitilizing the Advanced Capability-3 (PAC-3) missile is the most mature Element of the BMDS. Now operational with the U.S. Army, this Element is a land-based system built on the proven PATRIOT air and missile defense infrastructure. As the best defense against short-range ballistic missiles, PATRIOT was deployed to the Middle East as part of Operation Iraqi Freedom, where it successfully engaged all threatening ballistic missiles within its scope of operation. The Under Secretary of Defense approved the transfer of the PATRIOT Advanced Capability-3 missile and realignment of the Medium Extended Air Defense System (MEADS) programs from the Missile Defense Agency to the Army in March 2003.

In July 2004 the Under Secretary of Defense approved the Army's plan to combine management, development, and fielding of both the MEADS and PATRIOT systems. This approach provides for earlier fielding of enhanced air and missile defense capabilities across the currently fielded force to counter the evolving threat and allows for the knowledge that was gained in the development and fielding of the PATRIOT system to be fused into MEADS development and fielding. The Missile Segment Enhancement missile, the primary missile for the system, performs at an extended range.

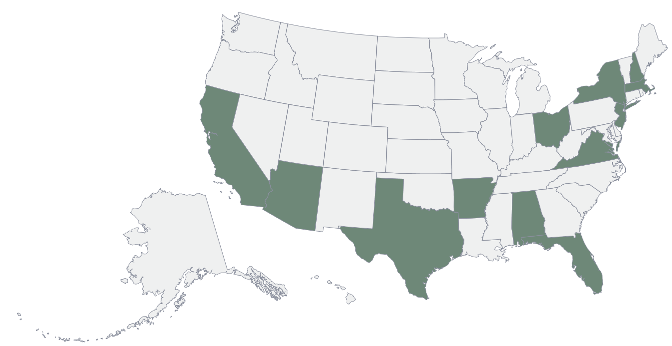
PROGRAM DESCRIPTION

Although the Army is now responsible for PAC-3 procurement and the PAC-3/MEADS combined aggregate development program, the Army and MDA continue to work together to ensure the successful integration of this component's capabilities into the BMDS architecture. MEADS is a cooperative effort among the United States, Germany, and Italy to develop a netted and distributed air and missile defense system that is mobile and transportable. This system will be capable of countering ballistic missiles and air-breathing threats (e.g., aircraft, unmanned aerial vehicles, and cruise missiles). It will help bridge the gap between short-range maneuver air and missile defense systems and the long-range BMDS elements. Mounted on wheeled vehicles, this system will include launchers carrying several interceptors along with advanced radars that will provide 360-degree coverage on the battlefield.

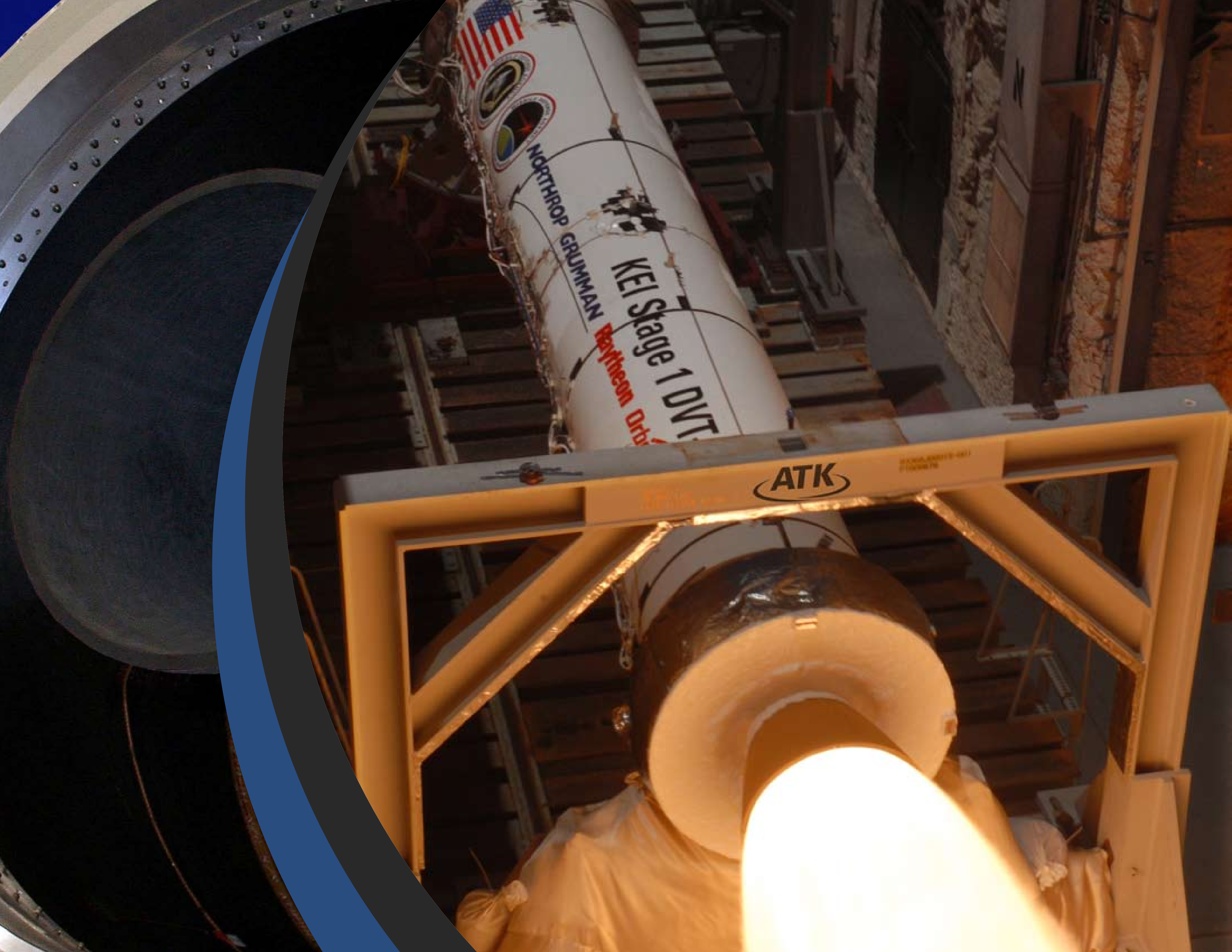
The PAC-3 and MEADS system components will be integrated with the BMDS's Command and Control, Battle Management, and Communications Element to provide the lower tier defense. Incorporation of the PAC-3 and MEADS components will allow an integrated fire control capability with upper tier terminal defense and utilization of the broad range of BMDS sensors that supports the BMDS integrated fire capability.

CONTRIBUTIONS TO THE BMDS

The PATRIOT weapon system provides simultaneous multi-role air and missile defense capabilities when integrated into the BMDS as the Lower Tier Element in defense of US deployed forces, friends, and allies. The system is employed as a theater element with Aegis BMD and THAAD missile systems to provide an integrated overlapping defense against missile threats in the Terminal Phase of flight. Jointly, these systems form a multi-tier theater defense against adversary missile threats by utilizing Peer-to-Peer engagement coordination, early warning track data, and battle management situational awareness to effectively engage the threat while minimizing interceptor wastage. In this role PATRIOT contributes to BMDS overall situational awareness for Short and Intermediate range TBM threats and can transmit precision cueing data to other theater elements while simultaneously protecting BMDS assets against large caliber rockets and air breathing threats. In the homeland defense mission area PATRIOT provides Cruise Missile engagement capabilities that are further enhanced by networked BMDS remote sensors supplying early warning data increasing the probability of successful threat engagement.



Majority of work for PAC-3 and MEADS is performed in the green colored states.


NORTHROP GRUMMAN
KEI Stage 1 DVT
Raytheon
ATK

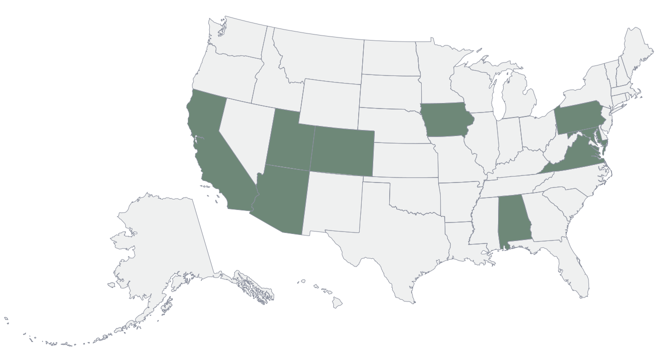
Kinetic Energy Interceptors

MISSION

The KEI program will develop and field a strategically deployable, tactically mobile, land- and sea-based capability to defeat medium- to long-range ballistic missiles during the boost, ascent, and midcourse phases of flight. Land- and sea-mobile capabilities will use hit-to-kill technologies and a high acceleration, common booster.

PROGRAM DESCRIPTION

MDA awarded the KEI Development and Test Phase contract to develop common, multi-use capabilities for the next-generation, high performance interceptor weapon system. This common design and performance approach is applicable to multiple platforms and provides mobility across the battle space. The program will reduce risk through a series of verification tests, robust systems engineering, and integration. The KEI program builds upon existing and planned BMDS sensors, C2BMC, Communications, and kill vehicle capabilities developed in other program elements.



Majority of work for Kinetic Energy Interceptors is performed in the green colored states.

CONTRIBUTIONS TO THE BMDS

The KEI program provides a high confidence path to a boost phase defense layer and a flexible, forward-based midcourse capability for the BMDS. The early KEI engagements, in combination with later Ground Based Interceptor or Aegis Ballistic Missile Defense engagements, provide additional layers of protection and increase effectiveness against countermeasures for the BMDS. A high performance, high mission assurance, and cost effective booster will enhance the BMDS capability following the KEI booster flight knowledge point.

2007 ACCOMPLISHMENTS

- Executed three stage-1 and stage-2 rocket motor static fires to validate booster performance
- Executed three stage-separation tests to validate booster performance
- Completed Modal Survey Test to validate flight configuration and flight algorithms
- Completed wind tunnel test series to validate booster performance
- Completed sea-mobile alternatives assessment to support future mobile platform decisions
- Completed launch site availability and range approvals in support of the program's first booster flight

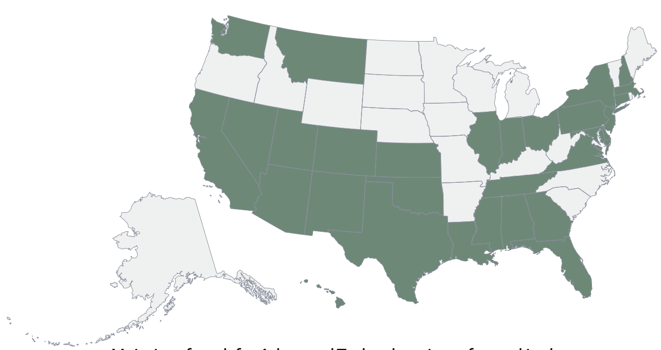
Advanced Technology

MISSION

The Advanced Technology Directorate (DV) is responsible for identifying and developing new technologies to improve BMDS capabilities. We promote investments to support spiral development of the system with minimal acquisition risk and offer both evolutionary and revolutionary improvements to outpace tomorrow's ballistic missile threat. Advanced Technology also leads a national effort to develop algorithms for improved target discrimination, sensor data fusion, and battle management capabilities.

PROGRAM DESCRIPTION

Advanced Technology serves as the focal point for identification and evaluation of advanced concepts with applicability to the system. For those technologies selected for development, Advanced Technology promotes their integration into the system through spiral development and invests resources in a balanced technology portfolio, including evolutionary, near-term enhancements, and revolutionary, far-term capabilities. These investments offer potential for dramatic improvement in system performance against the evolving ballistic missile threat. Approaches that are used to identify relevant new technologies and concepts include recurring technology-focused Broad Agency Announcements (BAA) to solicit proposals from individuals, businesses, universities, and international entities. Advanced Technology conducts outreach activities and collaborative efforts with industry, academia, and other government agencies and foreign activities. Technology areas for advanced development include: active and passive sensors, directed energy systems (lasers); interceptors; portable energy sources; decision and discrimination algorithms; fuels; and materials research. Advanced Technology also conducts the Technology Applications Program to assist businesses in the commercialization of developed technologies through product development, partnerships, and private funding to improve a product's technological maturity, while sharing cost and risk. The Deputy for Advanced Technology acts as the primary coordinator for the Missile Defense Agency's Science and Technology (S&T) activities within the Department of Defense and with allied nations.



Majority of work for Advanced Technology is performed in the green colored states.

CONTRIBUTIONS TO THE BMDS

The Advanced Technology Directorate ensures that appropriate technologies are being developed for the next generation of the BMDS. Technological areas of need are identified by the MDA Elements and the MDA System Engineer, resulting gaps are identified, and promising approaches are pursued. During the developmental efforts, DV also works with the elements to test developmental technology in relevant environments wherever possible, and establish a path for insertion of these technologies into existing systems.

2007 ACCOMPLISHMENTS

- Delivered engineering versions of an initial TPY-2 / SBX discrimination fusion capability to BC--X-Lab for transition testing
- Matured 44 algorithms by one or more technology readiness level
- Demonstrated light-weight "green" monopropellant divert and attitude control system in laboratory tests
- Developed CONOPS and initial design to carry PAC-3 and THAAD missiles on an F-15
- Developed CONOPS and initial design of an air-launched interceptor integrating AIM-9X seeker with AMRAAM booster and "green" monopropellant kill vehicle
- Characterized in laboratory an active-passive seeker testbed prototype
- Conducted light gas gun testing of novel configuration reactive materials to enhance kill vehicle lethality
- Demonstrated advanced radar signal processing algorithms that enable coherence of distributed receive antennas
- Made outstanding performance improvements in Over the Horizon HF Radar program
- Confirmed engineering analyses which indicate a low power, phased array, "next generation" digital radar system is possible with performance potentially exceeding current systems' performance and with acquisition and O&S costs far below current systems

"Since 2001, we've worked closely with countries such as Israel, and Italy, and Germany, and Japan, and the Netherlands, and Britain, and others on missile defense. Together with our friends and allies, we're deploying early warning radars, and missile interceptors, and ballistic missile defense ships. We're working to jointly develop new missile defense capabilities. As a result of this collaboration, missile defense has gone from an American innovation to a truly international effort to help defend free nations against the true threats of the 21st century."

– President George W. Bush
October 23, 2007

www.mda.mil