

GAO

Report to the Subcommittee on
Strategic Forces, Committee on Armed
Services, House of Representatives

September 2009

MISSILE DEFENSE

DOD Needs to More Fully Assess Requirements and Establish Operational Units before Fielding New Capabilities



GAO

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Highlights of [GAO-09-856](#), a report to the Subcommittee on Strategic Forces, Committee on Armed Services, House of Representatives

Why GAO Did This Study

In 2002, the Department of Defense (DOD) began developing and rapidly fielding a global Ballistic Missile Defense System (BMDS) composed of elements that include radars, interceptors, and command and control systems. These elements are envisioned to be linked together to defend against a broad range of ballistic missile threats. In 2009, DOD began a broadly scoped review of missile defense policy and strategy intended to reassess the BMDS and set direction for the future. In response to congressional interest in missile defense requirements and operations, GAO reviewed the extent to which DOD has (1) identified the types and quantities of elements and interceptors it needs and (2) established the units to operate elements that have been put into use. GAO reviewed key analyses, studies, plans, and other documents from the Missile Defense Agency (MDA), the services, combatant commands, and Joint Staff; and interviewed officials from across DOD.

What GAO Recommends

GAO is recommending that DOD perform a comprehensive analysis identifying its requirements for BMDS elements and interceptors and require, in the absence of an immediate threat, the establishment of operational units before making elements available for use. In comments on a draft of this report, DOD generally agreed with GAO's recommendations.

View [GAO-09-856](#) or [key components](#). For more information, contact John Pendleton at (202) 512-3489 or pendletonj@gao.gov.

MISSILE DEFENSE

DOD Needs to More Fully Assess Requirements and Establish Operational Units before Fielding New Capabilities

What GAO Found

DOD lacks the comprehensive analytic basis needed to make fully informed decisions about the types and quantities of elements and interceptors it needs. Such an analytic basis would include a comprehensive examination of the optimal mix of elements and interceptors needed to meet all of DOD's ballistic missile defense requirements. DOD studies prepared to date were completed for specific purposes, such as addressing regional threats. However, none of the studies have taken a comprehensive approach that addressed the full range of requirements. The Joint Staff conducted studies, for example, to identify the minimum interceptor quantities needed for certain ballistic missile defense elements designed to defend against short-to-intermediate-range threats. Additionally, the combatant commands have analyzed their ballistic missile defense requirements for their specific regions, and the services have studied requirements for specific elements. Without a full assessment of its overall requirements, DOD lacks the information it needs to make the best possible policy, strategy, and budgetary decisions for ballistic missile defense.

DOD has faced challenges in fully establishing units to operate five of eight ballistic missile defense elements that have been put into operational use. DOD typically requires that major weapon systems be fielded with a full complement of organized and trained personnel. To rapidly field missile defenses, however, DOD has in some cases put ballistic missile defense elements into operational use before first ensuring that the military services had created units and trained servicemembers to operate them. Three of the eight elements were modifications to existing systems, like the Navy's Aegis ships, so units already existed to operate these modified elements. The five remaining elements—the midcourse defense system designed to defend the United States from long-range threats; the high-altitude, theater missile defense system; a powerful radar placed on a sea-based, movable platform; ground-based radars currently fielded in Japan and Israel; and the command and control system designed to link the BMDS together—were put into use before operational units were fully established. As a result, DOD has faced a number of challenges. For example, the Army faced personnel shortfalls to operate the midcourse defense system. These shortages affected the Army units' ability to support ongoing research and development activities and ultimately resulted in operational readiness concerns. MDA and the military services are taking steps to establish the needed forces, but this may take years for some elements. DOD recognizes the challenges created by putting elements into early use, but has not set criteria requiring that operational units be in place before new elements are made available for use. Looking ahead, several new elements are in development, like the radars and interceptors currently being considered for deployment in Europe, and emerging threats could again cause DOD to press those capabilities into use. Unless fully trained units are in place to support missile defense elements when they are made operational, DOD will continue to face uncertainties and operational risks associated with the elements.

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Abbreviations

Aegis BMD	Aegis Ballistic Missile Defense
BMDS	Ballistic Missile Defense System
C2BMC	Command, Control, Battle Management, and Communications
DOD	Department of Defense
MDA	Missile Defense Agency
NATO	North Atlantic Treaty Organization
THAAD	Terminal High-Altitude Area Defense

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United States Government Accountability Office
Washington, DC 20548

September 16, 2009

The Honorable Jim Langevin
Chairman
The Honorable Michael Turner
Ranking Member
Subcommittee on Strategic Forces
Committee on Armed Services
House of Representatives

Since 2002, the Department of Defense (DOD) has emphasized the development and fielding of a globally integrated, interconnected, and layered Ballistic Missile Defense System (BMDS) composed of “elements” that include radars, interceptors, and command and control systems,¹ which together are to be capable of addressing all ranges of threatening ballistic missiles in all phases of flight.² With the submission of the fiscal year 2010 defense budget to Congress, DOD announced its intention to strike a new balance between developing new ballistic missile defense capabilities and fielding what it believes to be proven and effective weapon systems. The Missile Defense Agency’s (MDA) \$7.8 billion budget request for fiscal year 2010 emphasized the fielding of specific BMDS elements to defend against near-term threats from rogue states and threats to U.S. forces and population centers abroad. For example, the Secretary of Defense announced that DOD’s budget request added \$900 million to more rapidly acquire and field the Terminal High-Altitude Area Defense

¹Ballistic missile defense elements include Airborne Laser; Aegis Ballistic Missile Defense; AN/TPY-2 forward-based radar; Cobra Dane Radar Upgrade; Command, Control, Battle Management, and Communications; European Interceptor Site; European Midcourse Radar; Ground-based Midcourse Defense; Patriot Advanced Capability-3; Sea-based X-Band Radar; Space Tracking and Surveillance System; Terminal High-Altitude Area Defense; and Upgraded Early Warning Radar. An interceptor is a component of some ballistic missile defense elements that is used to destroy an adversary’s ballistic missile. For example, the Missile Defense Agency is building the Standard Missile-3 to be used as a ballistic missile defense interceptor as part of the Aegis Ballistic Missile Defense element.

²A missile attack involves four phases from launch to impact: (1) the boost phase is the period immediately after launch when the missile’s booster stages are still thrusting and typically lasts 3 to 5 minutes for intercontinental ballistic missiles; (2) the ascent phase is when the booster stages have stopped thrusting and dropped away, leaving a warhead and possible decoys; (3) the midcourse phase, lasting for about 20 minutes for intercontinental ballistic missiles, begins after the missile has stopped accelerating and the warhead travels through space; and (4) the terminal phase begins when the warhead reenters the atmosphere and lasts approximately a minute or less.

(THAAD) and Aegis Ballistic Missile Defense (Aegis BMD) elements and their associated interceptors, while reducing investments in some developmental programs designed to address longer-term threats. As the military services increasingly take responsibility from MDA for these and other elements as they transition from research and development to operations, the cost to the services for operating and maintaining ballistic missile defense elements is likely to grow; typically, such costs account for 70 percent of a weapon system's life-cycle costs.

To assist the subcommittee in its review of DOD's approach to acquiring, fielding, and operating ballistic missile defenses, you asked us to review DOD's overall requirements to perform worldwide ballistic missile defense missions. We focused on the types and quantities of ballistic missile defense elements (including inventories of interceptors) and the organizations, personnel, and training needed to operate these elements. Specifically, in addressing its overall force structure requirements, we reviewed the extent to which DOD has (1) identified the types and quantities of ballistic missile defense elements and interceptors that it needs for performing ballistic missile defense missions and (2) established the units to operate elements that have been put into use. To determine the extent to which DOD has identified the types and quantities of ballistic missile defense elements and interceptors that it requires, we identified, obtained, and reviewed key MDA and Joint Staff studies identifying ballistic missile defense requirements. We performed our analysis by comparing DOD's analytical and funding approaches for ballistic missile defense against criteria for establishing a knowledge-based approach to acquiring major weapon systems, which provides evidence that warfighting requirements are valid and can be met with chosen concepts that are developed and produced within existing resources.³ The documentation we reviewed also included direction and guidance from the Office of the Secretary of Defense, the Joint Staff, and MDA; MDA plans for developing ballistic missile defenses; and direction from the Deputy Secretary of Defense outlining the BMDS Life Cycle Management Process. To determine the extent to which DOD has established the units needed to operate ballistic missile defense elements that have been put into use, we identified, reviewed, and assessed MDA development plans and fielding schedules, Joint Staff orders, and U.S. Strategic Command processes and

³For example, see GAO, *Defense Acquisitions: A Knowledge-Based Funding Approach Could Improve Major Weapon System Program Outcomes*, [GAO-08-619](#) (Washington, D.C.: July 2, 2008), and *Defense Acquisitions: Assessments of Selected Weapon Programs*, [GAO-08-467SP](#) (Washington, D.C.: Mar. 31, 2008).

plans for evaluating the operational performance of ballistic missile defense capabilities. The scope of our analysis included those ballistic missile defense elements that have been delivered to the combatant commands for operational use as of July 2009.⁴ For both objectives, we interviewed officials from the Office of the Secretary of Defense, Joint Staff, MDA, Army, Navy, and Air Force. We also obtained documentation from key geographic combatant commands to understand their operational requirements for ballistic missile defense elements and service forces, the processes for establishing these requirements, and any challenges they have had or expect to encounter in obtaining the capabilities and forces that they need for operations. The combatant commands we visited were U.S. Strategic Command and the four geographic combatant commands—U.S. Central Command, U.S. European Command, U.S. Northern Command, and U.S. Pacific Command—that have participated in U.S. Strategic Command’s advocacy efforts to identify desirable characteristics and capabilities for the BMDS. We conducted this performance audit from August 2008 to September 2009 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

In 2002, the President reinforced ballistic missile defense as a national priority and directed DOD to proceed with plans to develop and put in place an initial capability beginning in 2004.⁵ To expedite the delivery of an operationally capable BMDS, in 2002 the Secretary of Defense established MDA, granted the agency expanded responsibility and authority to develop globally integrated capabilities, directed it to manage all ballistic missile defense systems then under development, and transferred those systems controlled by the military services to the agency. The systems transferred

⁴Our scope did not include an evaluation of the Army’s efforts to establish the units needed to operate the Patriot Advanced Capability-3 element, which is the most mature ballistic missile defense element. Although MDA and the Army continue to work together to integrate the system’s capabilities into the overall BMDS, Patriot Advanced Capability-3 transferred to the Army in 2003 and has been fully integrated into the Army’s existing force structure for the Patriot air and missile defense system.

⁵The White House, National Security Presidential Directive-23 *National Policy on Ballistic Missile Defense* (Dec. 16, 2002).

from the services and the new systems whose development MDA initiates are all considered to be ballistic missile defense elements.

Since its creation in 2002, MDA has developed, fielded, and declared ready for operations an increasingly complex set of ballistic missile defenses designed to defend the United States, deployed forces, allies, and friends from limited ballistic missile attacks. By leveraging existing service weapon systems and developmental concepts, MDA fielded an initial defensive capability beginning in 2004 to defend the United States from a limited, long-range ballistic missile attack. This initial defensive capability included the Ground-based Midcourse Defense system of interceptors and fire control systems, Upgraded Early Warning Radars, sea-based radars installed aboard Aegis cruisers and destroyers, and an early version of the Command, Control, Battle Management, and Communications (C2BMC) element. MDA first made these elements available for operations in April 2005 by establishing the initial BMDS operational baseline.⁶ DOD first put these elements to operational use by activating them in 2006 in response to North Korean ballistic missile activity. Since that time, DOD has added some elements to the operational baseline while declaring others ready for contingencies. Table 1 identifies the fielding locations and dates that MDA first delivered operational elements to the combatant commands as of July 2009.

⁶Missile Defense Agency, *Ballistic Missile Defense System Operational Baseline*, version 1.0 (April 2005). The BMDS operational baseline is a management tool that MDA uses to determine the composition of the operational BMDS at any given point in time.

Table 1: Ballistic Missile Defense Elements That MDA Has Delivered to the Combatant Commands for Operational Use as of July 2009

BMDS element/lead service	Element description	Fielding location(s)	Delivery date
Ground-based Midcourse Defense/Army	A ground-based system based on a developmental program transferred to MDA in 2002 that is designed to protect the U.S. homeland from intermediate- and intercontinental-range ballistic missile attacks from North Korea and the Middle East. The element employs ground-based interceptors to strike at threatening warheads as they travel through space toward their target(s).	Ground-based interceptors located in Alaska and California; fire control operations centers located in Alaska and Colorado	Included in the first operational baseline, published in April 2005.
Aegis Ballistic Missile Defense/Navy	A system that (1) provides a forward-deployed capability to search, detect, and track ballistic missiles of all ranges and transmit track data to the BMDS and (2) employs sensors and interceptors to protect deployed forces and population centers. The element is based on a modification to existing Navy Aegis ships to provide these capabilities. The interceptors include the Standard Missile-3, designed to defend against short- to medium-range missile threats in the midcourse phase, and a modified Standard Missile-2 interceptor designed to defend against short-range threats in the terminal phase.	Aegis-class Navy destroyers and cruisers homeported in Japan, Hawaii, California, and Virginia	Sensor capabilities to support the Ground-based Midcourse Defense element were included in the first operational baseline, published in April 2005. Midcourse intercept capabilities were added to the baseline in November 2006. In September 2008 terminal defense capabilities were first made available for contingency operations.
Cobra Dane Radar Upgrade/Air Force	Radar element that provides missile tracking data to the Ground-based Midcourse Defense element, in addition to legacy missions.	Alaska	Included in the first operational baseline, published in April 2005.
Upgraded Early Warning Radar/Air Force	Radar element that provides missile tracking data to the Ground-based Midcourse Defense element, in addition to legacy Air Force missions.	California and United Kingdom	First radar included in the first operational baseline, published in April 2005; second radar added to the operational baseline in December 2007.
Command, Control, Battle Management, and Communications/none designated	A networked computer and communications element developed by MDA to integrate the BMDS by providing deliberate planning, situational awareness, sensor management, and battle management capabilities.	Multiple combatant commands, the National Military Command Center, and other regional locations	Included in the first operational baseline, published in April 2005.

BMD element/lead service	Element description	Fielding location(s)	Delivery date
AN/TPY-2 Forward-based Radar ^a /Army	A transportable, land-based radar, similar in design to the THAAD radar, which provides advance warning of ballistic missile launches to the BMD from forward-based locations.	Japan and Israel	First radar, fielded in Japan, added to the operational baseline in September 2006; second radar, fielded in Israel, first made available for contingency operations in November 2008.
Sea-based X-Band Radar/Navy	An MDA-designed element, consisting of a radar built on a movable sea platform, which is to provide an improved ability to acquire, track, and discriminate threatening warheads from decoys, thereby improving the chances of a successful intercept by the Ground-based Midcourse Defense element.	Pacific Ocean (based in Hawaii)	First made available for contingency operations in July 2008.
Terminal High-Altitude Area Defense/Army	A ground-based system based on a developmental program transferred to MDA in 2002 that is designed to protect deployed U.S. forces and population centers from short- and medium-range ballistic missile attacks. The system employs interceptors designed to strike at threatening missiles both inside and just outside of the earth's atmosphere.	Texas	First made available for contingency operations in September 2008.

Source: GAO summary of DOD information.

Note: Does not include the Patriot Advanced Capability-3 element, which the Secretary of Defense assigned to the Army in 2003 as an operational system. The Patriot Advanced Capability-3 element is designed to protect deployed U.S. forces from short-range and medium-range ballistic missile threats.

^aAN/TPY stands for "Army Navy/Transportable Radar Surveillance."

As table 1 indicates, DOD has designated lead services for seven of the eight elements that have been delivered to the combatant commands for operational use; MDA currently plans to retain control of the eighth element delivered to date—C2BMC—and not transition it to a single lead service.⁷ Lead military services are expected to provide the rest of the military force structure—the organizations, personnel, and training—required for operations as the elements become more technically mature.⁸

⁷Three other elements—Airborne Laser, European Midcourse Radar, and Space Surveillance and Tracking System—have been assigned to the Air Force as lead service, and the Army is taking responsibility for operating the European Interceptor Site. MDA has not made these elements available for operational use.

⁸In contrast, under standard DOD practices the services are generally responsible for declaring weapon systems to be operational and for developing both the weapon systems and the force structure needed for operations.

Lead military services are also expected to begin funding operational and support costs as elements transition from MDA to the services.⁹

To develop ballistic missile defense capabilities, MDA both modified existing service weapon systems to perform ballistic missile defense missions and developed new elements, many based on previously existing concepts, expressly for ballistic missile defense purposes. For example, MDA developed the Upgraded Early Warning Radar and Aegis BMD elements as modifications to existing service weapon systems, whereas MDA developed the Ground-based Midcourse Defense and THAAD elements based on developmental programs transferred to MDA in 2002. MDA has spent about \$56 billion since 2002 to develop these assets. Additionally, MDA's fiscal year 2010 budget request proposes to develop more advanced Aegis BMD interceptors capable of addressing intermediate-range ballistic missile threats, enhance the C2BMC element's capabilities, and undertake other developmental initiatives, including research into ascent phase technologies.¹⁰ These developments are likely to affect both element quantities and service force structure requirements as MDA begins to field these capabilities.

MDA, under the direction and oversight of the Under Secretary of Defense for Acquisition, Technology and Logistics, is responsible for evaluating ballistic missile defense capabilities to determine which elements are ready to perform military operations, giving the Secretary of Defense the option of activating elements for operational use.¹¹ Under MDA's approach, an element is first available for crisis and contingency operations when it has achieved Early Capability Delivery, based upon MDA's assessment of element-level tests and its determination that the element's employment

⁹In developing an integrated BMDS, DOD's intention was for MDA to develop BMDS elements and then "transition" the elements to the services that would operate and support them. The transition process may, for some elements, end at a point that DOD calls transfer—with MDA and the lead service sharing development, operations, and sustainment responsibilities as defined by agreement.

¹⁰Since the release of the fiscal year 2010 budget request, MDA has changed the name of the ascent phase concept to "early intercept." However, we continue to refer to the concept as ascent phase throughout this report.

¹¹According to DOD Directive 5134.9, *Missile Defense Agency (MDA)*, October 2004, the Under Secretary of Defense for Acquisition, Technology and Logistics is responsible for recommending to the Secretary of Defense when Research, Development, Test, and Evaluation assets are available for emergency or contingency use. According to MDA's May 2009 *Ballistic Missile Defense System (BMDS) Master Plan*, MDA supports such decisions by determining which assets are suitable for emergency activation.

will not degrade other operational ballistic missile defenses. According to MDA's current approach, an Early Capability Delivery declaration is the first point at which an element is made available for operational employment in defense of the United States and U.S. allies. Subsequently, MDA declares when an element is added to the operational baseline by declaring that it has achieved Partial Capability Delivery, and is capable of day-to-day operations, or Full Capability Delivery meaning that the element is able to sustain operations over longer periods.¹² In May 2009, MDA updated its approach to making capability declarations so that it considers not only the agency's own developmental assessments, but also a U.S. Strategic Command-led assessment of the element's capabilities and limitations under operational conditions. MDA's first capability review under this new approach is expected to occur later in 2009.

Oversight of MDA is executed by the Under Secretary of Defense for Acquisition, Technology and Logistics. Because MDA is not subject to DOD's traditional joint requirements determination processes and because it utilizes flexible acquisition practices, DOD developed alternative oversight mechanisms. For example, in 2007 the Deputy Secretary of Defense established the Missile Defense Executive Board,¹³ which is to provide the Under Secretary of Defense for Acquisition, Technology and Logistics or Deputy Secretary of Defense, as necessary, with a recommended ballistic missile defense strategic program plan and feasible funding strategy for approval. In September 2008, the Deputy Secretary of Defense also established the BMDS Life Cycle Management Process, and directed the board to use the process to oversee the annual preparation of

¹²We have previously reported that MDA's effort to conform to a schedule of Early, Partial, and Full Capability Deliveries has resulted in making such declarations based on a more limited understanding of system effectiveness than planned. See GAO, *Defense Management: Key Challenges Should be Addressed When Considering Changes to Missile Defense Agency's Roles and Missions*, [GAO-09-466T](#) (Washington, D.C.: Mar. 26, 2009), and *Defense Acquisitions: Production and Fielding of Missile Defense Components Continue with Less Testing and Validation Than Planned*, [GAO-09-338](#) (Washington, D.C.: Mar. 13, 2009).

¹³The Missile Defense Executive Board is chaired by the Under Secretary of Defense for Acquisition, Technology and Logistics. The board's members are the Director, Defense Research and Engineering; Under Secretary of Defense for Policy; Director, Program Analysis and Evaluation; Assistant Secretary of the Army for Acquisition, Logistics, and Technology; Deputy Under Secretary of Air Force Space Programs; Under Secretary of Defense for Intelligence; Commander, U.S. Strategic Command; Assistant Secretary of State for International Security and Nonproliferation; Director, Operational Test and Evaluation; Vice Chief for Naval Operations; Director, Missile Defense Agency; and Vice Chairman, Joint Chiefs of Staff.

a required capabilities portfolio and develop a program plan to meet the requirements with Research, Development, Test, and Evaluation; procurement; operations and maintenance; and military construction in defensewide accounts.

DOD is currently undertaking a review of its approach and requirements for ballistic missile defenses. In the Duncan Hunter National Defense Authorization Act for Fiscal Year 2009,¹⁴ Congress required DOD to prepare a review of the ballistic missile defense policy and strategy of the United States. Among other matters, the congressionally mandated review is to address the full range of ballistic missile threats to the United States, deployed forces, friends, and allies; the organization, discharge, and oversight of acquisition for ballistic missile defense programs; roles and responsibilities of the Office of the Secretary of Defense, defense agencies, combatant commands, the Joint Chiefs of Staff, and military departments in such programs; DOD's process for determining the force structure and inventory objectives for ballistic missile defense programs; the near-term and long-term affordability and cost-effectiveness of such programs; and the role of international cooperation on missile defense in the ballistic missile defense policy and strategy of the United States. Congress required DOD to provide a report on its review by January 31, 2010.

This report is one in a series of reports we have issued on ballistic missile defense that have identified key acquisition, management, and operational challenges associated with the development of the BMDS. In August 2009 we published a report identifying actions that DOD needs to take to improve planning and to increase the transparency of total costs for the proposed European Interceptor Site and European Midcourse Radar elements.¹⁵ In March 2009, we issued our sixth annual assessment of DOD's progress in developing the BMDS; this report concluded that although MDA had shown the benefits of its flexible acquisition practices by fielding and improving upon an initial ballistic missile defense capability since 2005, this approach also has limited the ability of DOD and congressional decision makers to measure MDA's progress on cost, schedule, testing, and performance.¹⁶ In September 2008, we found that

¹⁴Pub. L. No. 110-417, § 234 (2008).

¹⁵GAO, *Ballistic Missile Defense: Actions Needed to Improve Planning and Information on Construction and Support Costs for Proposed European Sites*, [GAO-09-771](#) (Washington, D.C.: Aug. 6, 2009).

¹⁶[GAO-09-338](#).

although DOD had begun preparing for BMDS operations and support, difficulties in transitioning these responsibilities from MDA to lead services had complicated long-term planning to operate and support the elements over their life cycle.¹⁷ In July 2008, we reported that DOD had taken some steps to address the combatant commands' ballistic missile defense needs, but had yet to establish an effective process for identifying and addressing the overall priorities of the combatant commands when developing ballistic missile defense capabilities.¹⁸ We reported in May 2006 that DOD had begun preparations to operate ballistic missile defenses, such as identifying lead services, but had not established the criteria that must be met before the BMDS can be declared operational.¹⁹

DOD Identified Its Initial Ballistic Missile Defense Needs but Has Not Determined Its Overall Ballistic Missile Defense Requirements

DOD has identified its needs for establishing an initial and evolving ballistic missile defense capability, but lacks the comprehensive analytic basis needed to make fully informed decisions about the overall mix of elements and interceptors that it requires. A knowledge-based decision-making approach can help to provide the comprehensive analytic basis needed to establish missile defense policies and strategies and determine funding priorities. For ballistic missile defense, such an approach would require full examination of the optimal type and quantity of various ballistic missile defense elements and interceptors needed to meet all of DOD's requirements—a complex task due to the many factors that should be considered, including the evolving nature of the threat and emerging technologies. For example, the same mix of Aegis BMD ships and THAAD batteries provides different defensive coverage depending on whether the elements are acting autonomously or are integrated with another X-band radar. However, DOD's assessments of missile defense requirements prepared to date were limited in scope primarily because they were prepared for specific purposes. The Joint Staff, for example, conducted studies to identify the minimum interceptor quantities needed for certain ballistic missile defense elements designed to defend against short-to-

¹⁷GAO, *Missile Defense: Actions Needed to Improve Planning and Cost Estimates for Long-Term Support of Ballistic Missile Defense*, [GAO-08-1068](#) (Washington, D.C.: Sept. 25, 2008).

¹⁸GAO, *Ballistic Missile Defense: Actions Needed to Improve Process for Identifying and Addressing Combatant Command Priorities*, [GAO-08-740](#) (Washington, D.C.: July 31, 2008).

¹⁹GAO, *Defense Management: Actions Needed to Improve Operational Planning and Visibility of Costs for Ballistic Missile Defense*, [GAO-06-473](#) (Washington, D.C.: May 31, 2006).

intermediate-range threats. Additionally, the combatant commands have analyzed their ballistic missile defense requirements for their specific regions, and the services have studied requirements for specific elements. Without a comprehensive analytic basis that identifies the full range of operational type and quantity requirements for ballistic missile defense elements, DOD may not be acquiring the optimized mix of elements and interceptors that would provide the most effective missile defense.

DOD Has Identified the Types and Quantities of Ballistic Missile Defense Elements Needed for an Initial and Evolving Defensive Capability

MDA identified how many and what type of ballistic missile defense elements were needed to begin fielding an initial set of capabilities in 2004 and to evolve the BMDS over time. Directed by the President in 2002 to begin fielding an initial set of missile defense capabilities in 2004, MDA undertook the major early assessments that established DOD's initial and evolving ballistic missile defensive capability, which formed the foundation of the current BMDS. According to a February 2004 MDA briefing, the initial defensive capability prepared in response to the President's policy direction included the Cobra Dane Radar Upgrade, the Beale Upgraded Early Warning Radar, up to 20 ground-based interceptors located in Alaska and California, command and control in Colorado, and sea-based radars deployed aboard Aegis ships. Additionally, based on the President's policy direction and direction from the Secretary of Defense, also issued in 2002, MDA planned to expand the initial capability over time. To do so, MDA conducted internal studies and developed plans in 2002, 2003, and 2004 that identified the quantities of elements and interceptors it needed for research and development purposes and to defeat long-range ballistic missiles from rogue states. As of February 2005, these studies resulted in plans for fielding 48 ground-based interceptors to address the long-range ballistic missile threat, with 36 of the interceptors planned for fielding in Alaska, 2 in California, and 10 in Europe.²⁰ The studies also resulted in plans to establish a network of sensors—including

²⁰The total number of planned deployed ground-based interceptors remained 48 until the President's fiscal year 2008 budget request when the total number increased to 54—40 in Alaska, 4 in California, and 10 in Europe. The President's fiscal year 2010 budget request did not alter the total number of ground-based interceptors but changed the number of emplaced interceptors in Alaska and California from 44 to 30. In explaining this change, MDA reported to Congress in July 2009 that the 2002 projection of threat missiles was reassessed to be off by 10 to 20 missiles. Additionally, the report explains that the number of long-range missiles the interceptors would have to engage at any one time was limited because of the low number of launch complexes for these missiles. The report concludes that 30 emplaced interceptors is sufficient to defend the United States and that the number could be expanded if the threat grows.

radars aboard Aegis ships and land-based radars in North America, Asia, and Europe. Additionally, MDA planned to build up to 48 THAAD interceptors and 101 Aegis BMD interceptors by the end of calendar year 2011 as part of its efforts to develop and field capabilities to defeat short-, medium-, and intermediate-range ballistic missiles. However, these initial plans did not define DOD's overall requirements for ballistic missile defense elements and interceptors. In particular, MDA's analyses were primarily focused on addressing the requirements of an initial and evolving ballistic missile defense capability and were not intended to address all of DOD's operational requirements for performing ballistic missile defense missions worldwide.

Determining the Quantity of Ballistic Missile Defense Elements and Interceptors Required for All Missions Involves Many Factors

Establishing requirements for ballistic missile defense involves balancing several interrelated factors. A comprehensive analytic basis would include determining the optimum types and numbers of ballistic missile defense elements and interceptors for performing missile defense missions worldwide. However, optimizing the quantities of each element and interceptor involves many factors, including the integration of various types of ballistic missile defense elements, various risk assessments, the potential contributions of friends and allies, optimizing elements that can address multiple threats, and the evolving nature of the threat and emerging technologies. Our prior work shows that a knowledge-based decision-making process can help to provide the comprehensive analytic basis needed for establishing funding priorities, including determining the affordability of DOD's missile defense policies and strategies.²¹ A knowledge-based decision-making process includes providing decision makers with evidence that warfighting requirements are valid, that they can be met with the chosen weapon system designs, and that the chosen designs can be developed and produced within existing resources.

Integrated Elements Are More Effective Than Elements Operating Independently

Optimizing the numbers and types of each element and interceptor needed involves looking across the BMDS to see how the different elements can best work together as an integrated system. According to the Director of MDA, the integration of the many ballistic missile defense elements into a system makes the BMDS more effective than would the individual elements operating independently. Integration may include improving systems integration among elements, adding a different type of interceptor, adding a sensor, or a combination of these and other options

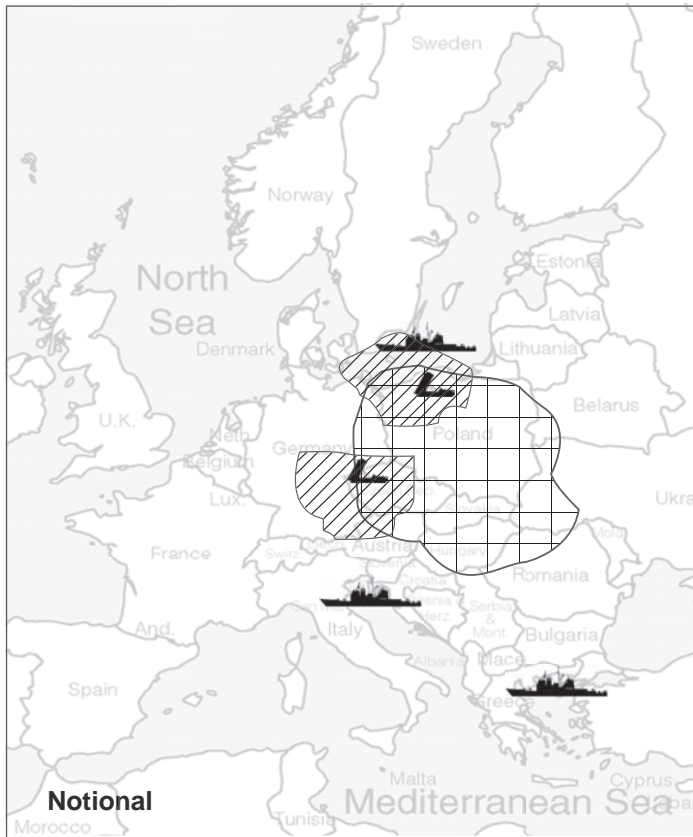
²¹GAO-08-619 and GAO-08-467SP.

in order to increase a defended area. For example, figure 1 illustrates how the same mix of Aegis BMD ships and THAAD batteries provides vastly different defensive coverage depending on whether the elements are acting autonomously (smaller coverage) or are integrated with a radar (larger coverage).²² Increased integration could therefore affect requirements, perhaps lessening the quantity of elements needed to defend an area. However, Air Force officials told us that the cost of integrating elements could be high enough in some circumstances that it may be more efficient to purchase additional elements and interceptors.

²² Areas on the figure do not signal current or intended deployment locations of the assets.






Figure 1: Benefits of Integration

Defended area with elements operating individually



Defended area with elements integrated together with a radar



-  THAAD defended area
-  Aegis BMD defended area
-  THAAD element
-  Aegis BMD element
-  X-Band radar

Source: GAO analysis of Missile Defense Agency data.

Note: The same number of elements acting individually provides a smaller defended area than when those elements are integrated together with a radar.

Risk Assessments Factor into Overall Requirements

Assessments of the threat and other risk assessments are also factors affecting overall requirements for the types and quantities of missile defense elements and interceptors. According to the Director of MDA, optimizing the size and type of the ballistic missile defense force requires an operational risk assessment of the adversary’s ballistic missile arsenal that would have to be engaged. It also requires understanding the

capabilities and limitations of BMDS elements needed to counter these threats, an understanding that continues to improve with additional testing. For example, the required number of ground-based interceptors needed to defend the United States from long-range threats would be affected if additional testing were to reveal an increase or decrease in the expected capability of that type of interceptor. Office of the Secretary of Defense and U.S. Strategic Command officials told us that risk assessments should also consider the extent to which different kinds of elements and interceptors provide redundant coverage. Air Force officials added that redundant capabilities should be considered when optimizing force structure, stating that even if there were a single element that could provide defensive coverage for an entire region, an optimized force structure may include additional elements so that the area would still be defended if the original element were incapacitated.

Allied Contributions Can Affect Quantity Requirements

The extent to which the United States can depend upon contributions from friends and allies also can affect the determination of DOD's optimized ballistic missile defense force structure. For example, U.S. Central Command officials told us that coordination with friends and allies on ballistic missile defenses and their purchase of ballistic missile defense elements and interceptors may allow the command to reorient its forces to fill other gaps. Similarly, U.S. Pacific Command told us that close ballistic missile defense cooperation with Japan has improved overall ballistic missile defense protection in the command's area of responsibility, allowing the command to expand protection of critical assets. The Director of MDA testified before Congress in June 2009 that if cooperative efforts with Russia were successful in integrating some radar facilities, it could enhance the ability of ground-based interceptors in Alaska and California. Finally, in regard to the proposed ballistic missile defense sites in Europe, DOD and the North Atlantic Treaty Organization (NATO) have been exploring ways to link U.S. missile defense assets with NATO's missile defense efforts. In April 2008, NATO declared its intention to develop options for a comprehensive missile defense architecture to extend coverage to all allied territory and populations not otherwise covered by the proposed U.S. system.

Some Elements Are Designed to Defend against Multiple Threats or Perform Different Missions

A key factor affecting the requirements for some elements is that they are designed to address multiple types of ballistic missile threats. For example, potential choices about whether to use the interceptors based in Europe as a reserve to defend the United States or to use them to intercept all incoming long-range threats regardless of the intended target could significantly affect how many ground-based interceptors would be needed overall. Similarly, the Aegis BMD element was designed to provide search

and track capabilities to help the Ground-based Midcourse Defense element defend the United States, and as a stand-alone element capable of defending deployed U.S. forces and population centers abroad from shorter-range threats. In addition, Navy and U.S. Pacific Command officials told us that Aegis ships are also in high demand to perform other maritime missions, such as antisubmarine warfare. As a result, the use of Aegis ships as ballistic missile defense weapon systems may constrain the ability of combatant commanders to use those ships for other purposes without increasing the size of the available force structure. In coming years, as the Aegis BMD element takes on new roles to intercept longer-range missiles that are targeting the United States,²³ regional combatant commanders who rely on the Aegis ships for multiple missions may be further constrained in how they deploy those assets. Consequently, even as the Aegis BMD element becomes more capable, requirements for Aegis force structure may increase in order to satisfy the multiple missions.

Changes in Threat and Evolving Missile Defense Technology Will Likely Affect Future Requirements

The evolving nature of the threat and emerging technologies also have implications for the quantity requirements for ballistic missile defense elements and interceptors. For example, MDA reported to Congress in July 2009 that the requirement for emplaced ground-based interceptors was reduced, in part, because the original intelligence estimate of the number of missiles that the ground-based interceptors were intended to counter was later assessed to be off by 10 to 20 missiles. Similarly, improvements in BMDS capabilities affect requirements. For example, the Director of MDA testified before Congress in May 2009 that new ascent phase capabilities will eliminate the need for the Multiple Kill Vehicle program and would reduce overall the number of ballistic missile defense interceptors needed to defeat an attack.

DOD's Analyses to Date Have Been Limited in Scope

Our review of DOD's analyses of its type and quantity requirements for ballistic missile defenses show that the studies prepared to date have been limited in scope and did not create the comprehensive analytic basis for making programwide decisions about policies, strategies, and investments. MDA's initial analyses were completed for the purpose of establishing an initial and evolving set of ballistic missile defense capabilities, not to

²³MDA is developing the Standard Missile-3 Block II interceptor, which is expected to be able to intercept intermediate-range missiles during the midcourse phase of flight. These interceptors are expected to be deployable on Aegis ships by 2015.

determine DOD's overall operational requirements. Similarly, we found that the assessments of ballistic missile defense quantity requirements conducted by other DOD organizations were prepared for specific purposes:

- The Joint Staff conducted two analyses beginning in 2006 that identified a minimum baseline need to double the number of THAAD and Aegis BMD interceptors planned in the fiscal year 2008 budget as well as a need for an additional THAAD battery and an upgraded AN/TPY-2 forward-based radar with self-defense capability. The Joint Staff focused on THAAD and Aegis BMD interceptor inventory requirements because production decisions for additional interceptors needed to be made in DOD's fiscal year 2010 future years' funding plan in order to avoid the possibility of closing down production. Combatant commands were also voicing a demand for these capabilities in order to protect deployed U.S. forces and population centers abroad. The Joint Staff characterized the studies as an "initial mark on the wall" because the studies made assumptions that tended to drive down the identified quantities in the baseline. For example, the studies did not factor in quantities needed for spares, training, testing, or in transit; assumed the lack of enemy countermeasures; and assumed that ballistic missile defense command and control systems would work perfectly under operational conditions. Acknowledging these limitations, Members of Congress and DOD officials nevertheless have cited the Joint Staff studies as identifying the requirement for boosting THAAD and Aegis BMD quantities and affecting DOD's fiscal year 2010 budget request.
- The geographic combatant commands regularly assess their individual requirements for ballistic missile defense forces, but these analyses are limited in scope to each command's unique area of responsibility, as assigned by the President. For example, U.S. Central Command officials told us that their requirements for ballistic missile defenses are driven by the need to protect against short- to medium-range threats from within the command's own theater. U.S. Northern Command officials told us that their requirements for ballistic missile defense forces are driven primarily by the command's need to protect against long-range strikes from states outside of their area of responsibility. U.S. Northern Command conducted an independent three-phase study on where to field ground-based interceptors that included looking at the operational benefits of an interceptor site located in the eastern United States in order to augment the planned European Interceptor Site. However, this study did not address whether MDA's budgeted requirement of ground-based interceptors—which at the time of the study included 44 interceptors in the United States and 10 in Europe—was sufficient to meet the command's requirement.

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- The military services have also started to perform assessments on ballistic missile defense quantity requirements, but these assessments have been limited in scope and do not attempt to optimize the number of ballistic missile defense elements and interceptors worldwide. For example, in 2007, the Navy completed a study assessing its requirement for making Aegis ships capable of performing the ballistic missile defense mission. Based on the study's findings, the Navy concluded that the entire Aegis fleet should have this capability and that ballistic missile defense was a core Navy mission. However, the Navy neither attempted to assess the requirements for the number and type of interceptors to be used aboard these ships, nor scoped the assessment to try to vary the mix of other elements and interceptors in order to optimize the number of Aegis BMD ships. For example, the Navy did not vary the number of THAAD, Patriot Advanced Capability-3, AN/TPY-2 forward-based radar, or other elements in order to see if that affected the requirement for Aegis BMD ships. The Army also recently undertook a short-turnaround study to identify whether it is a better option to maintain the THAAD battery procurement plan outlined in the fiscal year 2010 budget or to buy fewer batteries and instead develop and field a more capable THAAD interceptor. The Army study intends to explore different options for gaining the same capability that a new interceptor could provide, including placing THAAD interceptors forward of the battery and operating them remotely, as well as the use of sea- and land-based Aegis BMD interceptors. However, Army officials told us that while the study is looking at several combat scenarios, it is not intended to establish the global quantity requirements for THAAD or establish a global optimum mix of joint BMDS elements and interceptors.

DOD Has Opportunities to Establish What Type and How Many Elements and Interceptors Are Needed for All Missions and to Refine Ballistic Missile Defense Policy

Having prepared various but limited assessments of ballistic missile defense quantity requirements to support an initial and evolving ballistic missile defense capability, DOD now has the opportunity to build upon these studies to better define its overall requirements for ballistic missile defense elements and interceptors. The newly established BMDS Life Cycle Management Process, which DOD has started using to prepare an annual capabilities portfolio and program plan to meet requirements, has broadened the participation of stakeholders from across DOD in developing the annual budget proposal for ballistic missile defense capabilities development, operations, and support.²⁴ The Life Cycle Management Process is designed to allow DOD to balance long-term and

²⁴For a discussion of GAO's perspective on DOD's progress and challenges to improving oversight of the BMDS through the Life Cycle Management Process, see [GAO-09-466T](#).

near-term needs by reviewing ballistic missile defense capability developments as a portfolio. However, to date the Missile Defense Executive Board, which oversees the process, has not commissioned a broad-based analysis of DOD's overall requirements, and instead has depended on more limited analyses of quantity requirements to inform its deliberations over the missile defense budget. For example, in preparing DOD's fiscal year 2010 budget proposal, and again in beginning to prepare for the fiscal year 2011 proposal, the board relied on the Joint Staff's limited analysis of THAAD and Aegis BMD requirements. The Joint Staff is completing additional studies focused on the impact of countermeasures on ballistic missile defenses and plans on studying how ballistic missile defense and air defense can be integrated. However, according to Joint Staff officials, these studies do not assess ballistic missile defense requirements in their entirety. As part of the congressionally mandated review of ballistic missile defense policy and strategy, DOD expects to examine, among other things, the appropriate balance among elements to defend against ballistic missiles of all ranges; the role of allied contributions; and options for defending Europe from Iranian ballistic missile defense attack. The review is required to be completed by January 2010 and is expected to inform future budget requests. Given its broad charter and short time frame, the review is not expected to include an underpinning, comprehensive analysis of all requirements. However, the policy and strategy review could potentially lead to revised ballistic missile defense requirements.

Force Structure Not Fully in Place for Some Units Operating Ballistic Missile Defense Elements

DOD has faced challenges in fully establishing units to operate five of the eight ballistic missile defense elements that have been put into operational use. DOD typically requires that major weapon systems be fielded with a full complement of organized and trained personnel. To defend against potentially catastrophic threats posed by rogue states armed with ballistic missiles, however, DOD has in some cases put ballistic missile defense elements into operational use before first ensuring that the military services had created units and trained servicemembers to operate them. DOD had in place operational units to operate the three elements that were based on existing service weapon systems, such as Aegis ships and Air Force early warning radars that were upgraded to take on ballistic missile defense capabilities. However, the five remaining elements that have been put into operational use represent new capabilities designed expressly for ballistic missile defense purposes and for which new operational units had to be created. As a result, early fielding meant that units were not fully in place and required, in some cases, that personnel be temporarily assigned or borrowed from other organizations when the

elements are put into operational use to address these potential threats. For example, the Army has faced personnel shortfalls to operate the Ground-based Midcourse Defense element, which necessitated augmentation with personnel from the Army National Guard to overcome operational readiness concerns. These personnel shortages primarily resulted from the need for Army units to participate in MDA research and development activities, which are important to improving the element's capabilities. MDA and the military services are taking steps to establish the forces needed for operations, but this may take years for some elements. DOD recognizes the challenges created by putting elements into early use, but has not set criteria requiring that operational units be in place before new elements are made available for use. In the future, emerging threats or crises could again require DOD to press developmental capabilities into use. However, until DOD reconsiders its approach to making elements available for operational use before the units are fully organized, manned, and trained to perform all of the missions they will be expected to execute, the combatant commanders will lack certainty that the forces can operate the elements as expected.

DOD's Approach to Ballistic Missile Defense Has Focused on Early Fielding of Capabilities

DOD's approach to ballistic missile defense development differs from its standard weapons development process in order to stress the early fielding of new capabilities. DOD practices for developing military capabilities typically require that major weapon systems complete developmental activities and then be fielded with a full complement of organized and trained personnel so that servicemembers are capable of operating the systems on behalf of the combatant commands.²⁵ DOD customarily prepares planning documents that identify organizational, personnel, and training requirements that must be established before a new weapon system can be declared operational for the first time. These requirements typically include an assessment of the military specialties needed; identification of personnel requirements; and the development of individual, unit, and joint training programs. The individual services also typically require the establishment of an operational unit that is manned with trained servicemembers before new weapon systems are used operationally. According to Army officials, the Army declares new weapon

²⁵DOD's traditional requirements process is described in Chairman, Joint Chiefs of Staff Instruction 3170.01G, *Joint Capabilities Integration and Development System* (Mar. 1, 2009). DOD's acquisition process is described in DOD Directive 5000.01, *The Defense Acquisition System* (May 12, 2003), and DOD Instruction 5000.02, *Operation of the Defense Acquisition System* (Dec. 8, 2008).

systems to be initially operational only after units have been activated and soldiers have completed collective training requirements for operating the systems. Navy and Air Force practices also emphasize establishing the organizations, personnel, and training needed to operate a weapon system before it is declared operational.

DOD adopted a unique acquisition approach for ballistic missile defense capabilities in order to meet the President's direction to begin fielding in 2004 an initial capability to defend against ballistic missiles that may carry weapons of mass destruction. In establishing MDA, the Secretary of Defense directed it to use prototype and test assets to provide early capability, if necessary, and improve the effectiveness of deployed capabilities by continuing research and development activities and inserting new technologies as they become available. Further, the Secretary gave MDA the flexibility to field ballistic missile defense systems in limited numbers when available, and to base production decisions on test performance. Although the Secretary directed that the services provide forces to support ballistic missile defense operations, he also canceled the services' requirements documentation prepared for then-developmental programs—such as THAAD and Ground-based Midcourse Defense—because the service-generated requirements were not consistent with the BMDS developmental objectives. Additionally, the Secretary directed that BMDS development would not be subject to DOD's traditional joint requirements determination processes and would utilize certain flexible acquisition practices until a mature ballistic missile defense capability had been developed and was ready to be handed over to a military service for production and operation. Consequently, the services initially had little basis on which to determine force structure requirements for some ballistic missile defense elements, even as MDA began to develop elements and add them to the BMDS operational baseline.

Units Are in Place to Operate Existing Systems That Were Modified for Ballistic Missile Defense

Our analysis determined that the units operating the existing service systems that were modified for ballistic missile defense have been organized, manned, and trained to execute their ballistic missile defense capabilities. Such systems make up three of the ballistic missile defense elements that DOD first put into operational use by activating them in 2006 in response to North Korea's ballistic missile threat:

- Upgraded Early Warning Radars. Air Force early warning radars, such as those at Beale Air Force Base and Royal Air Force Base Fylingdales, United Kingdom, were first developed and operated in the Cold War. As

these radars have been modified for ballistic missile defense missions, the Air Force assigned responsibility to the 21st Space Wing for operating the Beale Upgraded Early Warning Radar, while the United Kingdom has agreed to provide forces to operate and maintain the Fylingdales radar. The Air Force has provided stand-alone training equipment to train and qualify site personnel at the two Upgraded Early Warning Radars that DOD has already declared operational, and has certified that operational crews are fully trained at these radar sites. The Air Force has made similar preparations to begin operating a third Upgraded Early Warning Radar, located at Thule, Greenland, later in 2009.

- **Cobra Dane Radar Upgrade.** In accepting the transfer of the Cobra Dane Radar Upgrade from MDA, which was approved by the Under Secretary of Defense for Acquisition, Technology and Logistics in February 2009, the Air Force agreed to continue to manage the radar on behalf of its multiple missions and stakeholders, while MDA agreed to fund missile defense mission-specific operations and maintenance training and to assist the Air Force in identifying mission-specific operations costs. MDA also is providing maintenance support through fiscal year 2013, when maintenance support becomes an Air Force-funded responsibility.
- **Aegis BMD.** Aegis BMD-capable ships are operated by the Navy, and the Navy supports those ships through existing service-based infrastructure and processes. Servicemembers have been initially qualified on the ballistic missile defense mission through existing Navy commands and according to Navy practices. The Navy updated its training and personnel requirements and relied on established procedures to certify the performance of Aegis crews to perform the full range of Aegis BMD missions.

Units Operating Newly Developed Ballistic Missile Defense Elements Have Not Been Fully Organized, Manned, and Trained for All Tasks

Our analysis determined that DOD has not yet put into place operational units that are fully organized, manned, and trained to execute all of their ballistic missile defense responsibilities for the remaining five ballistic missile defense elements, which were designed expressly for ballistic missile defense and thus required DOD to create new units. In order to address existing and emerging threats, DOD used flexible acquisition practices to make these elements available for operational use before the services were fully ready to operate them. However, without fully established organizations, personnel, and training, these units faced challenges in dealing with the rapid fielding of elements, the ongoing research and development activities involving fielded elements, and the lack of an established force structure for operating the BMDS command and control system.

Rapid Fielding of Elements Has Challenged Operational Units

Operational units have faced challenges resulting from the rapid fielding of elements before the units have had all of the necessary organizations, personnel, and training in place. For example, the Army had only a few months after being named lead service to organize and train a detachment for managing the AN/TPY-2 forward-based radar, which MDA fielded in Japan and added to the BMDS operational baseline in September 2006.²⁶ In contrast, the Army generally requires years to organize an operational unit, establish personnel requirements, and train servicemembers for operating a new weapon system. The rapid fielding required the Army to deploy soldiers without a complete and approved force structure for sensor management operations when MDA added the radar to the baseline. For example, the Army did not yet have a program to train Army soldiers; to mitigate this shortfall, MDA provided the first group of Army sensor managers with an orientation of the AN/TPY-2 forward-based radar and of the radar management software then in use. A U.S. Army Space and Missile Defense Command official told us that the initial servicemembers' orientation lacked the requirements, curriculum, training devices, standards, and evaluations that are generally expected to be in place as part of an initial qualification training course when the Army fields a new weapon system. As a result of the Army's initiative, the initial sensor managers developed their own tactics, techniques, and procedures for managing the radar before the Army had in place a training course to qualify servicemembers in sensor management. Since that time, the Army has established a training course, which has graduated a sufficient number of servicemembers projected to meet combatant command needs.

Despite the Army's successes in training servicemembers, DOD still faces interrelated organizational and personnel challenges for the sensor management of the second AN/TPY-2 forward-based radar, which MDA fielded in Israel and made available for contingency operations in November 2008. At the time DOD fielded the radar, the Europe-based Army unit responsible for sensor management operations lacked both the organizational structure and sufficient personnel to perform these functions on a continual basis.²⁷ Rather, the unit was organized and

²⁶Sensor management operations include integration and management of the sensor with the Ground-based Midcourse Defense element and are executed from a remote location. Sensor management of the radar fielded to Japan in 2006 is executed by an Army unit located in Hawaii, and sensor management of the radar fielded to Israel in 2008 is executed by an Army unit located in Germany.

²⁷Israel is located within the U.S. European Command area of responsibility and sensor management operations are performed remotely from Germany by the 357th Air Defense Artillery Detachment.

manned to perform air and missile defense operations on behalf of U.S. European Command, including command and control operations of Patriot air and missile defense forces, and air and missile defense operational and exercise planning. To minimize the potential risk to the unit's primary missions as it performed the newly assigned sensor management operations, the Air Force has deployed servicemembers, at U.S. European Command's request, and will deploy them throughout 2009 to augment the unit. However, these deployments have not fully addressed the stress to the unit. In March 2009, the Commander, U.S. European Command, testified that the unit's increasing requirements were "a moving target" and would demand considerable flexibility to identify and resource them in the near- to mid-term. U.S. Army Space and Missile Defense Command officials told us that the Army has established an operational unit in its force structure planning system to provide sensor management for the second AN/TPY-2 forward-based radar; however, the officials added that the Army has not activated the unit because DOD has not determined whether the radar will be permanently fielded in Israel.

The Sea-based X-Band Radar was first declared available for contingencies in 2008, and has been made operational for brief periods, without the full Navy force structure in place. Unlike Aegis BMD, which is based on existing Navy ships and support systems, the Sea-based X-Band Radar is a new system. In March 2007 the Navy agreed in principle to become the lead service for the Sea-based X-Band Radar, which could transfer to the Navy as early as 2011. However, to transfer to the Navy, the Sea-based X-Band radar element must pass a Navy inspection; and the combatant commands must determine not only that the element can perform all of its assigned missions, but also that the operator crew understands its current capabilities and limitations. Additionally, the Navy has agreed to the transfer of the element as long as funds for operating it are also transferred to the Navy; however, as we testified in March 2009,²⁸ the transfer agreement does not specify how these funds will be transferred to the Navy in the long term. Further, the Navy had yet to determine personnel requirements for the radar. To mitigate the potential risk of an incomplete force structure before the radar transfers, MDA has provided contractor personnel to support day-to-day operations, as needed.

MDA also declared the THAAD element to be available for contingencies in September 2008, and the Secretary of Defense activated the element in

²⁸ [GAO-09-466T](#).

the Pacific region twice during 2009, before the Army had the opportunity to fully establish the unit that will operate the first THAAD battery.²⁹ The Army activated a unit of 99 soldiers in 2008 to operate the first THAAD battery, but does not expect to complete the training and organizational activities needed to fully establish the unit and declare an initial operational capability until late in fiscal year 2010.³⁰ As a result, U.S. Pacific Command and other combatant commands are operating the element during contingencies with a unit composed of a mix of MDA personnel, contractors, and Army soldiers. According to MDA's August 2008 assessment of the element's capabilities and limitations at the time it was declared available for contingencies, the nonstandard unit lacks experience in tactical operations, has not completed collective training, and requires significant external support. Despite these force structure limitations, a U.S. Pacific Command official told us that the command requires THAAD in the event of a crisis. Further, Army and MDA officials told us that Army's approach to prepare forces to operate THAAD has been closely coordinated with MDA's schedule to acquire the element. Army officials added that the Army modified its approach from standard Army practices to more rapidly achieve an initial operational capability. However, Army officials told us that until the Army fully establishes the force structure to operate THAAD, the combatant commands may overestimate the Army's preparedness to deploy an operational unit to defend U.S. forces and population centers during a drawn out contingency. As a result, the benefit of rapidly fielding THAAD could be offset by the risks associated with depending on a unit that does not have the full complement of organized and trained personnel.

Operational Units Have Faced Challenges Caused by Ongoing Research and Development Activities

Operational units have also faced challenges resulting from ongoing research and development activities for which the units have not been organized, manned, and trained. U.S. Army Space and Missile Defense Command officials told us that involving operational units in BMDS research and development activities can be beneficial because it allows the lead service and operational personnel to directly affect an element's

²⁹This unit is the A Battery (THAAD), 4th Air Defense Artillery Regiment, 11th Air Defense Artillery Brigade, 32nd Area Air and Missile Defense Command. The Army also plans to activate the A Battery, 2nd Regiment, in fiscal year 2010; the D Battery, 2nd Regiment, in fiscal year 2012; and the B Battery, 2nd Regiment, in fiscal year 2013.

³⁰DOD defines an Initial Operational Capability as the first attainment of the capability to employ effectively a weapon, item of equipment, or system of approved specific characteristics that is manned or operated by an adequately trained, equipped, and supported military unit or force.

development. Like other BMDS elements, the Ground-based Midcourse Defense element was put into operational use to address existing threats, but is also simultaneously being tested and refined by MDA. Consequently, the Army units responsible for operating the element are also responsible for sending operational crews to participate in MDA-sponsored tests of new capabilities,³¹ such as upgraded versions of the Ground-based Midcourse Defense element's fire control software. However, like most other Army units, the Ground-based Midcourse Defense units are not organized, manned, and trained for tasks such as the testing associated with research and development activities. As a result, the Commanding General, U.S. Army Space and Missile Defense Command, concluded in May 2009 that the units' mismatch between the available crews and mission responsibility was creating an adverse impact on their operational readiness and performance of the Ground-based Midcourse Defense mission. Lacking additional crews and funding, the Commanding General determined that the units' operational requirements would preclude them from fully contributing to MDA's developmental efforts, which in turn would have a negative impact on both the operational crews' readiness and the efforts to rapidly develop the Ground-based Midcourse Defense element. To address this mismatch, the Army has agreed to temporarily activate Army National Guard soldiers to augment the units' personnel. However, the Army has not solved the long-term mismatch between operational requirements and available personnel, and has requested that U.S. Army Space and Missile Defense Command evaluate and present alternatives for meeting the long-term requirements that the mission entails.

Ongoing research and development, as well as upgrades to elements, also create uncertainty about the preparedness of some operational units to operate elements under realistic conditions. For example, as new versions of the Ground-based Midcourse Defense element's fire control software are installed, Army soldiers operating the software typically complete their initial qualification training, and crews are certified, according to standard Army practices. However, in August 2008, following the Army's participation in an MDA test using high-fidelity modeling and simulation capabilities, U.S. Northern Command determined that the existing training equipment provided by MDA did not adequately simulate how other

³¹The Army established the 100th Ground-based Midcourse Defense Brigade, based in Colorado, and the 49th Ground-based Midcourse Defense Battalion, based in Alaska, to operate the Ground-based Midcourse Defense element.

ballistic missile defense elements interact with the fire control system.³² As a result, the Deputy Commander, U.S. Northern Command, stated that the Army's operational crews would no longer be certified on the fire control software until the crews had access to training systems that better reflected the operational behavior of BMDS elements. Since that time, MDA has installed an upgraded training system for Army operators to use. U.S. Northern Command officials stated to us that the upgraded training system is an improvement over the prior capability, and the Army units were using the upgraded system to train servicemembers on the next version of the fire control software. Officials from the 100th Brigade, U.S. Strategic Command, and MDA told us that MDA delayed declaring the upgraded fire control capability to be operational until the units had an opportunity to train on the upgraded operational system. However, as of July 2009 the Commander, U.S. Northern Command, had not determined whether the upgraded training capabilities were sufficient to certify the crews for operations.

DOD Plans for Establishing the Force Structure for the BMDS Command and Control Element Are Unclear

MDA retains lead responsibility for the command and control element, or C2BMC, unlike the other ballistic missile defense elements, which are being made part of the military services' force structure. According to MDA, retaining responsibility of C2BMC helps the agency control the configuration of the element as it is upgraded to more capable versions. Therefore, none of the services have been required to create units, train personnel, or provide servicemembers to the combatant commands to operate the C2BMC element. However, unlike the services, MDA lacks the responsibility for providing forces to support military operations. As a result, the combatant commands have had to identify and organize C2BMC operators from within their existing resources by drawing upon servicemembers who are already deployed to the commands for other warfighting responsibilities.

MDA has provided personnel and training to support the combatant commands' C2BMC operational requirements, but additional steps are needed to ensure that the combatant commands' needs are met. The C2BMC element is the integrating element that makes the BMDS a global system by providing combatant commanders with communications links, real-time battle information to make decisions, and a planning capability

³²The operational crews of the 100th Ground-based Midcourse Defense Brigade are certified by U.S. Army Space and Missile Defense Command in support of U.S. Northern Command.

to optimize the fielding of ballistic missile defense forces on a global scale. It is also used to perform sensor management of the AN/TPY-2 forward-based radar, and future C2BMC versions are expected to have the capability to control additional sensors. To help meet the combatant commands' operational needs, MDA has trained hundreds of servicemembers who were already assigned to the combatant commands;³³ through the end of 2008, MDA trained more than 200 personnel at U.S. Pacific Command and the Navy Pacific Fleet, 250 personnel at U.S. Northern Command, and more than 175 personnel at U.S. Strategic Command. MDA also deploys its own personnel to 26 locations around the world to help the combatant commands and other users operate the element. However, according to U.S. Army Space and Missile Defense Command officials, the inability to identify and request additional personnel from the services to operate the C2BMC element creates a potential personnel shortfall in combatant commanders' operations centers, which may become acute during a crisis when there are not enough personnel to effectively perform all required activities. Officials from U.S. Army Space and Missile Defense Command and the U.S. Pacific Command-based Army unit using the C2BMC element also told us that the detachment responsible for managing the AN/TPY-2 forward-based radar can become overtaxed by the responsibility to operate the C2BMC element for other functions and purposes.

Though none has been designated the lead service for the C2BMC element, the Army, Navy, and Air Force have started preparing to support the organizational, training, and personnel requirements to operate ballistic missile defense command and control and battle management systems. Such requirements could grow as MDA continues to add functions to the C2BMC element. Although the services have not established personnel requirements for operating the C2BMC system, DOD officials told us that future versions of the software may require crews of up to five personnel per shift. Moreover, at present MDA trains only individual servicemembers, not crews, to operate the C2BMC system. Furthermore, as of July 2009, the services' effort to establish requirements for the C2BMC element is in its very early stages. Until the services determine their respective requirements for manning and training for the C2BMC element, operational risks and impacts will persist.

³³The MDA-provided training does not include training for sensor management of the AN/TPY-2 forward-based radar, which the Army has provided to servicemembers since 2008.

DOD Has Taken Steps to Evaluate Operational Capabilities and Limitations, but Potential Risks Remain When Elements Are First Declared Operational

DOD has taken steps to evaluate the operational capabilities and limitations of ballistic missile defenses when they are first made available for operations. DOD recognized the potential operational risk of using developmental ballistic missile defense elements for military operations following the fielding of the AN/TPY-2 forward-based radar to Japan in 2006. In 2006, we also recommended that DOD develop operational criteria for evaluating ballistic missile defense elements before the Secretary of Defense declares the elements operational.³⁴ We found that without such criteria, the Secretary of Defense lacked a baseline against which to objectively assess the combatant commands' and services' preparations to conduct ballistic missile defense operations. Moreover, we found that lacking clear criteria, DOD may have difficulty determining whether the return on its significant development investment in the BMDS can be realized. Since our report was issued, U.S. Strategic Command's functional component for integrated missile defense has developed and begun evaluating ballistic missile defense elements against operational criteria to help the combatant commands and element operators understand the capabilities and limitations of ballistic missile defense elements as they are added to the BMDS operational baseline. However, these criteria were not designed to evaluate the extent to which the services had fully established the organizations, training, and personnel needed to operate ballistic missile defense elements.

In May 2009, MDA updated its *BMDS Master Plan* to more fully consider the extent to which the services are developing the organizations, personnel, and training needed for operations when declaring that an element has achieved Early Capability Delivery,³⁵ which is the first point where the element is made available for operational employment in defense of the United States or U.S. allies. MDA's plan incorporates reviews of the elements' performance under the commands' operational criteria before the MDA Director makes capability delivery declarations. The updated plan also states that MDA will support service and combatant command requirements for new equipment training, unit training, and certification, and that MDA will provide appropriate training facilities and support. These steps could help coordinate the services' force structure development with MDA's capability delivery schedule in the future. However, MDA's updated plan does not require that organizations,

³⁴GAO-06-473.

³⁵Missile Defense Agency, *Ballistic Missile Defense System (BMDS) Master Plan*, version 9.1 (April 2009). The plan was signed by the MDA Director on May 18, 2009.

personnel, and training of the operational unit be in place before MDA makes an Early Capability Delivery declaration, or before the Secretary of Defense subsequently activates the element.

The tension between the early fielding of ballistic missile defense capabilities and the desirability of preparing units to operate these capabilities was reflected in the views expressed by officials from across DOD during our review. Officials from the Office of the Secretary of Defense told us that MDA's flexibility to shift resources when developing and fielding ballistic missile defenses has allowed DOD to employ ballistic missile defense capabilities more quickly than if the services had been responsible for their development. Such flexibilities continue to reflect the urgency and national priority of the ballistic missile defense mission. However, they stated that it was appropriate to consider a ballistic missile defense element to be part of the respective service's force structure when MDA declared that the element had achieved Early Capability Delivery. Office of the Secretary of Defense, U.S. Strategic Command, and Army officials emphasized the need to establish a lead service early in development and to provide adequate lead time to establish an operational force structure before operating elements. For example, Army officials told us that the Army has established the operational units needed to perform ballistic missile defense missions, but agreed that the previous lack of coordination with MDA on the timing of fielding missile defense elements and declaring them operational has been problematic. Navy officials told us that the Navy does not recognize distinctions among MDA's capability delivery declarations; the Navy does not consider a ballistic missile defense element to be operational until the element has been fully incorporated into the Navy force structure. A U.S. Pacific Command official told us that some crises could require DOD to put developmental capabilities to operational use, adding that shifting emphasis to the establishment of the services' force structure could delay the availability of ballistic missile defense capabilities to the combatant commanders. However, the official agreed that it was reasonable for DOD to ensure that the services had fully established the units' organizations, personnel, and training needed to operate ballistic missile defenses before the elements were declared available for operations, provided that such assurances reflected a broader shift in DOD's policy goals from fielding systems quickly to the more deliberate development of capabilities that can be readily operated over sustained periods.

Better linkage between force structure development and element fielding plans is important because the currently configured BMDS is the starting point for additional capabilities and elements that await future

deployment. For example, MDA plans to field and declare operational additional AN/TPY-2 forward-based radars; although the Army now has in place the units to operate these radars in its force structure plans, the Army requires time to activate these units and prepare them for operations. Similarly, although both the Army and the Air Force have started planning to operate the proposed European Interceptor Site and European Midcourse Radar elements, which would be fielded in Europe to defend against ballistic missiles launched from the Middle East, both services will require time to prepare the operational units in order to be ready when MDA completes the development and fielding of these systems. Additionally, DOD's fiscal year 2010 missile defense budget proposal shifts emphasis toward developing new ascent phase capabilities, which are expected to intercept ballistic missiles before they can release countermeasures to defeat U.S. defenses. As DOD makes this shift, MDA and the services will need to closely coordinate their efforts in order to avoid the challenges that affected the operations of elements that have been previously fielded.

Conclusions

Ballistic missile defense elements and interceptors of various types are in demand from the geographic combatant commands, but DOD faces a high price tag to develop, acquire, operate, and support ballistic missile defense capabilities over the long term. Thus far, decisions regarding the shape and structure of the BMDS have been made based on policy first established in 2002 and on limited analyses of force structure options. DOD's analyses to date have helped the department understand some of its requirements and inform its policies, but these analyses are incomplete and have not covered the full range of ballistic missile defense missions. DOD's ongoing review of its ballistic missile defense policy and strategy provides a good opportunity for DOD to reassess its ballistic missile defense priorities and needs. However, the review is moving forward without the benefits that a comprehensive assessment of DOD's quantity requirements would provide. Lacking the solid foundation of a knowledge-based, comprehensive analytic basis for making decisions, which includes careful assessments of DOD's overall ballistic missile defense quantity requirements, DOD will continue to lack crucial data it needs to make the best possible policy, strategy, and budgetary decisions for ballistic missile defense.

Making BMDS elements available for operational use before units were fully established reflected DOD's sense of urgency to rapidly field defenses against potentially catastrophic threats. However, now that some ballistic missile defenses are in place, the risk of putting additional elements in use

before operational units are fully established must be weighed against the marginal benefits, absent an imminent threat. Looking forward, reassessing this approach is important because DOD has several elements in development that may be fielded in coming years, including additional forward-based radars, the interceptors and radars that are planned for fielding in Europe, and new elements associated with ascent phase intercept.

Recommendations for Executive Action

To establish the foundation needed to make effective policy, strategy, budgetary, and acquisition decisions, we recommend that the Secretary of Defense take the following two actions:

- Direct the preparation and periodic updating of a comprehensive analysis of the types and quantities of ballistic missile defense elements and interceptors that are required for performing ballistic missile defense missions worldwide. The analysis should consider the integration of elements; risk assessments of the threat, capabilities and limitations of the BMDS, and redundancy requirements; allied contributions; the employment of elements that can perform multiple types of ballistic missile defense missions and other missions; and any other relevant factors identified by the department.
- Use this analysis as a foundation for evaluating DOD's ballistic missile defense developmental and acquisition priorities in future budget requests as well as its overall ballistic missile defense policy and strategy direction.

To reduce the potential risks associated with operating ballistic missile defense elements with insufficient force structure, we further recommend that the Secretary of Defense require, in the absence of an immediate threat or crisis, that operational units be established with the organizations, personnel, and training needed to perform all of their ballistic missile defense responsibilities before first making elements available for operational use.

Agency Comments and Our Evaluation

In written comments on a draft of this report, DOD partially concurred with one and concurred with two of our recommendations. DOD's comments are reprinted in appendix II. DOD also provided technical comments that we incorporated as appropriate.

DOD partially concurred with our first recommendation to prepare and periodically update a comprehensive analysis of the types and quantities of ballistic missile defense elements and interceptors that are required for

performing ballistic missile defense missions worldwide. In its comments, DOD validated the need for a comprehensive and recurring analysis. DOD indicated that the ongoing ballistic missile defense review will develop the strategic themes and analytic bases to be used in future analyses. DOD also noted the interrelationships between ballistic missile defense and air defense, and that a comprehensive assessment must include these defenses. Moreover, DOD stated that decisions related to ballistic missile defenses must factor in the priorities of other government agencies, like the State Department. In our recommendation, we stated that DOD should consider any other relevant factors it identifies, and the inclusion of air defense and priorities of other government agencies can reasonably be seen as such relevant factors. DOD intends to perform a detailed assessment for ballistic missile defense requirements during each Quadrennial Defense Review cycle and once in the intervening years.³⁶ Overall, we generally agree with DOD's suggested approach to implement our first recommendation; such steps, if taken, would meet its intent.

In its response to our second recommendation that DOD use the comprehensive analysis as a foundation for future ballistic missile defense budget requests as well as setting policy and strategy direction, DOD concurred and indicated that this analysis would be used to shape ballistic missile defense developmental and acquisition priorities in future budget requests, and to shape overall ballistic missile defense policy, strategy, and future deployment options. However, until DOD conducts this detailed assessment of its overall ballistic missile defense quantity requirements, it will continue to lack crucial data needed to make policy, strategy, and budgetary decisions.

DOD concurred without comment with our third recommendation to require, in the absence of an immediate threat or crisis, that operational units be established with the organizations, personnel, and training needed to perform all of their ballistic missile defense responsibilities before first making elements available for operational use. Our recommendation recognizes that facing an immediate threat or crisis, DOD may need to field elements without first fully establishing operational units. However, now that some ballistic missile defenses are in place, we continue to

³⁶Section 901 of the National Defense Authorization Act for Fiscal Year 2000, Pub. L. No. 106-65 (1999), codified at 10 U.S.C. § 118, directed DOD to conduct comprehensive Quadrennial Defense Reviews every 4 years to examine elements of the defense program and policies of the United States, including the national defense strategy, force structure, modernization, infrastructure, and budget plan.

believe that DOD must carefully weigh the risk of putting additional elements in use before operational units are fully established against the marginal benefits of rapid fielding.

We are sending copies of this report to the Secretary of Defense; the Director, Missile Defense Agency; the Chairman, Joint Chiefs of Staff; the Commander, U.S. Strategic Command; and the Chiefs of Staff and Secretaries of the Army, Navy, and Air Force. In addition, this report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-3489 or pendletonj@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix III.



John H. Pendleton
Director
Defense Capabilities and Management

Appendix I: Scope and Methodology

During this review, we evaluated the Department of Defense's (DOD) assessments, prepared since 2002, of the types and quantities of ballistic missile defense elements required for ballistic missile defense missions, and DOD's efforts to establish the units to operate elements that have been put into use through July 2009.¹ To determine the extent to which DOD has identified the types and quantities of ballistic missile defense elements that it requires, we identified, obtained, and reviewed key guidance, studies, and analyses from the Office of the Secretary of Defense, Missile Defense Agency (MDA), the Joint Staff, U.S. Strategic Command, other combatant commands, and the military services. These documents included memorandums from the Office of the Secretary of Defense and DOD Directive 5134.9, *Missile Defense Agency (MDA)*, dated October 9, 2004, which established MDA and directed the development of the Ballistic Missile Defense System (BMDS); Office of the Secretary of Defense budget guidance establishing the goals and objectives of the BMDS; and direction from the Deputy Secretary of Defense establishing the Missile Defense Executive Board and BMDS Life Cycle Management Process. We obtained and reviewed classified briefings summarizing MDA studies, including the September 26, 2002, *Missile Defense Agency Response to Defense Planning Guidance Tasking*; the October 26, 2004, briefing titled *Missile Defense Capability*; and the March 23, 2007, *European Site Technical Rationale*. We confirmed with MDA officials that these studies constituted the key initial MDA analyses outlining the types and quantities of elements and interceptors constituting the BMDS. We also obtained and reviewed unclassified briefings summarizing MDA's 2002-2004 plans to establish an initial and evolving defensive capability against ballistic missile threats. To understand the Joint Staff's roles and contributions to determining DOD's quantity requirements for ballistic missile defense elements and interceptors, we obtained and reviewed briefings summarizing the Joint Staff's studies of Aegis Ballistic Missile Defense (Aegis BMD) and Terminal High-Altitude Area Defense (THAAD) quantity requirements, including the 2006 *Joint Ballistic Missile Defense Capability Mix Study* and the subsequent *Ballistic Missile Defense Joint Capability Mix II* and *Ballistic Missile Defense Joint Capability Mix Sensitivity Analysis*.

¹Because Patriot Advanced Capability-3 is not among the Ballistic Missile Defense System (BMDS) elements that the Missile Defense Agency (MDA) has declared ready for operations, we did not evaluate the Army's efforts to establish the units needed to operate the element. Although MDA and the Army continue to work together to integrate the system's capabilities into the overall BMDS, Patriot Advanced Capability-3 transferred to the Army in 2003 and has been fully integrated into the Army's existing force structure for the Patriot air and missile defense system.

studies. To understand how these studies were used to develop MDA's fiscal year 2010 budget request, we obtained and reviewed key memorandums from the Joint Staff and the Office of the Secretary of Defense. We also obtained and reviewed guidance approved by the Deputy Secretary of Defense establishing the Joint Staff's and U.S. Strategic Command's roles to develop analytical studies that are to be used as the basis for developing annual BMDS budget proposals. From U.S. Strategic Command, we obtained and reviewed Strategic Command Instruction 538.3, *Warfighter Involvement Process*, dated June 2008, and the 2007 *Prioritized Capabilities List* to help us to understand the command's role in identifying and advocating for BMDS quantity requirements. We also used the U.S. Strategic Command documentation to identify key geographic combatant commands with ballistic missile defense requirements. These commands are U.S. Central Command, U.S. European Command, U.S. Northern Command, and U.S. Pacific Command. We then obtained and reviewed briefings and other documents to understand the extent to which these commands had identified quantity requirements for ballistic missile defense elements and interceptors. We also identified and reviewed Army and Navy analyses to identify the quantities of key elements. We analyzed DOD's various studies by comparing them with criteria for establishing a knowledge-based approach to acquiring major weapon systems, which we established based on our prior work on knowledge-based acquisition² and on DOD documentation. We also met with officials from the Office of the Secretary of Defense, Joint Staff, MDA headquarters and element program offices, key geographic combatant commands, U.S. Strategic Command, and each of the military services to discuss DOD's efforts to establish type and quantity requirements for ballistic missile defense force structure, their respective roles and responsibilities in preparing such analyses, and the challenges of doing so.

To determine the extent to which the military services have established the units needed to operate ballistic missile defense elements, we performed our work at each of the military services, MDA, the Office of the Secretary of Defense, and key combatant commands. During our work at each of the services, we adopted an element-by-element approach to review the progress made by each service:

- To review the extent to which the Air Force has established units for operating the Upgraded Early Warning Radars and the Cobra Dane Radar

²[GAO-08-619](#) and [GAO-08-467SP](#).

Upgrade, we obtained and reviewed Air Force plans for declaring the Beale and Fylingdales radars operational. We obtained Air Force memorandums declaring whether the radars had met Air Force operational criteria for being considered initially operational. We also met with officials from the Air Force Air Staff and Air Force Space Command, and submitted questions to Air Force Space Command, which provided us with written responses. We also reviewed an agreement between the Air Force and MDA describing each organization's roles and responsibilities upon the transfer of the Cobra Dane Radar Upgrade from MDA to the Air Force.

- To review the extent to which the Navy has established the force structure for Aegis BMD and Sea-based X-Band Radar elements, we obtained and reviewed Navy certifications of the Aegis BMD capability and the Pacific Fleet's December 2008 draft *Sea-based X-Band Radar Concept of Operations*. We also reviewed an agreement between MDA and the Navy describing each organization's roles and responsibilities for providing operational forces for the Sea-based X-Band Radar until the radar transfers to the Navy. We also met with Navy officials from the Office of the Chief of Naval Operations and from the Office of the Commander, Pacific Fleet.
- To review the extent to which the Army has established units with the required organizations, training, and personnel for the Ground-based Midcourse Defense, THAAD, and AN/TPY-2 forward-based radar elements, we reviewed documentation establishing each of the Army units covered by our review. We obtained and reviewed Army doctrine for THAAD and Ground-based Midcourse Defense operations and the Army's 2009-2013 and 2010-2015 force structure plans. We obtained and reviewed key U.S. Army Space and Missile Defense Command documentation regarding a command initiative to review and update the force structure for Ground-based Midcourse Defense. We met with officials from the Army staff, U.S. Army Space and Missile Defense Command, 100th Missile Defense Brigade, 49th Missile Defense Battalion, Forward-based X-Band Radar Detachment, 94th Army Air and Missile Defense Command, and 357th Air Defense Artillery Detachment.

In addition to our work at the services, we also met with officials from MDA to discuss the agency's perspectives and contributions to the ballistic missile defense force structure, particularly for the Command, Control, Battle Management, and Communications element. We submitted questions to each element program office and received written responses. We also obtained and reviewed key documents from the Office of the Secretary of Defense, including the *BMDS 2007 Transition and Transfer Plan*, which was published in February 2008. We established criteria for assessing the services' efforts to establish units with the required

organizations, personnel, and training by reviewing our prior work on planning for ballistic missile defense operations,³ and by obtaining and reviewing key DOD and service documents. These included Chairman, Joint Chiefs of Staff, Instruction 3170.01G, *Joint Capabilities Integration and Development System*; Army Regulation 71-11, *Total Army Analysis*; Army Regulation 71-32, *Force Development and Documentation—Consolidated Policies*; and Air Force Instruction 10-601, *Capabilities-Based Requirements Development*. We obtained and reviewed documents outlining MDA's process and criteria for declaring elements to be available for operational use; these included MDA's *Ballistic Missile Defense (BMDS) Master Plan*, version 9.1, which was signed in May 2009, and prior versions of this plan; integrated master schedules; and other MDA guidance. We determined when MDA had first delivered capabilities to the combatant commands for operational use by reviewing MDA's initial operational baseline, dated April 2005, and subsequent memorandums issued by the MDA Director to update this baseline or declare elements to be available for contingency operations. We met with officials from U.S. Strategic Command and from the four geographic combatant commands that have identified ballistic missile defense priorities: U.S. Central Command, U.S. European Command, U.S. Northern Command, and U.S. Pacific Command. We also met with officials from U.S. Strategic Command's Joint Functional Component Command for Integrated Missile Defense, who provided us with the component's most recently completed *Force Preparation Campaign Plan* that outlines the command's approach and operational criteria for assessing ballistic missile defense element performance.

We conducted this performance audit from August 2008 to September 2009 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

³[GAO-06-473](#).

Appendix II: Comments from the Department of Defense



OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

SEP - 9 2009

Mr. John H. Pendleton
Director, Defense Capabilities and Management
U. S. Government Accountability Office
441 G. Street, N.W.
Washington, DC 20548

Dear Mr. Pendleton:

This is the Department of Defense (DoD) response to the GAO draft report GAO-09-856, "MISSILE DEFENSE: DoD Needs to More Fully Assess Requirements and Establish Operational Units before Fielding New Capabilities," dated August 14, 2009 (GAO Code 351260).

The DoD concurs with two of the draft report's recommendations and partially-concurs with one. The rationale for our position is included in the enclosure. I submitted separately a list of technical and factual errors for your consideration.

We appreciate the opportunity to comment on the draft report. My point of contact for this effort is Mr. David Crim, 703-697-5385, david.crim@osd.mil.

Sincerely,

David G. Ahern
Director
Portfolio Systems Acquisition

Enclosure:
As stated

GAO DRAFT REPORT – DATED AUGUST 14, 2009
GAO CODE 351260/GAO-09-856

"MISSILE DEFENSE: DoD Needs to More Fully Assess
Requirements and Establish Operational Units before Fielding New
Capabilities"

DEPARTMENT OF DEFENSE COMMENTS
TO THE GAO RECOMMENDATIONS

RECOMMENDATION 1: The GAO recommends that the Secretary of Defense direct the preparation and periodic updating of a comprehensive analysis of the types and quantities of ballistic missile defense elements and interceptors that are required for performing ballistic missile defense missions worldwide. The analysis should consider the integration of elements; risk assessments of the threat, capabilities and limitations of the BMDS, and redundancy requirements; allied contributions; the employment of elements that can perform multiple types of ballistic missile defense missions and other missions; and any other relevant factors identified by the Department.

DoD RESPONSE: Partially Concur. While as the GAO notes, the DoD currently conducts a number of analyses to determine the appropriate set of ballistic missile defense capabilities, the recommendation for DoD to prepare and update a comprehensive analysis of types and quantities of ballistic missile defense elements (to include interceptors) required for performing worldwide ballistic missile defense missions is valid. In addition, given the interrelationships between ballistic missile defense and air defense both operationally and technically, analyzing ballistic missile defenses must include a comprehensive assessment of global capabilities. In addition, decisions related to ballistic missile defenses must factor in the priorities not only of the broader DoD enterprise, but of other government agencies (e.g. the Department of State).

The ongoing Ballistic Missile Defense Review will develop the strategic themes and analytic bases to be used in this periodic review. This analysis can then be incorporated into the Quadrennial Defense Review (QDR), which includes all principal stakeholders and meets the criterion for periodic update. The DoD will conduct a more detailed assessment of needs and capabilities during each QDR cycle and once in the intervening four years between QDRs the DoD will update the assessment. Because of the large number of factors GAO recommends for inclusion in the review (degree of integration, threat risk assessments, Ballistic Missile Defense System capabilities and limitations, redundancy requirements, allied contributions, employment of multi-mission assets, and other relevant factors) and the biennial budget planning process, it would be impractical to conduct such a comprehensive review on a more frequent basis.

RECOMMENDATION 2: The GAO recommends that the Secretary of Defense use this analysis as a foundation for evaluating DoD's ballistic missile defense developmental and acquisition priorities in future budget requests as well as its overall ballistic missile defense policy and strategy direction.

DoD RESPONSE: Concur. If undertaken as part of the Quadrennial Defense Review, this analysis would serve the GAO-recommended purposes of shaping ballistic missile defense developmental and acquisition priorities in future budget requests, and shaping overall ballistic missile defense policy, strategy, and future deployment options.

RECOMMENDATION 3: The GAO recommends that the Secretary of Defense require, in the absence of an immediate threat or crisis, that operational units be established with the organizations, personnel, and training needed to perform of their ballistic missile defense responsibilities before first making elements available for operational use.

DoD RESPONSE: Concur.

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

John H. Pendleton, (202) 512-3489 or pendletonj@gao.gov

Acknowledgments

In addition to the contact named above, Marie Mak, Assistant Director; David Best; Colin Chambers; Tara Copp Connolly; Nicolaas C. Cornelisse; Susan Ditto; and Kevin L. O'Neill, Analyst-in-Charge, made significant contributions to this report.

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