Report to Congress
on
Assessment of the Ground-Based Midcourse Defense Element of the Ballistic Missile Defense System

Under Secretary of Defense
(Acquisition, Technology & Logistics)

May 2010

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Exemptions 2, 3, and 5 apply.

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1.0 REPORT PURPOSE

This report is a response to the National Defense Authorization Act for Fiscal Year 2010 (Section 232 of Public Law 111–84) which directs the following:

(a) SENSE OF CONGRESS.— It is the sense of Congress that the Secretary of Defense should ensure the reliability, availability, maintainability, and supportability of the Ground-Based Midcourse Defense element of the Ballistic Missile Defense system throughout the service life of such element.

(b) ASSESSMENT REQUIRED.—

> *(1) IN GENERAL.—As part of the quadrennial defense review, the Nuclear Posture Review, and the Ballistic Missile Defense Review, the Secretary of Defense shall conduct an assessment of the following:*
>
> > *(A) Ground-Based Midcourse Defense element of the Ballistic Missile Defense system.*
> >
> > *(B) Future options for the Ground-Based Midcourse Defense element.*
>
> *(2) ELEMENTS.—The assessment required by paragraph (1) shall include an assessment of the following:*
>
> > *(A) The ballistic missile threat against which the Ground-Based Midcourse Defense element is intended to defend.*
> >
> > *(B) The military requirements for Ground-Based Midcourse Defense capabilities against such missile threat.*
> >
> > *(C) The capabilities of the Ground-Based Midcourse Defense element as of the date of the assessment.*

(D) The planned capabilities of the Ground-Based Midcourse Defense element, if different from the capabilities under subparagraph (C).

(E) The force structure and inventory levels necessary for the Ground-Based Midcourse Defense element to achieve the planned capabilities of that element, including an analysis of the costs and the potential advantages and disadvantages of deploying 44 operational Ground-Based Interceptor missiles.

(F) The infrastructure necessary to achieve such capabilities, including the number and location of operational silos.

(G) The number of Ground-Based Interceptor missiles necessary for operational assets, test assets (including developmental and operational test assets and aging and surveillance test assets), and spare missiles.

(3) REPORT.—At or about the same time the budget of the President for fiscal year 2011 is submitted to Congress pursuant to section 1105 of title 31, United States Code, the Secretary shall submit to the congressional defense committees a report setting forth the results of the assessment required by paragraph (1). The report shall be in unclassified form, but may include a classified annex.

2.0 EXECUTIVE SUMMARY

The United States is currently protected against limited long-range ballistic missile attacks. As part of the U.S. Ballistic Missile Defense System (BMDS), the Ground-Based Midcourse Defense (GMD) element is the backbone of a continuous operational capability to protect the United States against intermediate range and intercontinental ballistic missiles. However, given the uncertainties of future intercontinental ballistic missiles (ICBM) threats, including the rate at which they will mature, the United States plans to preserve its position of advantage by maintaining and enhancing the current midcourse defense capability and developing a hedge against future threat growth. The United States remains determined to provide a robust defense of the homeland against the threats of today and tomorrow, but it does not need to develop such capabilities at an accelerated rate with increased levels of programmatic risk.

> "Our goal is to enhance missile defense for the Unites States and our allies in Europe and elsewhere. As I have said many times, such a system has to work, be cost effective, and must address the real threats to the United States and our allies..."
>
> - President Obama

By the end of Fiscal Year (FY) 2010, a total of 30 operational Ground-Based Interceptors (GBIs) will be deployed as part of the BMDS with 26 at Fort Greely, Alaska and four at Vandenberg Air Force Base, California. Given the continuing improvements planned for the GMD element, 30 operational GBIs will defend the homeland for the foreseeable future against the projected threat from North Korea and Iran. Eight additional empty silos and storage of test and spare GBIs will provide a hedge against unanticipated ICBM threat growth through 2019.

The President's FY 2011 budget request provides a substantial investment in the GMD element, a total of $5.9 Billion across the Future Years Defense Plan (FYDP), including $1.3 Billion in FY 2011. The FYDP ensures the GMD element remains effective and viable over the long term by funding element and system improvements, including:

- Delivery of 22 GBIs for testing, stockpile reliability, aging and surveillance, and operational spare requirements;
- Refurbishment of 16 of the original 52 GBIs for both operational and flight test rotation during the FYDP;
- New software upgrades to expand GMD integration with the BMDS and improve interceptor discrimination capability;
- Interceptor obsolescence mitigation and avionics upgrades;
- Completion of Missile Field 2 with 14 silos at Fort Greely, Alaska by FY 2012 to increase the number of silos available for operational use if additional GBI deployments are needed;

- Completion of the Future Power Plant at Fort Greely, Alaska (b)(2),(b)(5) (b)(2),(b)(5); and
- Execution of the GMD reliability, availability, and maintainability program.

The President's FY 2011 budget also requests funds to continue executing operationally-realistic ground and flight testing of the GMD element of the BMDS, and to validate BMDS performance through robust models and simulation anchored by flight test data.

(b)(2),(b)(5)

The President's FY 2011 budget request supports operational, testing, rotational, and operational spare requirements of the GBI inventory.

- Thirty operational GBIs are needed to defend the homeland;
- Sixteen GBIs are needed to meet test requirements as determined by the Integrated Master Test Plan (IMTP); and
- Six GBIs are needed meet Stockpile Reliability Program and spare requirements to maintain an operational fleet of 30 GBIs as determined by reliability, availability, maintainability, and testability analysis.

Increasing the number of operationally deployed GBIs beyond thirty would significantly stress the planned inventory of 22 mission critical non-operational GBIs, requiring additional interceptor production, maintenance, and sustainment, at a significant increase in lifecycle costs. A complete report on the GMD element program plan is also provided.

The United States plans to deploy missile defenses to counter more immediate regional ballistic missile threats to our forward deployed troops and to our Allies in Europe. These plans involve a forward-deployed radar in Europe that will help homeland defense by detecting and tracking threat missiles launched out of the Middle East as early as possible and providing this tracking information to the GMD element to assist with the protection of the United States against the launch of ICBMs from that region.

To counter future missile threats, the United States is developing next-generation missile defense capabilities by investing in technologies which support early intercept of a threat missile in the initial phase of its flight. Early intercept provides opportunities for engagements early in the battle space and optimizes the ability to execute a shoot-look-

shoot tactic, force less effective deployment of countermeasures, minimize the potential impact of debris, and reduce the number of interceptors required to defeat a raid of threat missiles. Accordingly, the United States will invest in further development of the Standard Missile-3 for future land-based deployment as the ICBM threat matures and increase investment in sensors and early intercept kill systems to help defeat missile defense countermeasures. The United States is also pursuing a hedging strategy for defense of the homeland against long-range ballistic missile attacks by continuing the development and assessment of a two-stage GBI. These developments position the BMDS to stay ahead of the emerging long-range ballistic missile threat.

3.0 BALLISTIC MISSILE THREAT

Assess the ballistic missile threat against which the Ground-Based Midcourse Defense element is intended to defend

One of the most significant threats to the U.S. homeland is the continued progress of states in developing weapons of mass destruction and the means to deliver them with long-range ballistic missiles. For example, North Korean and Iranian space launch programs are part of their comprehensive development programs for ballistic missiles.

While it is difficult to make confident predictions about the future missile threat, the Intelligence Community assesses the threat posed by ballistic missile delivery systems is likely to increase and grow more complex. Current trends indicate that proliferation of ballistic missile systems, using advanced liquid- or solid-propellant propulsion technologies, are becoming more mobile, survivable, reliable, accurate and capable of striking targets over longer distances.

> "Current trends indicate that adversary ballistic missiles, with advanced liquid- or solid-propellant propulsion systems, are becoming more flexible, mobile, survivable, reliable and accurate while also presenting longer ranges."
>
> - LTG Michael Maples, Director, DIA

While both Iran and North Korea have demonstrated technologies that are directly applicable to the development of ICBMs, neither has yet to show any evidence of developing an ICBM-class warhead. The timing and attainment by North Korea and Iran of these and other capabilities are open questions, as is the deployment of such capabilities in increasing quantities over time. The Intelligence Community's assessment of the threat posed by ballistic missiles points to a balanced investment which contributes to the effective defense of the homeland and of U.S. forces, allies and friends overseas in both the near- and long-term. Defensive capabilities must be adaptable to unexpected threat developments as threats may mature more rapidly or slowly than predicted, appear in unexpected locations, or involve novel technologies or concepts of operations. It is essential that the United States be well-hedged and postured against unpredicted threat developments.

In addition to Sections 3.1 and 3.2 below, the classified annex of this report contains information on ballistic missile threats from North Korea and Iran against which the GMD element of the BMDS is intended to defend.

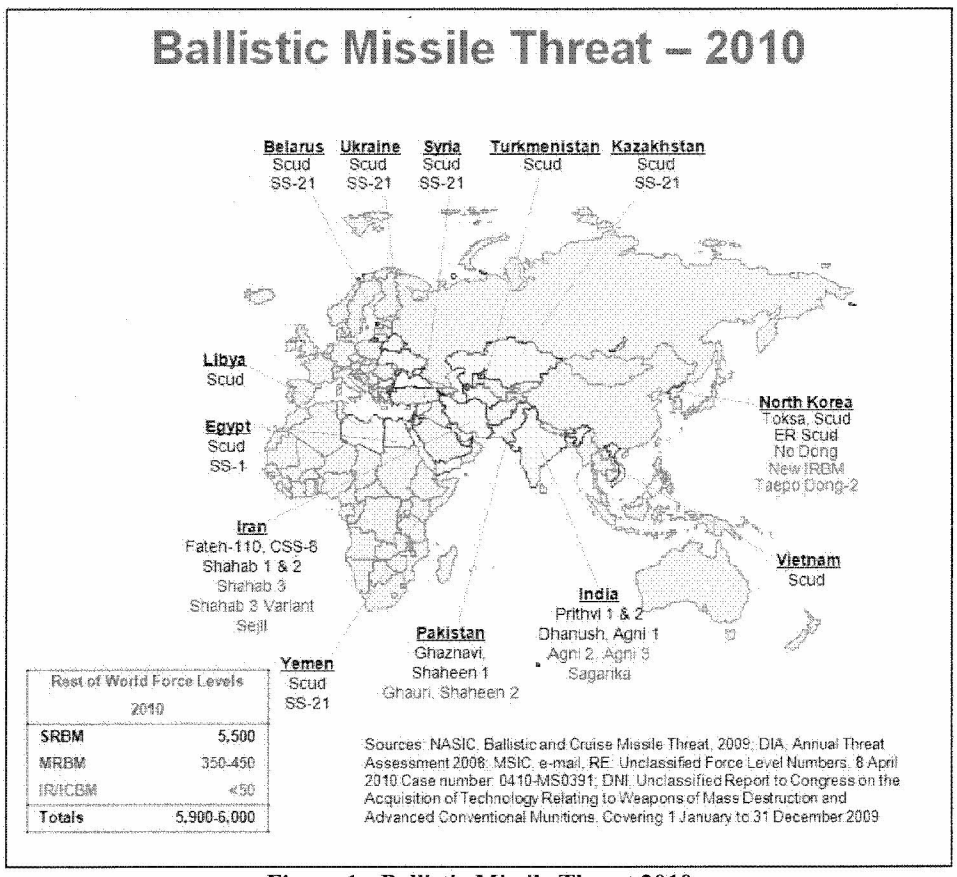

Figure 1: Ballistic Missile Threat 2010

3.1 North Korea

North Korea is developing the Taepo Dong-2 (TD-2) ballistic missile, which could reach the United States if developed as an ICBM. Although both launches of the TD-2 ended in failure, the April 5, 2009 flight, in an attempt to place a satellite into orbit, demonstrated a more complete performance than the July 2006 launch by successfully demonstrating the staging and separation technologies required to launch a two-stage TD-2 ICBM capable of reaching the United States.[1]

North Korea also possesses a No Dong ballistic missile capable of reaching Japan, South Korea and U.S. bases throughout the region, and continues to develop a new intermediate-range ballistic missile (IRBM) capable of reaching Guam and the Aleutian Islands.

[1] NASIC, Ballistic and Cruise Missile Threat, NASIC-1031-0985-09, p. 3 (NASIC Slicky)

North Korea's continued progress in developing the TD-2 clearly shows a determination to achieve long-range ballistic missile and space launch capabilities. If there are no major changes in North Korea's national security strategy in the next decade, it is reasonable to assume that North Korea will successfully flight test the TD-2 and be able to mate a nuclear warhead to a proven delivery system. Moreover, given North Korea's past activities to transfer its technology and ballistic missiles, the TD-2 could be exported to other countries in the future.[2]

3.2 Iran

Iran has grown its short- and medium-range missile inventories, while improving the lethality, deployability, and effectiveness of existing systems with new propellants, more accurate guidance systems and payloads.

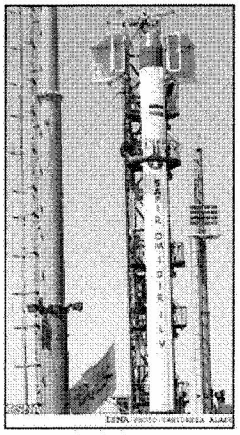

Figure 2: Iranian Safir SLV prior to launch on February 2, 2009

The Defense Intelligence Agency (DIA) assesses that Iran has not yet developed or deployed ICBM capabilities, but it continues to pursue longer-range ballistic missiles. In early 2009, Iran launched the Safir, a multi-staged space launch vehicle (SLV), demonstrating progress in some technologies relevant to ICBMs, and, in February 2010, displayed its next generation SLV, the Simorgh, showing progress in booster design that could be applicable to an ICBM design.[3] Iran's launch of a solid-fuel, 2,000 km medium-range ballistic missile (MRBM) in 2009[4] demonstrates a capability to strike targets in southern Europe as well as Israel. Intelligence assessments indicate that the continued production and deployment of these more capable MRBMs has become one of Iran's highest missile priorities.

With the successful launch of the Safir SLV on February 2, 2009, Iran demonstrated technologies that are directly applicable to the development of ICBMs.[5] Iran has ambitious ballistic missile and space launch development programs, and although it has not stated an intent to develop ICBMs, it continues to pursue longer range ballistic missiles. DIA assesses that, with sufficient foreign assistance, Iran could develop and test an ICBM capable of reaching the United States.[6]

---

[2] NASIC, Ballistic and Cruise Missile Threat, NASIC-1031-0985-09, p. 15.
[3] BMDR Report, February 2010, p. 4; and Iran's Military Power, Statement before the Committee on Armed Services United States Senate, 14 April 2010, by LTG Ronald L. Burgess, Director, DIA
[4] AFIS news article 5 July 2009
[5] DIA 2009 Threat Assessment
[6] Iran's Military Power, Statement before the Committee on Armed Services United States Senate, 14 April 2010, by LTG Ronald L. Burgess, Director, DIA.

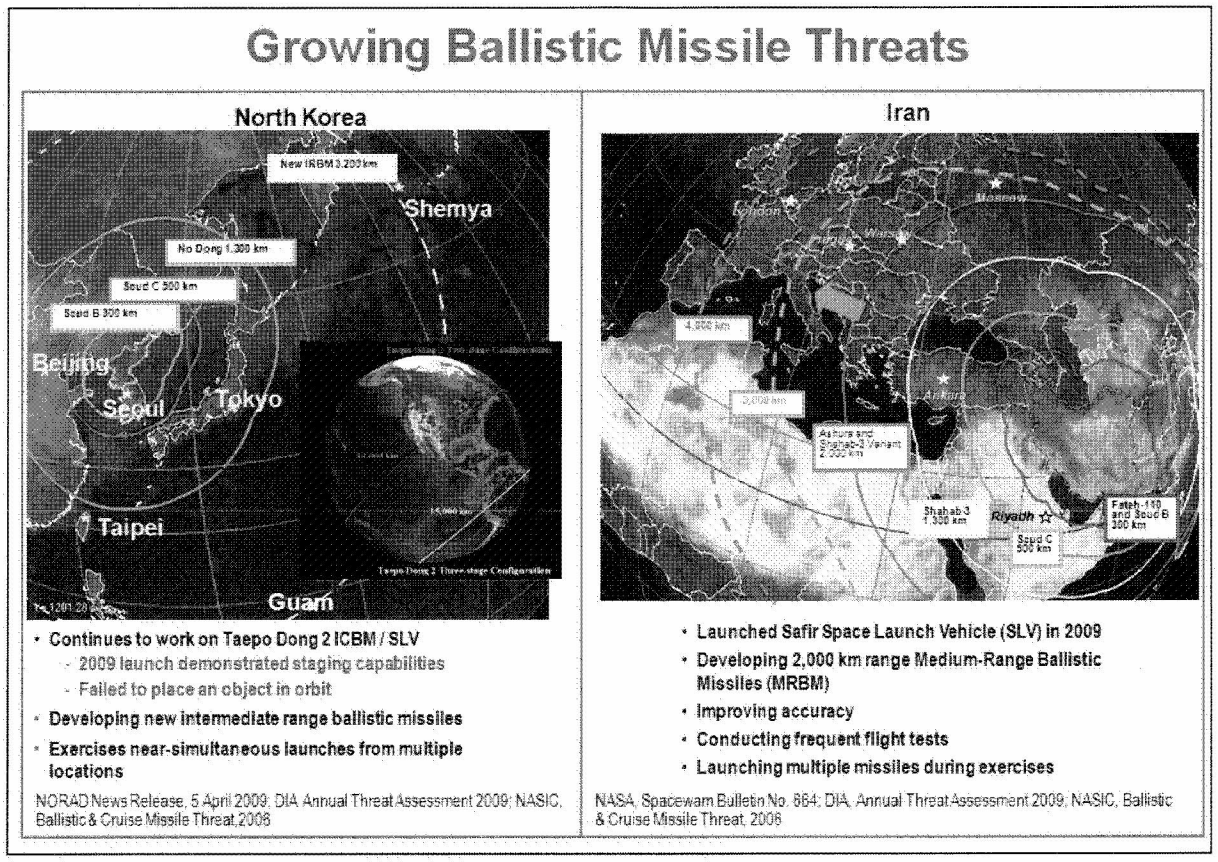

Figure 3: Growing Ballistic Missile Threats

4.0 BMDS LIFECYCLE MANAGEMENT

Assess the military requirements for Ground-Based Midcourse Defense capabilities against such missile threat

The President's FY 2011 missile defense budget request is the result of a comprehensive assessment of available and achievable capabilities, Warfighter requirements, and development risks, vetted through the Missile Defense Executive Board (MDEB) process.

The MDEB is chaired by the Under Secretary of Defense for Acquisition, Technology, and Logistics and includes representatives of the Combatant Commanders, the Joint Chiefs of Staff, Military Departments, Department of State and the National Security Staff. The MDEB provides guidance and oversight of U.S. missile defense activities and meets bi-monthly to review program progress, inform missile defense budget decisions, conduct missile defense development portfolio trades, and provide guidance to the MDA.

The MDEB is comprised of the following members:

- Under Secretary of Defense for Acquisition, Technology, and Logistics (Chairman)
- Under Secretary of Defense for Policy
- Under Secretary of Defense for Intelligence
- Assistant Secretary of State for International Security and Nonproliferation
- Vice Chairman, Joint Chiefs of Staff
- Commander, U.S. Strategic Command
- Director of Operational Test & Evaluation (DOT&E)
- Director of Defense Research & Engineering
- Vice Chief of Naval Operations
- Assistant Secretary of the Army for Acquisition, Logistics and Technology
- Deputy Under Secretary of the Air Force for Space Programs
- Director, Cost Assessment and Program Evaluation
- Director, Missile Defense Agency

To identify ballistic missile defense requirements, allocate resources and provide Departmental insight into cost control, the Department of Defense uses a Lifecycle Management Process. The Military Departments are involved in the process of setting requirements for capabilities and working through the service component commands with the Combatant Commands to provide capability to the Warfighter. All stakeholders in future ballistic missile defense capabilities are engaged in the oversight of the developmental process. The current approach, outlined in figure 4, defines requirements and acquires capabilities needed in a timely fashion.

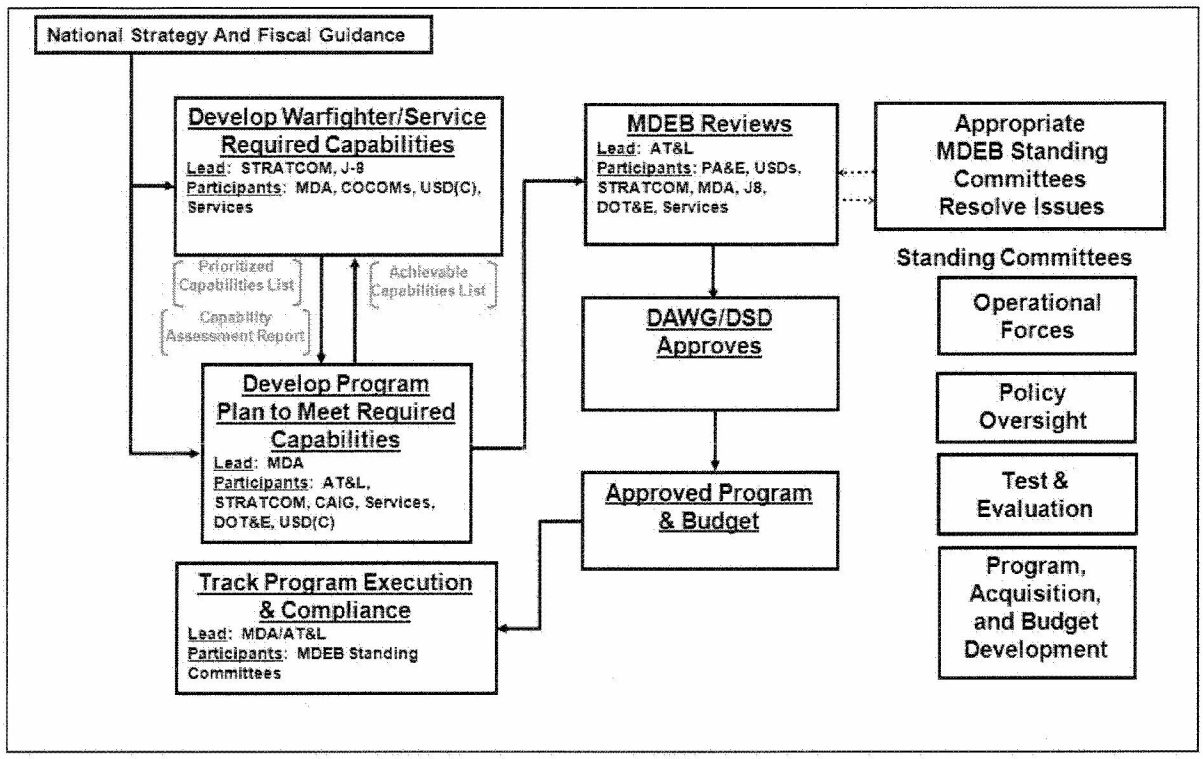

Figure 4: BMDS Lifecycle Management Process

In accordance with the 2008 Unified Command Plan, the United States Strategic Command (USSTRATCOM) systematically assesses and establishes the priorities for developing and fielding BMDS capabilities through the bi-annual Warfighter Involvement Process (WIP). The WIP involves all Combatant Commands and the Military Departments, and produces a Prioritized Capability List (PCL) of desired missile defense capabilities, which is reviewed by the MDEB on a recurring basis. Working with the Office of the Secretary of Defense (OSD), government laboratories, and industry, the MDA responds to the PCL with an assessment called the Achievable Capabilities List (ACL). The ACL provides the technical and schedule risks and programmatic feasibility of delivering the requested capabilities in the timeframe specified. The USSTRATCOM, as a member of the MDA's Program Control Board that manages the configuration of the MDA's programmatic and operational baselines, then rates the degree to which the ACL satisfies the PCL in the Capability Assessment Report (CAR). The CAR forms the rationale and justification for the MDA's annual budget submission to the MDEB.

The USSTRATCOM used the MDA's 2008 ACL and other studies, war games and exercises to develop the CAR delivered in April 2009. The CAR connects Combatant Command (COCOM) priorities with actual MDA development activities and allows for

an assessment of overall missile defense development trends. This process directly supports section 105 of the Weapons System Acquisition Reform Act of 2009, requiring COCOM input and ensuring a comprehensive and accurate description of the Combatant Commanders' needs and the responsiveness of the Office of the Secretary of Defense and the MDA to meeting those needs. The 2009 CAR projected capability through 2015, and in no case did the Warfighter assess that progress toward achieving desired capabilities is unsatisfactory.

The classified annex to this report contains GMD-related Warfighter desired items on the PCL, the subsequent CAR ratings by USSTRATCOM for each GMD-related PCL item, and corresponding activities in the President's FY 2011 budget request for the GMD element.

5.0 CURRENT CAPABILITIES OF THE U.S. BALLISTIC MISSILE DEFENSE SYSTEM

Assess the capabilities of the Ground-Based Midcourse Defense element as of the date of the assessment

As part of the BMDS, the GMD element provides Combatant Commanders with continuous (24/7/365), operational capability to protect the U.S. homeland against limited intermediate range and intercontinental ballistic missile attacks by engaging incoming warheads in the midcourse battle space. Figure 5 depicts current BMDS defensive coverage of the homeland against limited long-range ballistic missile attacks from North Korea and projected future threats from Iran.

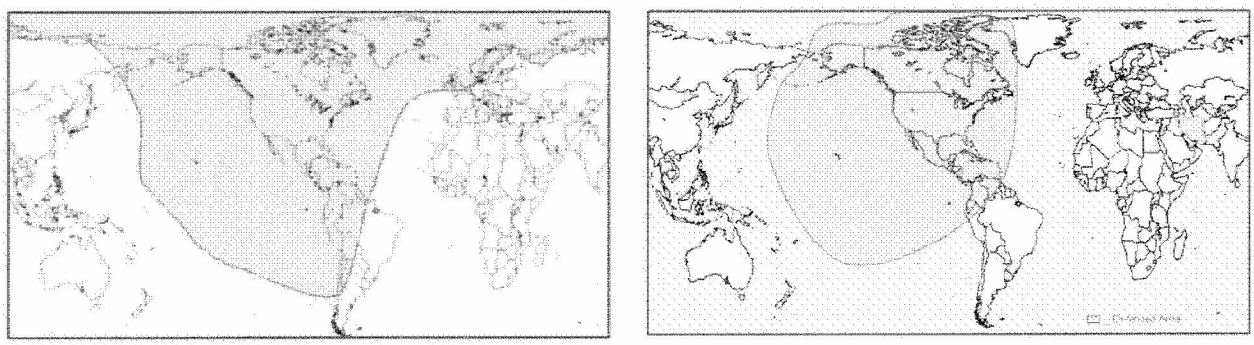

Figure 5: Current defensive coverage of the homeland provided by the BMDS employing GBIs in Alaska and California against limited long-range threats from North Korea (left) and future threats from Iran (right)

The classified annex to this report contains additional information on current BMDS capabilities to defend the homeland.

~~(FOUO)~~ (b)(2),(b)(5)
(b)(2),(b)(5)

[redacted]

[7] Ballistic Missile Defense System Accountability Report for 2009

(b)(2),(b)(5)

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BMDS performance metrics include:

- **Probability of Engagement Success (P_{ES}):** The Probability of Engagement Success, or P_{ES}, is the probability that the BMDS will prevent an adversary warhead from carrying out its mission. A major factor in determining the P_{ES} of an operational BMDS is the Probability of Destroying the threat, which is sometimes commonly referred to as the Probability of Kill with Single Shot (P_{SSK}) of the engaging weapon. P_{SSK} represents the lethality of a weapon system, generally referring to a system's armaments (e.g., missiles and ordnance). In general, each threat missile/warhead launch is unique and its P_{ES} is affected by both adversary- and BMDS-related variables, which include the following:

    - *Adversary Variables*: Threat Missile Characteristics, Launch Point/Aim Point, Trajectory, Raid Timing and Spacing, Attack Strategy, Countermeasures

    - *BMDS Variables*: Defense Deployment, Quantities of Defensive Resources, System (Kill Chain) Performance, Sensors, Weapons, Command and Control/Communications, Counter-counter Measures, Integration, Battle Management (e.g., Shot Doctrine, Tactics), Reliability/Availability of the Defense Elements

- **Launch Area Denied (LAD):** The geographic area from which an adversary targeting a designated defended region, represented as a set of designated aim points or regions, cannot launch a ballistic missile without it being engaged by the BMDS.

- **Defended Area (DA):** The geographic area that the BMDS is capable of defending against adversary ballistic missiles originating from specified launch positions or a designated launch region.

- **Threat & Countermeasures:** Various threat techniques (e.g., environmental, tactical), devices (e.g., decoys, jammers), and/or combinations (suites) of both that are designed to aid in defeating/disrupting a defensive weapon system's performance.

- **Environmental Resistance:** The ability of the BMDS to satisfy the Technical Objectives and Goals (TOG) effectiveness metrics in the presence of the designated stressing natural and hostile environments, which includes countermeasure devices and techniques, and adversary missile attacks on defense assets.

6.0 PLANNED CAPABILITIES OF THE U.S. BALLISTIC MISSILE DEFENSE SYSTEM

Assess the planned capabilities of the Ground-Based Midcourse Defense element, if different from the capabilities under subparagraph (C).

Given the uncertainties of future ICBM threats, we will preserve a position of advantage by maintaining and enhancing the current midcourse defense capability.

The President's FY 2011 budget request provides a substantial investment in the GMD element to ensure it remains effective and viable over the long-term. This is accomplished by funding element and system improvements, including:

- Refurbishment or delivery of 22 GBIs for testing and operational spare requirements;
- New software upgrades to expand GMD integration with the BMDS and improve interceptor discrimination capability;
- Interceptor obsolescence mitigation and avionics upgrades;
- The completion of Missile Field 2 with 14 silos at Fort Greely, Alaska by FY 2012 to increase the number of silos available for operational use if additional GBI deployments are needed;
- The completion of the Future Power Plant at Fort Greely, Alaska to address survivability and reliability concerns; and
- Implementation of a GMD reliability, availability, and maintainability program.

The President's FY 2011 budget also requests funds to continue executing operationally-realistic ground and flight testing of the GMD element of the BMDS, and to validate BMDS system performance through robust models and simulation anchored by flight test data.

The United States plans to deploy missile defenses to counter more immediate ballistic missile threats to our forward deployed troops and to our Allies. In Europe, these plans involve a forward-deployed radar that will provide data to augment missile defense coverage of the United States.

~~(FOUO)~~ (b)(2),(b)(5)
(b)(2),(b)(5)

[redacted]

[8] Ballistic Missile Defense System Accountability Report for 2009

(b)(2),(b)(5)

[redacted]

7.0 GROUND-BASED MIDCOURSE DEFENSE ELEMENT INVENTORY

Assess the force structure and inventory levels necessary for the Ground-Based Midcourse Defense element to achieve the planned capabilities of that element, including an analysis of the costs and the potential advantages and disadvantages of deploying 44 operational Ground-Based Interceptor missiles

7.1 Ground-Based Midcourse Defense Force Structure and Inventory Levels

The MDA will continue to follow the Department of Defense Ballistic Missile Defense capability-based acquisition strategy for the GMD element emphasizing test, development, and evolutionary acquisition. As described in Section 4.0 of this report, the MDA has structured its missile defense acquisition strategy in full consultation with key Department of Defense stakeholders through the MDEB and in accordance with the BMDS Lifecycle Management Process to continually provide needed upgrades to GMD element components within authorized funding availability. This process minimizes the risk of obsolescence, provides opportunities for updates based on threat assessments and test results, continually refurbishes the GBI fleet and collects aging data, and gives key stakeholders insight to make informed systems engineering trades between cost, schedule, and performance while exploring operational and technological possibilities.

~~(FOUO)~~ (b)(2),(b)(5)

(b)(2),(b)(5)

(b)(2),(b)(5)

(b)(2),(b)(5)

"Based on this limited threat and expectations of those counties' ability to improve their capabilities in the mid-term, I am confident that maintaining 30 interceptors on alert in Alaska and California gives the nation a robust defensive capability."

- Secretary of Defense

(b)(2),(b)(5)

7.2 Analysis of the Costs and Potential Advantages and Disadvantages of Deploying Forty-Four Operational Ground-Based Interceptors

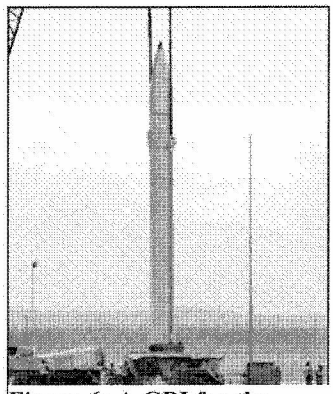

Figure 6: A GBI for the defense of the homeland is emplaced at Fort Greely, Alaska.

~~(FOUO)~~ (b)(2),(b)(5)

(b)(2),(b)(5)

(b)(2),(b)(5)

(b)(2),(b)(5)

(b)(2),(b)(5)

~~(FOUO)~~ (b)(2),(b)(5)

(b)(2),(b)(5)

8.0 GROUND-BASED MIDCOURSE DEFENSE ELEMENT INFRASTRUCTURE

Assess the infrastructure necessary to achieve such capabilities, including the number and location of operational silos

In order to achieve the capabilities described in Section 6.0 and the classified annex to this report a total of 30 operational GBIs and 39 silos are required, including 30 silos for operational use, eight silos as operational spares, and one for test. Although the Department of Defense has no plans to deploy more than 26 operational interceptors at Fort Greely, given the uncertainties of future ICBM threats, an additional eight spare silos provide the flexibility for a future contingency deployment of up to eight additional GBIs, if needed over the next decade in response to emerging threats. The procurement of additional GBIs is not required for this purpose.

Today there are 31 GBI silos at two sites in the United States: Fort Greely, Alaska, and VAFB, California. Thirty silos are currently available for operational use.

VAFB has five launch facilities, each with one silo. Of those five silos, three silos are dedicated for operational use with one silo available for either test or operations; and one silo dedicated for testing.

There are currently two completed missile fields at Fort Greely: Missile Field 1 and Missile Field 3 with six and 20 silos, respectively. All 26 silos at Fort Greely are designated for operational use.

Figure 7: Missile Field 2 at Fort Greely, Alaska under construction in September 2009. Construction of the 14 silo field will be complete in FY 2012.

~~(FOUO)~~ (b)(2),(b)(5)

(b)(2),(b)(5)

(b)(2),(b)(5)

(b)(2),(b)(5)

Concerning the location of operational GBI silos, Fort Greely, Alaska is strategically located to defend the homeland against long-range ballistic missile threats from both North Korea and Iran as it is the closest part of the United States to both countries.

Figure 8: Alaska is the closest part of the United States to both North Korea and Iran

GMD consists of other ground systems for battle management, launch control, and communications. Located at Fort Greely, Alaska are the Launch Site Component (LSC), GMD Fire Control (GFC), Command Launch Equipment (CLE), In-flight Interceptor Communication System (IFICS) Data Terminals (IDT), and the Defense Satellite Communication System (DSCS) equipment. VAFB has re-locatable IDT, CLE and LSC equipment. At Colorado Springs, Colorado there are two GFC nodes and three GFC remote workstation capabilities at Schriever Air Force Base (SAFB), Cheyenne Mountain Directorate (CMD), and Peterson Air Force Base (PAFB) for COCOM situational awareness and battle management.

Figure 9 below depicts the current GMD element, illustrating the integrated site components.

(b)(2),(b)(5)

Figure 9: Current GMD Element Configuration

9.0 GROUND-BASED INTERCEPTOR INVENTORY

Assess the number of Ground-Based Interceptor missiles necessary for operational assets, test assets (including developmental and operational test assets and aging and surveillance test assets), and spare missiles.

A total of 52 GBIs are necessary to meet operational, test, and operational spare requirements.

- Thirty GBIs for operational use
- Sixteen GBIs for IMTP testing
- Six GBIs for use as operational spare interceptors and Stockpile reliability testing

(b)(2),(b)(5)

Figure 10: GBI Requirements for Operations, Test, and Spares

9.1 Operational Inventory Requirements

A total of 30 operational GBIs will be deployed as part of the BMDS. Because of continuing improvements to the GMD element, this large number of GBIs, compared to the potential North Korean and Iranian long-range ballistic missile capabilities, as outlined in Section 3.0 and the classified annex to this report, is sufficient to defend the homeland for the foreseeable future, as outlined in Sections 5.0 and 6.0 and the classified annex to this report.

9.2 Test Inventory Requirements

A total of 22 GBIs are required for necessary data for the Critical Engagement Conditions (CECs) and Empirical Measurement Events (EMEs), Spares, SRP, and Aging and Surveillance goals associated with the GMD element. Of those 22, to meet IMTP flight test requirements, 16 GBIs are required to support 13 flight test events, between FY10 and FY20. At the end of 2020, six GBIs will remain for spares and Stockpile Reliability Program (SRP) testing. SRP testing includes specific aging surveillance actions as well as flight testing. See Appendix 11.1 for a list of GMD-specific CECs and EMEs.

9.2.1 Integrated Master Test Plan

Working closely with the Military Departments' Operational Test Agencies, the MDA is executing a rigorous test program documented in the Integrated Master Test Plan (IMTP) that includes expanding flight and ground test programs to test BMDS capabilities against medium-, intermediate-, and long-range threats. Because BMDS flight tests are expensive, as high as $200 Million for a long-range flight test, and are impacted by safety constraints and long planning timelines, the MDA focuses flight and ground test programs on fully validating models and simulations. Validated models and simulations are then used to run thousands of operationally realistic test scenarios across a full range of engagement conditions at a fraction of the cost of a flight test. The BMDS flight test program also helps demonstrate the integration of system assets, such as GMD, THAAD, AN/TPY-2, C2BMC, and the AN/SPY-1 radar on Aegis BMD ships. Integration expands BMD capability by pairing weapons and sensors according to mission needs.

Through the end of FY 2009, GMD flight testing was limited despite being three-for-three in flight intercept test attempts in its production hardware configuration. Only the performance of its most basic capability has been successfully demonstrated against IRBM-class targets. The MDA has been unable to demonstrate capability against simple countermeasures due to a target failure, and more testing is needed when considering the operating parameters associated with a system designed to destroy ICBMs.

Under the new parameter-based approach, the MDA and the Military Departments' Operational Test Agencies have identified the specific data to be gathered and the circumstances in which to measure them – Critical Engagement Conditions (CECs) and Empirical Measurement Events (EMEs). These CECs include measuring the effect of varying the following key factors affecting a kill vehicle's ability to see a target and adequately maneuver in time to collide with it: solar and lunar backgrounds; low intercept altitudes; timing between salvo launches; long times of flight; high closing velocities (ICBM-class targets); correcting for varying booster burnout velocities; and responding to countermeasures. While GMD has repeatedly intercepted re-entry vehicles in the IRBM regime, testing is needed against ICBM-class targets. GMD EMEs include measuring the GBIs ability to correct for booster burnout guidance errors, and assessing the ability to discriminate reentry vehicles from other objects using data provided by the Sea-Based X-band radar and other external sensors to assist with discrimination of multiple objects in the GBI kill vehicle seeker's field of view.

~~(FOUO)~~ (b)(2),(b)(5)

(b)(2),(b)(5)

9.2.2 GMD Sustainment Program

~~(FOUO)~~ (b)(2),(b)(5)

(b)(2),(b)(5)

(b)(2),(b)(5)

[redacted]

To meet IMTP flight test requirements for the GMD element and to gather the necessary CEC and EME data, a total of 16 GBIs are required to support 13 flight test events between FY10 and FY20. The six remaining GBIs will be utilized as spares or for SRP testing. SRP testing includes specific aging surveillance actions as well as flight testing. It is important to note that extensive stockpile reliability data will be gathered through the planned IMTP flight test events, refurbishment efforts, limited life component replacement and testing, as well as the SRP.

9.3 Operational Spare Inventory Requirements

At the end of 2020, six GBIs will remain for spares and SRP testing. Spare GBIs are required to maintain an operational fleet of 30 GBIs and GBI refurbishment objectives as determined by the GMD Reliability, Availability, Maintainability, and Testability (RAM-T) program. RAM-T analysis is based on several years of reliability data from operational GBIs gathered by Maintenance Built-In Test (MBIT) which monitors the health and status of fielded interceptors.

10.0 SUMMARY

The United States is currently protected by the BMDS against limited long-range ballistic missile attacks. Thirty operational GBIs will be deployed as part of the BMDS to defend the homeland for the foreseeable future from the potential ballistic missile capabilities of North Korea and Iran. However, given the Intelligence Community's ballistic missile threat assessment, the United States must ensure a balanced investment in BMDS capabilities to enable effective defense of the homeland, U.S. forces, allies and friends overseas in the near- and long-term. Defensive capabilities must be adaptable as threats may mature more rapidly or slowly than predicted, appear in unexpected locations, or involve novel technologies or concepts of operations.

Accordingly, the President's FY 2011 budget request provides a substantial investment in the GMD element to ensure it remains effective and viable over the long term. The request funds the operational, testing, rotational, and spare requirements of the GBI inventory and improvements to enhance the current midcourse defense capability, including the deployment of radars in southern Europe that will help homeland defense, and the completion of Missile Field 2 with 14 silos at Fort Greely to increase the number of silos available for operational use if additional GBI deployments are needed. However, increasing the number of operationally deployed GBIs beyond 30 would stress the planned inventory of mission critical non-operational GBIs, requiring additional interceptor production, maintenance, and sustainment, at a significant increase in lifecycle costs.

As a hedge against the potential threat growth the United States will also focus on developing proven technologies and capabilities to further enhance future defense of the homeland. The United States plans to invest in technologies to enable intercept of a threat missile early in its flight. Specifically, the United States will further develop the Standard Missile-3 for future land-based deployment as the ICBM threat matures and increase investment in sensors and other early intercept kill systems. These developments will ensure that the United States will stay ahead of the emerging long-range ballistic missile threat.

The GMD element is the backbone of a continuous operational capability to protect the United States against limited intermediate range and intercontinental ballistic missile attack.

11.0 APPENDIX

11.1 GMD Critical Engagement Conditions (CECs) and Empirical Measurement Events (EMEs)

GM-CEC-01, Solar Exclusion Angle
GM-CEC-03, Anti-Scintillation Modem Latency
GM-CEC-04, Low Intercept Altitude
GM-CEC-05, Salvo Intercept Time Spacing
GM-CEC-06, Large Weapon Task Plan (WTP) Errors
GM-CEC-08, Long Time of Flight
GM-EME-09, Closing Velocity
GM-EME-11, Booster Burnout with Large Velocity Error
GM-EME-12, Exo-atmospheric Kill Vehicle (EKV) Mitigation of Test Problem Report (TPR) 5920
GM-EME-13, 2-Stage with Original Avionics Flight
GM-EME-14, 2-Stage with Fleet Avionic Upgrade / Obsolescence Program (FAU/OP) Avionics Flight
GM-EME-15, 3-Stage with FAU/OP Avionics Flight
GM-EME-16, EKV Discrimination of Associated Objects

11.2 Acronym List

ACL	Achievable Capabilities List
AFIS	Air Force Intelligence Service
AN/SPY-1	Not an acronym – U.S. Military Electronics Type Designation for radar onboard Aegis BMD ships
AN/TPY-2	Not an acronym – U.S. Military Electronics Type Designation for Forward Based X-band Transportable Radar
BMDS	Ballistic Missile Defense System
BST	BMDS System Track
BVT	Booster Verification Test
C2BMC	Command and Control Battle Management and Communications
CAR	Capability Assessment Report
CE	Capability Enhancement
CEC	Critical Engagement Conditions
CLE	Command Launch Equipment
COCOM	Combatant Command
COS	Colorado Springs
CMD	Cheyenne Mountain Directorate
DA	Defended Area

DIA	Defense Intelligence Agency
DOT&E	Director, Operational Test and Evaluation
DSCS	Defense Satellite Communications System
ECM	Electronic Countermeasure
EE&I	Element Engineering and Integrations
EKV	Exo-atmospheric Kill Vehicle
EME	Empirical Measurement Events
FAU/OP	Fleet Avionic Upgrade / Obsolescence Program
FBM	Forward Based Mode
FGA	Fort Greely, Alaska
FIT	Failure Investigation Team
FOIA	Freedom of Information Act
FTG	Flight Test – Ground-Based Interceptor
FY	Fiscal Year
GBI	Ground-Based Interceptor
GCN	GMD Communications Network
GFC	GMD Fire Control
GMD	Ground-Based Midcourse Defense
ICBM	Intercontinental Ballistic Missile
IDT	In-Flight Interceptor Communication System Data Terminal
IFICS	In-Flight Interceptor Communication System
IMTP	Integrated Master Test Plan
IRBM	Intermediate Range Ballistic Missile
ISSA	Inter Service Support Agreement
J-GTEC	Joint GMD Training and Exercise Center
LAD	Launch Area Denied
LF	Launch Facility
LRS&T	Long Range Search & Track
LSC	Launch Site Components
LTG	Lieutenant General
M&S	Models and Simulations
MBIT	Maintenance Built-In Test
MDA	Missile Defense Agency
MDEB	Missile Defense Executive Board
MDIOC	Missile Defense Integration and Operations Center
MEB	Mechanical Electrical Building
MF	Missile Field
MRBM	Medium Range Ballistic Missile
NASA	National Aeronautics and Space Administration
NASIC	National Air and Space Intelligence Center
NORAD	North American Aerospace Defense Command

O&S	Operations and Sustainment
OBV	Orbital Boost Vehicle
OSD	Office of the Secretary of Defense
OTA	Operational Test Agencies
P_{ES}	Probability of Engagement Success
P_{SSK}	Probability of Kill with Single Shot
PAFB	Peterson Air Force Base
PBR	President's Budget Request
PCL	Prioritized Capability List
PDSS	Post Deployment Software Support
PE	Program Element
PM	Program Management
RAM-T	Reliability, Availability, Maintainability, and Testability
RDT&E	Research, Development, Test and Evaluation
RTS	Reagan Test Site
SAFB	Schriever Air Force Base
SBX	Sea-Based X-Band Radar
SRBM	Short Range Ballistic Missile
SRP	Stockpile Reliability Program
THAAD	Terminal High-Altitude Area Defense
TPR	Test Problem Report
TWA	Test and Warfighter Availability
UEWR	Upgraded Early Warning Radar
USNORTHCOM	U.S. Northern Command
USSTRATCOM	U.S. Strategic Command
VAFB	Vandenberg Air Force Base
WTP	Weapon Task Plan