



# Navy Aegis Ballistic Missile Defense (BMD) Program: Background and Issues for Congress

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## Summary

The Aegis ballistic missile defense (BMD) program, which is carried out by the Missile Defense Agency (MDA) and the Navy, gives Navy Aegis cruisers and destroyers a capability for conducting BMD operations. Under MDA and Navy plans, the number of BMD-capable Navy Aegis ships is scheduled to grow from 24 at the end of FY2011 to 36 at the end of FY2018.

Under the Administration's European Phased Adaptive Approach (EPAA) for European BMD operations, BMD-capable Aegis ships have begun operating in European waters to defend Europe from potential ballistic missile attacks from countries such as Iran. On October 5, 2011, the United States, Spain, and NATO jointly announced that, as part of the EPAA, four BMD-capable Aegis ships are to be forward-homeported (i.e., based) at Rota, Spain, in FY2014 and FY2015. BMD-capable Aegis ships also operate in the Western Pacific and the Persian Gulf to provide regional defense against potential ballistic missile attacks from countries such as North Korea and Iran.

The Aegis BMD program is funded mostly through MDA's budget. The Navy's budget provides additional funding for BMD-related efforts. MDA's proposed FY2013 budget requests a total of \$2,303.0 million in procurement and research and development funding for Aegis BMD efforts, including funding for Aegis Ashore sites that are to be part of the EPAA.

Issues for Congress for FY2013 include:

- the reduction under the proposed FY2013 budget in the ramp-up rate for numbers of BMD-capable Aegis ships over the next few years;
- the cost effectiveness and U.S. economic impact of shifting four Aegis ships to Rota, Spain;
- U.S. vs. European naval contributions to European BMD;
- the lack of a target for simulating the endo-atmospheric (i.e., final) phase of flight of China's DF-21 anti-ship ballistic missile;
- the capability of the SM-3 Block IIB Aegis BMD interceptor; and
- concurrency and technical risk in the Aegis BMD program.

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## Introduction

This report provides background information and issues for Congress on the Aegis ballistic missile defense (BMD) program, which is carried out by the Missile Defense Agency (MDA) and the Navy, and gives Navy Aegis cruisers and destroyers a capability for conducting BMD operations. Congress's decisions on the Aegis BMD program could significantly affect U.S. BMD capabilities and funding requirements, and the BMD-related industrial base.

## Background

### Aegis Ships

The Navy's cruisers and destroyers are called Aegis ships because they are equipped with the Aegis ship combat system—an integrated collection of sensors, computers, software, displays, weapon launchers, and weapons named for the mythological shield that defended Zeus. The Aegis system was originally developed in the 1970s for defending ships against aircraft, anti-ship cruise missiles (ASCMs), surface threats, and subsurface threats. The system was first deployed by the Navy in 1983, and it has been updated many times since. The Navy's Aegis ships include Ticonderoga (CG-47) class cruisers and Arleigh Burke (DDG-51) class destroyers.

### Ticonderoga (CG-47) Class Aegis Cruisers

A total of 27 CG-47s were procured for the Navy between FY1978 and FY1988; the ships entered service between 1983 and 1994. The first five (CGs 47 through 51), which were built to an earlier technical standard in certain respects, were judged by the Navy to be too expensive to modernize and were removed from service in 2004-2005.

As a cost-saving measure, the Navy's FY2013 budget proposes retiring 7 of the remaining 22 Aegis cruisers in FY2013 and FY2014, more than a decade before the end of their 35-year expected service lives.<sup>1</sup> One of these seven ships has been given a capability for BMD operations;<sup>2</sup> some or all of the other six were scheduled to be modified for BMD operations at some point.

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<sup>1</sup> The seven ships are *Cowpens* (CG-63), *Anzio* (CG-68), *Vicksburg* (CG-69), and *Port Royal* (CG-73), which are proposed for retirement in FY2013, and *Gettysburg* (CG-64), *Chosin* (CG-65), and *Hue City* (CG-66), which are proposed for retirement in FY2014. These ships entered service between 1991 (*Cowpens*) and 1994 (*Port Royal*); their 35-year service lives would extend to between 2026 and 2029. *Port Royal* was the last of the 27 ships in the class (i.e., it is the youngest ship in the class). Of the 22 Aegis cruisers currently in service, the oldest is *Bunker Hill* (CG-52), which entered service in 1986.

<sup>2</sup> The ship that has already been given a capability for BMD operations is *Port Royal* (CG-73).

## **Arleigh Burke (DDG-51) Class Aegis Destroyers<sup>3</sup>**

### ***62 Flight I/II and Flight IIA DDG-51s Procured in FY1985-FY2005***

A total of 62 DDG-51s were procured for the Navy between FY1985 and FY2005; the first entered service in 1991 and the 62<sup>nd</sup> is scheduled to enter service in FY2012. The first 28 ships, known as Flight I/II DDG-51s, are scheduled to remain in service until age 35. The next 34 ships, known as Flight IIA DDG-51s, incorporate some design changes and are scheduled to remain in service until age 40.

### ***No DDG-51s Procured in FY2006-FY2009***

No DDG-51s were procured in FY2006-FY2009. The Navy during this period instead procured three Zumwalt (DDG-1000) class destroyers. The DDG-1000 design does not use the Aegis system and does not include a capability for conducting BMD operations. Navy plans do not call for modifying DDG-1000s to make them BMD-capable.

### ***10 Flight IIA DDG-51s Procured or Programmed for FY2010-FY2016***

Procurement of DDG-51s resumed in FY2010. One Flight IIA DDG-51 was procured in FY2010, two more were procured in FY2011, and a fourth was procured in FY2012. Navy plans call for procuring six more Flight IIA DDG-51s in FY2013-FY2016. The ship procured in FY2010 is scheduled to enter service in FY2016.

### ***Flight III DDG-51s Programmed Starting in FY2016***

Navy plans call for shifting to procurement of a new version of the DDG-51, called the Flight III version, starting in FY2016.<sup>4</sup> The Flight III version is to be equipped with a new radar, called the Air and Missile Defense Radar (AMDR), that is more capable than the SPY-1 radar installed on all previous Aegis cruisers and destroyers.

## **Projected Aegis Ship Force Levels**

The Navy's FY2013 30-year (FY2013-FY2042) shipbuilding plan projects that the total number of Aegis cruisers and destroyers will decline from 80 ships in FY2013 to 77 ships in FY2014-FY2015, grow to a peak of 87 ships in FY2027, decline to 75 ships in FY2034, and grow back to 85 or 86 ships in FY2039-FY2042. These figures are for Aegis cruisers and destroyers only; they do not include the three DDG-1000s procured in FY2006-FY2009.<sup>5</sup>

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<sup>3</sup> For more on the DDG-51 program, see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.

<sup>4</sup> Of the two DDG-51s scheduled for procurement in FY2016, one is to be the final Flight IIA ship, and the other is to be the first Flight III ship.

<sup>5</sup> The three DDG-1000s are scheduled to enter service in FY2014, FY2016, and FY2018, and remain in service beyond the end of the 30-year period. For a table showing the total number of cruisers and destroyers each year from FY2013 through FY2042 (including the three DDG-1000s), see CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke. A similar table can be found in CRS (continued...)

## **Aegis Ships in Allied Navies**

Sales of the Aegis system to allied countries began in the late 1980s. Allied countries that now operate, are building, or are planning to build Aegis-equipped ships include Japan, South Korea, Australia, Spain, and Norway.<sup>6</sup>

## **Aegis BMD System<sup>7</sup>**

Aegis ships are given a capability for conducting BMD operations by incorporating changes to the Aegis system's computers and software, and by arming the ships with BMD interceptor missiles. In-service Aegis ships can be modified to become BMD-capable ships, and DDG-51s procured in FY2010 and subsequent years are to be built from the start with a BMD capability.

## **Versions of Aegis BMD System**

Currently fielded versions of the Aegis BMD system are called the 3.6.1 version and the newer and more capable 4.0.1 version. MDA and Navy plans call for fielding increasingly capable versions in coming years; these planned versions are called 5.0, 5.1, and 5.2. Improved versions feature improved processors and software, and are to be capable of using improved versions of the SM-3 interceptor missile (see **Table 1**).

MDA states that an in-service Aegis ship with a 3.6.1 BMD capability can be upgraded to a 4.0.1 BMD capability for about \$45 million to \$55 million.

## **Aegis BMD Interceptor Missiles**

The BMD interceptor missiles used by Aegis ships are the Standard Missile-3 (SM-3) and the Standard Missile-2 Block IV (SM-2 Block IV). The SM-2 Block IV is to be succeeded in coming years by a BMD version of the new SM-6 interceptor.

### ***SM-3 Midcourse Interceptor***

The SM-3 is designed to intercept ballistic missiles above the atmosphere (i.e., exo-atmospheric intercept), in the midcourse phase of an enemy ballistic missile's flight. It is equipped with a "hit-to-kill" warhead, called a kinetic warhead, that is designed to destroy a ballistic missile's warhead by colliding with it.

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(...continued)

Report RL32665, *Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress*, by Ronald O'Rourke.

<sup>6</sup> The Norwegian ships are somewhat smaller than the other Aegis ships, and consequently carry a reduced-size version of the Aegis system that includes a smaller, less-powerful version of the SPY-1 radar.

<sup>7</sup> Unless stated otherwise, information in this section is taken from MDA briefings on the Aegis BMD program given to CRS and CBO analysts in March 2010, March 2011, and March 2012.

MDA and Navy plans call for fielding increasingly capable versions of the SM-3 in coming years. The current version, called the SM-3 Block IA, is now being supplemented by the more capable SM-3 Block IB. These are to be followed by the SM-3 Block IIA and the SM-3 Block IIB.

Compared to the Block IA version, the Block IB version has an improved (two-color) target seeker, an advanced signal processor, and an improved divert/attitude control system for adjusting its course.

In contrast to the Block IA and IB versions, which have a 21-inch-diameter booster stage at the bottom but are 13.5 inches in diameter along the remainder of their lengths, the Block IIA version is to have a 21-inch diameter along its entire length. The increase in diameter to a uniform 21 inches provides more room for rocket fuel, permitting the Block IIA version to have a burnout velocity (a maximum velocity, reached at the time the propulsion stack burns out) that is greater than that of the Block IA and IB versions,<sup>8</sup> as well as a larger-diameter kinetic warhead. The United States and Japan have cooperated in developing certain technologies for the Block IIA version, with Japan funding a significant share of the effort.<sup>9</sup>

Compared to the Block IIA, the Block IIB version is to include a lighter kill vehicle, flexible propulsion, and upgraded fire control software.<sup>10</sup>

MDA states that that SM-3 Block IBs have an estimated unit procurement cost of about \$12 million to \$15 million, and that SM-3 Block IIAs have an estimated unit procurement cost of about \$20 million to \$24 million.

### ***SM-2 and SM-6 Terminal Interceptors***

The SM-2 Block IV is designed to intercept ballistic missiles inside the atmosphere (i.e., endo-atmospheric intercept), during the terminal phase of an enemy ballistic missile's flight. It is equipped with a blast fragmentation warhead.

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<sup>8</sup> Some press reports and journal articles, most now a decade or more old, report unconfirmed figures on the burnout velocities of various SM-3 missile configurations (some of which were proposed but ultimately not pursued). See, for example, J. D. Marshall, *The Future Of Aegis Ballistic Missile Defense*, point paper dated October 15, 2004, accessed online at <http://www.marshall.org/pdf/materials/259.pdf>; "STANDARD Missile-3 Destroys a Ballistic Missile Target in Test of Sea-based Missile Defense System," Raytheon news release circa January 26, 2002; Gopal Ratnam, "U.S. Navy To Play Larger Role In Missile Defense," *Defense News*, January 21-27, 2002: 10; Hans Mark, "A White Paper on the Defense Against Ballistic Missiles," *The Bridge*, Summer 2001, pp. 17-26, accessed online at [http://www.nae.edu/nae/bridgecom.nsf/weblinks/NAEW-63BM86/\\$FILE/BrSum01.pdf?OpenElement](http://www.nae.edu/nae/bridgecom.nsf/weblinks/NAEW-63BM86/$FILE/BrSum01.pdf?OpenElement); Michael C. Sirak, "White House Decision May Move Sea-Based NMD Into Spotlight," *Inside Missile Defense*, September 6, 2000: 1; Henry F. Cooper and J.D. Williams, "The Earliest Deployment Option—Sea-Based Defenses," *Inside Missile Defense*, September 6, 2000 (guest perspective; including graphic on page 21); Robert Holzer, "DoD Weighs Navy Interceptor Options," *Defense News*, July 24, 2000: 1, 60 (graphic on page 1); and Robert Holzer, "U.S. Navy Gathers Strength, Allies in NMD Showdown," *Defense News*, March 15, 1999: 1, 42 (graphic on page 1).

<sup>9</sup> The cooperative research effort has been carried out under a U.S.-Japan memorandum of agreement signed in 1999. The effort has focused on risk reduction for four parts of the missile: the sensor, an advanced kinetic warhead, the second-stage propulsion, and a lightweight nose cone. The Block IIA development effort includes the development of a missile, called the Block II, as a stepping stone to the Block IIA. As a result, the Block IIA development effort has sometimes been called the Block II/IIA development effort. The Block II missile is not planned as a fielded capability.

<sup>10</sup> Source: H.Rept. 111-491 of May 21, 2010 (the House Armed Services Committee report on H.R. 5136, the FY2011 defense authorization bill), p. 196.



The existing inventory of SM-2 Block IVs—72 as of February 2012—was created by modifying SM-2s that were originally built to intercept aircraft and ASCMs. A total of 75 SM-2 Block IVs were modified, and three have been used in BMD flight tests, leaving the current remaining inventory of 72.

MDA and Navy plans call for developing and procuring a more capable terminal-phase BMD interceptor based on the SM-6 air defense missile (the successor to the SM-2 air defense missile). The initial version of the SM-6 BMD interceptor, called Increment 1, is to enter service around 2015; a subsequent version, called Increment 2, is to enter service around 2018.

**Table 1** summarizes the various versions of the Aegis BMD system and correlates them with the phases of the European Phased Adaptive Approach (or EPAA; see below) for European BMD operations.

**Table I. Versions of Aegis BMD System**

EPAA Phase	Phase I	Phase II	Phase III	Phase IV	
<b>Version of Aegis BMD system</b>	<b>3.6.1</b>	<b>4.0.1</b>	<b>5.0/5.0.1</b>	<b>5.1/5.1.1</b>	<b>5.1/5.1.1</b>
Certified for initial use	2006	2012	2014	2018	2020
OTE assessment	2008	2014	2016	2020	2022
<b>Mid-course interceptor(s) used</b>					
SM-3 Block IA	X	X	X	X	X
SM-3 Block IB		X	X	X	X
SM-3 Block IIA				X	X
SM-3 Block IIB					X
<b>Terminal-phase interceptor used</b>					
SM-2 Block IV	X			X	
SM-6 Increment 1			X		
SM-6 Increment 2				X	X
<b>Types of ballistic missiles that can be engaged</b>					
SRBM	Yes	Yes	Yes	Yes	Yes
MRBM	Yes	Yes	Yes	Yes	Yes
IRBM	Limited	Yes	Yes	Enhanced	Enhanced
ICBM	No <sup>a</sup>	No <sup>a</sup>	No <sup>a</sup>	Limited	Limited
<b>Launch or engage on remote capability</b>					
Launch on remote	Initial	Enhanced	Yes	Yes	Yes
Engage on remote	No	No	No	Yes	Yes

**Source:** MDA briefings to CRS and the Congressional Budget Office (CBO), March 2010, March 2011, March 2012.

**Notes:** OTE is operational test and evaluation. SRBM is short-range ballistic missile; MRBM is medium-range ballistic missile; IRBM is intermediate-range ballistic missile; ICBM is intercontinental ballistic missile. Launch on remote is the ability to launch the interceptor using data from off-board sensors. Engage on remote is the ability to engage targets using data from off-board sensors.

- a. Cannot intercept ICBMs, but the system has a long-range search and track (LRS&T) capability—an ability to detect and track ballistic missiles at long ranges.

## **European Phased Adaptive Approach (EPAA) for European BMD**

On September 17, 2009, the Obama Administration announced a new approach for regional BMD operations called the Phased Adaptive Approach (PAA). The first application of the approach is in Europe, and is called the European PAA (EPAA). EPAA calls for using BMD-capable Aegis ships, a land-based radar in Europe, and eventually two Aegis Ashore sites in Romania and Poland to defend Europe against ballistic missile threats from countries such as Iran. MDA states that:

The Department [of Defense] met its commitment for EPAA Phase 1 by deploying Aegis BMD ships and a land-based radar in Europe by the end of 2011. Deliveries in the next three EPAA phases include:

- Aegis Ashore in Romania with SM-3 IB interceptors in the 2015 timeframe (Phase 2),
- Aegis Ashore in Poland with SM-3 IIA interceptors in the 2018 timeframe (Phase 3), and
- SM-3 IIB interceptors and early intercept capability in the 2020 timeframe (Phase 4)

The United States will also pursue phased adaptive approaches in the Asia Pacific and the Middle East by building on current efforts.<sup>11</sup>

Each Aegis Ashore site in the EPAA is to include a structure housing an Aegis system similar to the deckhouse on an Aegis ship and 24 SM-3 missiles launched from a re-locatable Vertical Launch System (VLS) based on the VLS that is installed in Navy Aegis ships.

Although BMD-capable Aegis ships have deployed to European waters in the past, the first BMD-capable Aegis ship officially deployed to European waters as part of the EPAA departed its home port of Norfolk, VA, on March 7, 2011, for a deployment to the Mediterranean that lasted several months.<sup>12</sup>

## **Planned Numbers of BMD-Capable Aegis Ships and SM-3 Interceptors**

As shown in **Table 2**, under the proposed FY2013 budget, the number of BMD-capable Navy Aegis ships is scheduled to grow from 24 at the end of FY2011 to 36 at the end of FY2018.

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<sup>11</sup> Department of Defense, *Department of Defense, Fiscal Year (FY) 2013 President's Budget Submission, Missile Defense Agency, Justification Book Volume 2a, Research, Development, Test & Evaluation, Defense-Wide*, February 2012, pp. xix-xx.

<sup>12</sup> Karen Parrish, "Milestone nears for European Missile Defense Plan," *American Forces Press Service*, March 2, 2011 (accessed online at <http://www.defense.gov/news/newsarticle.aspx?id=62997>); Untitled "Eye On The Fleet" news item, *Navy News Service*, March 7, 2011 (accessed online at [http://www.navy.mil/view\\_single.asp?id=98184](http://www.navy.mil/view_single.asp?id=98184)); "Warship With Radar Going To Mediterranean," *Washington Post*, March 2, 2011; Brock Vergakis, "US Warship Deploys to Mediterranean to Protect Europe From Ballistic Missiles," *Canadian Press*, March 7, 2011.

Table 2. Numbers of BMD-Capable Aegis Ships and SM-3 Missiles

	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
<b>BMD-capable Aegis ships</b>										
<i>BMD conversions of existing Aegis cruisers and destroyers (cumulative totals)</i>										
3.6.1 version <sup>a</sup>	22	24	23	19	17	16	13	11	TBD	TBD
4.0.1 version	2	4	6	9	9	9	9	9	TBD	TBD
5.0 version	0	1	3	4	6	7	10	11	TBD	TBD
5.1 version	0	0	0	0	0	0	0	1	TBD	TBD
Subtotal	24	29	32	32	32	32	32	32	TBD	TBD
<i>New Aegis destroyers procured in FY2010 and beyond, with BMD installed during ship's construction (cumulative totals)</i>										
5.0 version	0	0	0	0	0	1 <sup>b</sup>	3 <sup>b</sup>	4 <sup>b</sup>	6 <sup>b</sup>	7 <sup>b</sup>
<b>TOTAL</b>	<b>24</b>	<b>29</b>	<b>32</b>	<b>32</b>	<b>32</b>	<b>33</b>	<b>35</b>	<b>36</b>	<b>TBD + 6</b>	<b>TBD + 7</b>
<b>SM-3 missile procurement (annual quantities)</b>										
Block IA	26	0	0	0	0	0	0	0	0	0
Block IB	0 <sup>c</sup>	46	29	69	82	77	72	72	72	72
Block IIA	0	0	0	0	22 <sup>d</sup>	0	12	36	48	TBD
Block IIB	0	0	0	0	0	0	0	0	TBD	TBD
<b>Total</b>	<b>26</b>	<b>46</b>	<b>29</b>	<b>69</b>	<b>104</b>	<b>77</b>	<b>84</b>	<b>108</b>	<b>120 + TBD</b>	<b>72 + TBD</b>
<b>SM-3 missile deliveries/inventory<sup>e</sup></b>										
Block I/IA	107/87	113/92	113/91	136/114	136/105	136/88	136/70	136/45	136/27	136/16
Block IB	1/0	16/12	25/18	61/49	100/83	169/152	251/234	328/311	400/381	472/453
Block IIA	0/0	0/0	0/0	0/0	0/0	0/0	7/7	19/13	31/21	70/60
Block IIB	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
<b>Total</b>	<b>108/87</b>	<b>129/104</b>	<b>138/109</b>	<b>197/163</b>	<b>236/188</b>	<b>305/240</b>	<b>394/311</b>	<b>483/369</b>	<b>567/429</b>	<b>678/529</b>

**Source:** DOD budget submissions for FY2013 and prior years, and (for certain SM-3 annual procurement quantities) telephone consultation with MDA, March 19, 2012.

**Notes:** TBD is to be determined.

- Declining totals for 3.6.1 ships after FY2012 reflect the upgrading of some of these ships to more advanced versions of the Aegis BMD system.
- Figures taken from the Navy's FY2013 budget submission. MDA shows two ships as being in service by FY2016 (as opposed to the one ship shown in the Navy's budget submission as being in service by then).
- 25 Block IB missiles (including 1 Pathfinder missile) funded prior to the 46 shown for FY2012.
- 22 Block IIA missiles to be funded with research and development in FY2015.
- Deliveries figures are cumulative and include missiles procured prior to FY2011 through both RDT&E and procurement funds. Inventory figures reflect missiles used or projected to be used in Aegis BMD flight tests.

## Home Ports of BMD-Capable Aegis Ships

### Pacific vs. Atlantic Fleet Homeporting

As of February 2012, 16 of the Navy's 24 BMD-capable Aegis ships were homeported in the Pacific, including 5 at Yokosuka, Japan, 6 at Pearl Harbor, HI, and 5 at San Diego, CA. The other eight BMD-capable Aegis ships were homeported in the Atlantic, with seven at Norfolk, VA, and one at Mayport, FL.

Reflecting the implementation of the EPAA, the number of BMD-capable Aegis ships homeported in the Atlantic is scheduled to grow over time. By the end of FY2012, the Navy is to still have 16 BMD-capable Aegis ships homeported in the Pacific, but the number of Aegis-BMD ships homeported in the Atlantic is to grow to 13, including 11 at Norfolk and 2 at Mayport.

### October 5, 2011, Announcement of Homeporting in Spain

On October 5, 2011, the United States, Spain, and NATO jointly announced that, as part of the EPAA, four BMD-capable Aegis ships are to be forward-homeported (i.e., based) at the naval base at Rota, Spain.<sup>13</sup> The four ships are the destroyers *Ross* (DDG-71) and *Donald Cook* (DDG-75), which are to move to Rota in FY2014, and the destroyers *Carney* (DDG-64) and *Porter* (DDG-78), which are to move to Rota in FY2015. As of early 2012, *Carney* was homeported at Mayport, FL, and the other three ships were homeported at Norfolk.<sup>14</sup> The move is to involve an estimated 1,239 military billets (including 1,204 crew members for the four ships and 35 shore-based support personnel),<sup>15</sup> and about 2,100 family members.<sup>16</sup>

The Navy estimates the up-front costs of transferring the four ships at \$92 million in FY2013, and the recurring costs of basing the four ships in Spain rather than in the United States at roughly \$100 million per year.<sup>17</sup>

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<sup>13</sup> "Announcement on missile defence cooperation by NATO Secretary General Anders Fogh Rasmussen, the Prime Minister of Spain, Jose Luis Rodriguez Zapatero and US Defense Secretary Leon Panetta," October 5, 2011, accessed October 6, 2011, at [http://www.nato.int/cps/en/SID-107ADE55-FF83A6B8/natolive/opinions\\_78838.htm](http://www.nato.int/cps/en/SID-107ADE55-FF83A6B8/natolive/opinions_78838.htm). See also "SECDEF Announces Stationing of Aegis Ships at Rota, Spain," accessed October 6, 2011, at [http://www.navy.mil/search/display.asp?story\\_id=63109](http://www.navy.mil/search/display.asp?story_id=63109).

<sup>14</sup> See "Navy Names Forward Deployed Ships to Rota, Spain," *Navy News Service*, February 16, 2012, accessed online at [http://www.navy.mil/search/display.asp?story\\_id=65393](http://www.navy.mil/search/display.asp?story_id=65393); Kate Wiltrout, "Three Norfolk-Based Navy Ships To Move To Spain," *Norfolk Virginian-Pilot*, February 17, 2012; "Bound for Spain," *Inside the Navy*, February 20, 2012.

<sup>15</sup> Source: Navy information paper dated March 8, 2012, provided by Navy Office of Legislative Affairs to CRS on March 9, 2012.

<sup>16</sup> Source: Navy briefing slides dated February 27, 2012, provided by the Navy to CRS on March 9, 2012.

<sup>17</sup> Source: Navy briefing slides dated February 27, 2012, provided by the Navy to CRS on March 9, 2012. The briefing slides state that the estimated up-front cost of \$92 million includes \$13.5 million for constructing a new weapon magazine, \$0.8 million for constructing a pier laydown area, \$3.4 million for constructing a warehouse, \$5.0 million for repairing an existing facility that is to be used as an administrative/operations space, and \$69.3 million for conducting maintenance work on the four ships in the United States prior to moving them to Rota. The briefing states that the estimated recurring cost of \$100 million per year includes costs for base operating support, annual PCS (personnel change of station) costs, a pay and allowances delta, annual mobile training team costs, ship maintenance work, the operation of a Ship Support Activity, and higher fuel costs associated with a higher operating tempo that is maintained by ships that are homeported in foreign countries.

Rota is on the southwestern Atlantic coast of Spain, a few miles northwest of Cadiz, and about 65 miles northwest of the Strait of Gibraltar leading into the Mediterranean. U.S. Navy ships have been homeported at Rota at various points in the past, most recently in 1979.<sup>18</sup>

As part of the October 5, 2011, joint announcement, the Prime Minister of Spain, Jose Luis Rodriguez Zapatero, stated in part:

This meeting marks a step forward on the path that we set for ourselves less than a year ago at the Lisbon Summit, aiming to make NATO an Alliance that is “more effective, engaged and efficient than ever before”, in the words of [NATO] Secretary-General Rasmussen.

At that historic Summit, decisions of enormous importance for the future of the Alliance were taken, such as the New Strategic Concept to face the new challenges of the 21<sup>st</sup> century, and the establishment of a new command structure that is leaner and more flexible, and improved.

Besides these two important innovations, and as a consequence of them, the allies decided to develop an Anti-Missile Defence System....

As you will recall, as a consequence of this new structure launched in Lisbon, Spain obtained an installation of great importance within NATO’s Command and Control Structure: the Combined Air Operations Centre (CAOC) in Torrejón de Ardoz, Spain.

This Centre, together with the Centre in Uedem, Germany, will form part of the air command and control system which is to include the anti-missile defence that the Alliance is going to implement.

Together with this land-based component of the new air defence system, I can inform you that Spain is also going to support, starting in 2013, an important part of the system’s naval element.

In recent months, the different options have been studied, and finally, it was decided that Spain should be the site for this component of the system, due to its geostrategic location and its position as gateway to the Mediterranean.

Specifically, the United States is going to deploy, as its contribution to NATO’s Anti-Missile Defence System, a total of four vessels equipped with the AEGIS system, to be based in Rota.

This means that Rota is going to become a support centre for vessel deployment, enabling them to join multinational forces or carry out NATO missions in international waters, particularly in the Mediterranean....

Moreover, this initiative will have a positive impact, in socio-economic terms, on our country, and most especially on the Bay of Cadiz.

Permanently basing four vessels in Rota will require investing in the Base’s infrastructure, and contracts with service providers, thus generating approximately a thousand new jobs, both directly and indirectly.

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<sup>18</sup> Source: Sam Fellman, “U.S. To Base Anti-Missile Ships in Spain,” *Defense News*, October 10, 2011: 76.

For the shipyards, and for Spain's defence industry, the foreseeable impact will also be highly positive, as the USA is considering conducting the vessels' maintenance and upkeep at the nearby San Fernando shipyards, in the province of Cadiz. In addition, there will be significant transfer of state-of-the-art technology, from which Spain can benefit.<sup>19</sup>

As part of the same joint announcement, Secretary of Defense Leon Panetta stated in part:

With four Aegis ships at Rota, the alliance is significantly boosting combined naval capabilities in the Mediterranean, and enhancing our ability to ensure the security of this vital region. This relocation of assets takes place as part of the United States' ongoing effort to better position forces and defensive capabilities in coordination with our European allies and partners.

This announcement should send a very strong signal that the United States is continuing to invest in this alliance, and that we are committed to our defense relationship with Europe even as we face growing budget constraints at home....

Alongside important agreements that were recently concluded with Romania, Poland, and Turkey, Spain's decision represents a critical step in implementing the European Phased Adaptive Approach, as our leaders agreed to in Lisbon....

Beyond missile defense, the Aegis destroyers will perform a variety of other important missions, including participating in the Standing NATO Maritime Groups, as well as joining in naval exercises, port visits, and maritime security cooperation activities....

The agreement also enables the United States to provide rapid and responsive support to the U.S. Africa and U.S. Central Commands, as needed.<sup>20</sup>

An October 5, 2011, press report stated:

A senior U.S. defense official said making the [ships'] base at Rota, on Spain's southwestern Atlantic coast near Cadiz, would reduce the numbers of [BMD-capable Aegis] ships needed for the [EPAA] system.

"You [would] probably need 10 of these ships if they were based in the eastern U.S. to be able to ... transit across the ocean back and forth to [keep the same number on] patrol in the Med," he said.

The U.S. official said the United States was committed to having at least one ship on station at all times in the eastern Mediterranean, where their anti-missile missiles would be most effective. Having them based in Rota would enable more than one to be in the eastern Mediterranean as needed.

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<sup>19</sup> "Announcement on missile defence cooperation by NATO Secretary General Anders Fogh Rasmussen, the Prime Minister of Spain, Jose Luis Rodriguez Zapatero and US Defense Secretary Leon Panetta," October 5, 2011, accessed October 6, 2011, at [http://www.nato.int/cps/en/SID-107ADE55-FF83A6B8/natolive/opinions\\_78838.htm](http://www.nato.int/cps/en/SID-107ADE55-FF83A6B8/natolive/opinions_78838.htm).

<sup>20</sup> "Announcement on missile defence cooperation by NATO Secretary General Anders Fogh Rasmussen, the Prime Minister of Spain, Jose Luis Rodriguez Zapatero and US Defense Secretary Leon Panetta," October 5, 2011, accessed October 6, 2011, at [http://www.nato.int/cps/en/SID-107ADE55-FF83A6B8/natolive/opinions\\_78838.htm](http://www.nato.int/cps/en/SID-107ADE55-FF83A6B8/natolive/opinions_78838.htm). See also "SECDEF Announces Stationing of Aegis Ships at Rota, Spain," accessed October 6, 2011, at [http://www.navy.mil/search/display.asp?story\\_id=63109](http://www.navy.mil/search/display.asp?story_id=63109).

The ships also would be part of the pool of vessels available to participate in standing NATO maritime groups, which are used to counter piracy and for other missions, he said.<sup>21</sup>

An October 10, 2011, press report stated:

“Our plan is to have the first couple [of ships] there in 2014 and the next two in about 2015,” said Cmdr. Marc Boyd, spokesman for [U.S. Navy] 6<sup>th</sup> Fleet. Boyd added: “It’s really early in the process and we haven’t selected any of the ships yet.” Boyd said the shift will bring an estimated 1,300 sailors and Navy civilians and 2,100 dependents to Naval Station Rota, which would double the base’s ranks. Naval Station Rota spokesman Lt. j.g. Jason Fischer said the base now has 1,067 sailors....

The three piers at the base primarily support Navy ships passing through on port calls.

Boyd said 6<sup>th</sup> Fleet is considering plans to add base infrastructure and maintenance facilities to support the ships, as well as additional housing for crews, “but the base is pretty suited as it is now.”<sup>22</sup>

## **Aegis BMD Flight Tests**

DOD states that since January 2002, the Aegis BMD system has achieved 20 successful exo-atmospheric intercepts in 25 attempts using the SM-3 missile (including three successful intercepts in four attempts by Japanese Aegis ships), and 3 successful endo-atmospheric intercepts in 3 attempts using the SM-2 Block IV missile, making for a combined total of 23 successful intercepts in 28 attempts.

In addition, on February 20, 2008, a BMD-capable Aegis cruiser operating northwest of Hawaii used a modified version of the Aegis BMD system to shoot down an inoperable U.S. surveillance satellite that was in a deteriorating orbit.<sup>23</sup> Including this intercept in the count increases the totals

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<sup>21</sup> David Brunnstrom and David Alexander, “Spain To Host U.S. Missile Defense Ships,” *Reuters*, October 5, 2011. Ellipsis as in original.

<sup>22</sup> Sam Fellman, “U.S. To Base Anti-Missile Ships in Spain,” *Defense News*, October 10, 2011: 76.

<sup>23</sup> The modifications to the ship’s Aegis BMD midcourse system reportedly involved primarily making changes to software. DOD stated that the modifications were of a temporary, one-time nature. Three SM-3 missiles reportedly were modified for the operation. The first modified SM-3 fired by the cruiser successfully intercepted the satellite at an altitude of about 133 nautical miles (some sources provide differing altitudes). The other two modified SM-3s (one carried by the cruiser, another carried by an engage-capable Aegis destroyer) were not fired, and the Navy stated it would reverse the modifications to these two missiles. (For additional information, see the MDA discussion available online at [http://www.mda.mil/system/aegis\\_one\\_time\\_mission.html](http://www.mda.mil/system/aegis_one_time_mission.html), and also Peter Spiegel, “Navy Missile Hits Falling Spy Satellite,” *Los Angeles Times*, February 21, 2008; Marc Kaufman and Josh White, “Navy Missile Hits Satellite, Pentagon Says,” *Washington Post*, February 21, 2008; Thom Shanker, “Missile Strikes A Spy Satellite Falling From Its Orbit,” *New York Times*, February 21, 2008; Bryan Bender, “US Missile Hits Crippled Satellite,” *Boston Globe*, February 21, 2008; Zachary M. Peterson, “Navy Hits Wayward Satellite On First Attempt,” *NavyTimes.com*, February 21, 2008; Dan Nakaso, “Satellite Smasher Back At Pearl,” *Honolulu Advertiser*, February 23, 2008; Zachary M. Peterson, “Lake Erie CO Describes Anti-Satellite Shot,” *NavyTimes.com*, February 25, 2008; Anne Mulrine, “The Satellite Shootdown: Behind the Scenes,” *U.S. News & World Report*, February 25, 2008; Nick Brown, “US Modified Aegis and SM-3 to Carry Out Satellite Interception Shot,” *Jane’s International Defence Review*, April 2008: 35.)

MDA states that the incremental cost of the shoot-down operation was \$112.4 million when all costs are included. MDA states that this cost is to be paid by MDA and the Pacific Command (PACOM), and that if MDA is directed to absorb the entire cost, “some realignment or reprogramming from other MDA [program] Elements may be necessary to lessen significant adverse impact on [the] AEGIS [BMD program’s] cost and schedule.” (MDA information paper dated March 7, 2008, provided to CRS on June 6, 2008. See also Jason Sherman, “Total Cost for Shoot-Down of Failed (continued...)”)

to 21 successful exo-atmospheric intercepts in 26 attempts using the SM-3 missile, and 24 successful exo- and endo-atmospheric intercepts in 29 attempts using both SM-3 and SM-2 Block IV missiles.

A December 2011 report on various DOD acquisition programs from DOD's Director, Operational Test and Evaluation (DOT&E)—DOT&E's annual report for FY2011—stated, in the section on the Aegis BMD program, that

In FY[20]11, Aegis BMD demonstrated, for the first time, the capability to engage an intermediate-range separating ballistic missile in the midcourse phase with an SM-3 Block IA interceptor. In that engagement, the firing ship used track data forwarded by C2BMC from an AN/TPY-2 (FBM) radar to develop a firing solution. The engagement, which exercised Aegis BMD 3.6.1 launch-on-remote functionality, demonstrated an important type of engagement capability needed to support Phase 1 of the PAA for defense of Europe. Cued engagements against longer-range targets would be expected in the European theater.

Anomalous behavior was observed during the flyout of the SM-3 Block IA interceptor in FTM-15, but the anomaly did not preclude an intercept. If the anomaly occurred under different engagement conditions, it could have had an impact on the success of the engagement. However, it should be noted that the anomaly was not observed in any of the 21 previous SM-3 flyouts. The cause of the anomaly is under investigation by the program.

Aegis BMD continues to improve its interoperability with other BMDS elements and sensors, as demonstrated in recent ground testing. Improvements in interoperability are still needed, however, to ensure that Aegis BMD can send and receive cues and track data of sufficient quality to support PAA Phase 1, which will be deployed at the end of CY11.

FTM-16 Event 2 failed to demonstrate the capability to intercept a ballistic missile with the new SM-3 Block IB interceptor fired from an Aegis BMD 4.0.1 ship. Although the interceptor failed to intercept the target, many of the new capabilities of the Aegis BMD 4.0.1 system were exercised during the mission, and functioned as designed. FTM-16 Event 2 was the first developmental firing mission with the Aegis BMD 4.0.1 system. A Failure Review Board is determining the root cause.<sup>24</sup>

For further discussion of Aegis BMD flight tests—including a May 2010 magazine article and supplementary white paper in which two professors with scientific backgrounds criticize DOD claims of successes in Aegis (and other DOD) BMD flight tests—see the **Appendix**.

## **Allied Participation and Interest in Aegis BMD Program**

### **Japan**

Japan's interest in BMD, and in cooperating with the United States on the issue, was heightened in August 1998 when North Korea test-fired a Taepo Dong-1 ballistic missile that flew over Japan before falling into the Pacific.<sup>25</sup> In addition to cooperating with the United States on development

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(...continued)

NRO Satellite Climbs Higher," *InsideDefense.com*, May 12, 2008.)

<sup>24</sup> Director, Operational Test and Evaluation, *FY 2011 Annual Report*, December 2011, p. 257.

<sup>25</sup> For a discussion, see CRS Report RL31337, *Japan-U.S. Cooperation on Ballistic Missile Defense: Issues and* (continued...)



of technologies for the SM-3 Block IIA missile, Japan is modifying all six of its Aegis destroyers with an approximate equivalent of the 3.6.1 version Aegis BMD system. (Japan's previous plans called for modifying four of the six ships.) As of December 2010, four of Japan's Aegis ships had received the modification.<sup>26</sup> Japanese BMD-capable Aegis ships have conducted four flight tests of the Aegis BMD system using the SM-3 interceptor, achieving three successful exo-atmospheric intercepts.

## **Other Countries**

Other countries that MDA views as potential naval BMD operators (using either the Aegis BMD system or some other system of their own design) include the United Kingdom, the Netherlands, Spain, Germany, Denmark, South Korea, and Australia. As mentioned earlier, Spain, South Korea, and Australia either operate, are building, or are planning to build Aegis ships. The other countries operate destroyers and frigates with different combat systems that may have potential for contributing to BMD operations.

A September 2011 press report states:

The gap in sea-based ballistic missile defence (BMD) capability between the navies of NATO's European member states and the US Navy (USN) was brought into stark relief by the recent deployment of the Ticonderoga-class cruiser USS Monterey to the Mediterranean and Black Sea region, as the first element of the United States' European Phased Adaptive Approach (EPAA) for missile defence....

However, this situation is about to change as European NATO nations are committing their naval assets to BMD in response to evolving alliance policy towards developing a BMD architecture to protect the continent from perceived threats emanating from the Middle East.

NATO embarked on an Active Layered Theatre Ballistic Missile Defence System (ALTBMDs) programme in September 2005, following a two-year feasibility study. Its initial focus was the protection of deployed alliance forces and high-value assets against short- and medium-range threats. At the November 2010 Lisbon Summit, political leaders from NATO states committed to expanding that remit to include the defence of the alliance's European territory.

ALTBMD is providing a C2 framework on which to build a scalable and adaptable BMD 'system of systems' architecture, integrating new national systems as they are committed to the alliance and enabling a complete lower- and upper-layer capability covering Europe to be fielded. The first of these, Capability 1, with initial operational capability planned for the 2012 timeframe, integrates C2 infrastructure, sensors and ground-based Patriot interceptors. The expansion to provide upper-layer defence is due to achieve full operational capability between 2015 and 2016.

The US contribution to this architecture is the EPAA set out by the Obama administration in September 2009....

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(...continued)

*Prospects*, by Richard P. Cronin. This archived report was last updated on March 19, 2002. See also CRS Report RL33436, *Japan-U.S. Relations: Issues for Congress*, coordinated by Emma Chanlett-Avery.

<sup>26</sup> John Liang, "Japan To Increase Aegis BMD Ship Fleet From Four To Six," *Inside the Navy*, December 27, 2010.

There is evidence that the EPAA has acted as a spur for some European nations to make a more coherent contribution to the NATO BMD construct, particularly in the maritime domain, as they seek to maintain sovereignty in the development and integration of indigenous BMD systems and defence of their territories.

A number of classes of the latest generation of anti-air warfare (AAW) combatants with the potential to acquire a BMD capability are either operational or entering service in the navies of Denmark, France, Germany, Italy, the Netherlands, Norway, Spain and the UK. These offer the attributes of flexibility in deployment, mobility and sustainability inherent in naval platforms and could operate as effective sensor nodes even without an organic intercept capability.

They would be able to forward deploy close to the origin of the threat and act as force multipliers in this role by providing early warning of launches and cueing of off-board interceptor systems with the provision of timely and accurate impact point prediction and missile tracks, together with launch point prediction for counter-targeting.<sup>27</sup>

An October 3, 2011, press report stated that

The Netherlands, which has had a longtime interest in a missile shield, is pressing ahead to build up its own capabilities. The Dutch defense ministry plans to expand the capabilities of the Thales Smart-L radar on Dutch frigates to take on BMD roles. The program's value is estimated at €100-250 million, including logistics support and spares.

Other European navies using the sensor may follow the Dutch lead.

Dutch Defense Minister Hans Hillen notes that the Smart-L effort would help address the BMD sensor shortage within the NATO alliance. Citing NATO's decision last year to take a more expansive approach to BMD, Hillen says Smart-L could give the ALTBMD [Active Layered Theater BMD] command-and control backbone the required long-range target-detection analysis to help identify where a threat originates.

The Netherlands has already carried out a sensor trial for the expanded role in cooperation with the U.S. Navy. The move does not include the purchase of Raytheon Standard Missile SM-3 interceptors.

Both hardware and software modifications to the combat management system are needed. All four [of the Dutch navy's] De Zeven Provinciën-class frigates would be modified to ensure that two can be deployed, even as one is in maintenance and the fourth is being readied for operations.

Thales is due to complete a series of studies to prepare for the acquisition of the upgrade in the third quarter of 2012. The goal is to have the first frigates ready for operations by 2017. All four should be upgraded by the end of that year.

Although the Netherlands is leading the program, other Smart-L users, including the German navy and Denmark, have been monitoring the effort. France also has shown interest in the system, Hillen said in a letter to legislators.

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<sup>27</sup> Charles Hollosi, "European Fleets Respond to Ballistic Missile Threats," *Jane's Navy International*, September 2011: 23-24, 26-30.

France also wants to upgrade its Aster 30 interceptor to give it a basic BMD capability, although a formal contract has not been awarded....

Raytheon, meanwhile, is still fighting to win a foothold for its Standard Missile 3 (SM-3) in Europe. The company continues its push to persuade continental navies to embrace the SM-3 Block 1B for missile defense roles, and says it has largely validated the dual-mode data link that would be key to the concept.

The data link would feature both S- and X-band capability—the former to support the Aegis radar system used by the U.S. and others, and the latter for the Smart-L/APAR (active phased array radar) combination used, for instance, by the Dutch navy.<sup>28</sup>

A May 7, 2012, press report states:

The German Navy's fleet of frigates could be upgraded to deploy Raytheon's [RTN] Standard Missile-3 to participate in NATO's ballistic missile defense program if the modifications were approved by the government, Germany's top naval officer recently said.

Vice Admiral Axel Schimpf, the counterpart to the U.S. Navy's chief of naval operations, said in a recently published article that the F124 frigates are capable of being upgraded to play a vital role in ballistic missile defense (BMD).

"The German Navy, with the F124 Frigates in their current configuration, has a weapon system at their disposal which forms the basis for capability enhancements for (German) armed forces' participation in various roles," according to a translation of an article he penned in *Marine Forum*, a publication of the German Maritime Institute.

One option, Schimpf said, would be to upgrade the F124s' SMART-L and Active Phased Array Radar (APAR) combat management system, along with the Mk-41 vertical launch system to accommodate the SM-3....

The enhancements would be one way for Germany to participate in the Obama administration's European Phased Adaptive Approach (EPAA) embraced by NATO, and could be done in cooperation with Denmark or the Netherlands, Schimpf said....

The German government has not made on decisions on whether to adapt its frigates for ballistic missile defense, and Germany's role in EPAA is the source of ongoing political discussions in Berlin ahead of NATO's May 20-21 summit in Chicago....

Only a handful of NATO allies deploy the Aegis combat system on ships, and Germany is not one of them. Germany's combat system does not operate on an S-band frequency used on Aegis. Raytheon, however, says it has developed a dual band data link that would allow the combat system on allied ships to talk to the SM-3 and guide it to targets.<sup>29</sup>

A journal article published in the summer of 2012 states:

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<sup>28</sup> Robert Wall, Amy Svitak, and Amy Butler, "Supporting Role," *Aviation Week & Space Technology*, October 3, 2011: 28-29. A shorter version of the story was published as Robert Wall, "Dutch Press Forward On Ship-Based Missile Defense Effort," *Aerospace Daily & Defense Report*, September 27, 2011: 4. See also Menno Steketee, "Dutch Frigates to Gain BMD Capability," *Jane's Navy International (Janes.com)*, September 28, 2011. (The print version of the report appeared under the same article title in the November 2011 issue of *Jane's Navy International*, page 8.

<sup>29</sup> Mike McCarthy, "Raytheon's SM-3 An Option For German Role In Missile Defense, Admiral Says," *Defense Daily*, May 7, 2012: 9.

Today the steady growth of Aegis-capable ships in the U.S. Navy—as well as an increasing number of world navies fielding such ships—presents new opportunities and challenges....

... the Aegis BMD capabilities present in the navies of U.S. allies and friends can now provide the Global Maritime Partnership with a means to address the “high end” of the kill chain with combined, coordinated, ballistic-missile defense: the Aegis BMD Global Enterprise.

This potential is already manifest in the Asia-Pacific region in the close working relationship between the United States and Japan. Korea and Australia could well join this Aegis network soon, giving the four governments the means to address not only territorial BMD but also coordinated BMD of fleet units operating together. In Europe, plans are well along to provide robust territorial defense of European nations with ALTBMD [active layered theater BMD] and the EPAA. Together, these systems provide a nascent BMD capability today and promise an even more robust capability as the EPAA evolves over the next decade and a half.

But as demonstrated in Iraq, Afghanistan, and now Libya, NATO and the nations of Europe have equities often well beyond the territorial boundaries of the European continent. Also, a European military deployed beyond Europe’s borders will always have a naval component. This is therefore a propitious time to begin to link European allies more completely into an Aegis BMD Global Enterprise in much the same way the U.S. Navy is linked to its Asia-Pacific partners—Japan today, Korea soon, and thereafter Australia in the near future—in a high-end Aegis BMD Global Maritime Partnership....

The diffusion of Aegis BMD capability abroad is occurring quietly. Governments that have made naval force-structure investment decisions based primarily on inwardly focused national interests have discovered that their investments also enable them to combine their resources in collective defense....

This effort to create a broad BMD enterprise builds on the current participation of allied navies in the Aegis program. This global effort started with a foreign military sales relationship with Japan, subsequently expanded to relationships with Australia and Korea, and now includes a commercial connection with Spain as well as an enterprise between Norway and Spain.<sup>22</sup> Several other states have expressed interest in acquiring the Aegis weapon system and Aegis BMD. Importantly, Australia and other countries that are acquiring the Aegis system are stipulating that the systems they buy must have the capability of adding BMD in the future....

In Europe, the decision as to whether and how to connect the European NATO allies’ short- and medium-range theater missile-defense systems to the U.S. long-range missile defense system will be critical to the coherence of alliance-wide BMD. A high level of commitment to international partnership on the parts of both the United States and its allies—already evinced by ALTBMD and C2BMC shared situational-awareness tests—will encourage interoperability initiatives. This interoperability will, in turn, help ensure the success of the U.S. Phased Adaptive Approach....

Close cooperation in the area of Aegis BMD between the United States and Japan, possibly Korea, and potentially Australia does not in itself qualify as an “Aegis BMD Global Enterprise.” But to include European nations in an Aegis-afloat enterprise of capabilities approaching those planned for the ALTBMD/EPAA system would....

European navies are now deployed worldwide fulfilling the vision of a Global Maritime Partnership: supporting operations in Iraq and Afghanistan, fighting in Libya, conducting antipiracy patrols in the Horn of Africa and elsewhere, and supporting humanitarian

assistance operations around the world. There could be no more propitious time to begin to link more completely European allies in an Aegis BMD Global Enterprise, in much the same way the U.S. Navy is now linked to its Asia-Pacific partners in a high-end Aegis BMD Global Maritime Partnership....

But it is unlikely that such a venture would succeed without ongoing U.S. leadership, the same sort of leadership that is supporting sea-based Aegis BMD for territorial and fleet ballistic-missile defense today in the northeast Pacific as well as sea-based and land-based ballistic territorial missile defense in Europe. Clearly, U.S. leadership could be what accelerates the morphing of a now-nascent Aegis BMD Global Enterprise in Europe into a global Aegis BMD afloat capability....

There is a growing worldwide commitment to Aegis ballistic-missile defense, a commitment with broad potential to field an international global enterprise capable of defending against the most imminent, and growing, threat to nations and navies, on land and at sea alike—the threat of ballistic missiles, particularly those armed with weapons of mass destruction.<sup>30</sup>

## FY2013 Funding Request

The Aegis BMD program is funded mostly through MDA’s budget. The Navy’s budget provides additional funding for BMD-related efforts. As shown in **Table 3**, MDA’s proposed FY2013 budget requests a total of \$2,303.0 million in procurement and research and development funding for Aegis BMD efforts, including funding for Aegis Ashore sites that are to be part of the EPAA, which is referred to in the table as funding for the land-based SM-3.

**Table 3. MDA Funding for Aegis BMD Efforts, FY2012-FY2017**

(In millions of dollars, rounded to nearest tenth; totals may not add due to rounding; FY2012 is actual; FY2013 is requested; FY2014-FY2017 are programmed)

	FY12	FY13	FY14	FY15	FY16	FY17
<b>Procurement</b>						
Aegis BMD (Line 31)	565.4	389.6	757.0	834.3	775.7	1,003.0
<b>Research, development, test &amp; evaluation (RDT&amp;E)</b>						
Next-generation Aegis missile (SM-3 IIB) (PE 0603902C, line 65)	13.4	224.1	295.2	455.4	508.4	430.2
Aegis BMD (PE 0603892C, line 86)	988.9	992.4	960.9	950.1	1,030.2	958.7
Land-based SM-3 (LBSM3) (PE0604881C, line 107)	306.2	276.3	127.2	113.7	47.7	56.2
Aegis SM-3 IIA Co-development (PE0604881C, line 108)	473.8	420.6	273.9	200.7	185.0	46.1
<b>SUBTOTAL RDT&amp;E</b>	<b>1,782.3</b>	<b>1,913.4</b>	<b>1,657.2</b>	<b>1,719.9</b>	<b>1,771.3</b>	<b>1,491.2</b>
<b>TOTAL</b>	<b>2,347.7</b>	<b>2,303.0</b>	<b>2,414.2</b>	<b>2,554.2</b>	<b>2,547.0</b>	<b>2,494.2</b>

**Source:** FY2013 budget-justification books for MDA for Research, Development, Test & Evaluation, Defense-Wide (Volume 2a) and for Procurement, Defense-Wide (Volume 2b).

<sup>30</sup> Brad Hicks, George Galdorisi, and Scott C. Truver, “The Aegis BMD Global Enterprise,” Naval War College Review, Summer 2012: 65-80.

## Issues for Congress

### Reduction in Ramp-Up Rate for BMD-Capable Aegis Ships

One potential oversight issue for Congress concerns a reduction under the proposed FY2013 budget in the ramp-up rate for numbers of BMD-capable Aegis ships over the next few years. **Table 4** shows projected numbers of BMD-capable Aegis ships under the FY2013 compared to projected numbers under the FY2012 budget.

**Table 4. Numbers of BMD-Capable Aegis Ships Under FY2012 and FY2013 Budgets**

	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
<b>FY2012 budget</b>										
Conversions	23	28	32	36	37	38	38	37	37	37
New-built DDG-51s	0	0	0	0	1 <sup>a</sup>	3	4	6	6	6
<b>Total</b>	<b>23</b>	<b>28</b>	<b>32</b>	<b>36</b>	<b>38</b>	<b>41</b>	<b>42</b>	<b>43</b>	<b>43</b>	<b>43</b>
<b>FY2013 budget</b>										
Conversions	24	29	32	32	32	32	32	32	TBD	TBD
New-built DDG-51s	0	0	0	0	0	1 <sup>b</sup>	3 <sup>b</sup>	4 <sup>b</sup>	6 <sup>b</sup>	7 <sup>b</sup>
<b>Total</b>	<b>24</b>	<b>29</b>	<b>32</b>	<b>32</b>	<b>32</b>	<b>33</b>	<b>35</b>	<b>36</b>	<b>TBD + 6</b>	<b>TBD + 6</b>
<b>FY2013 plan compared to FY2012 plan</b>										
	<b>+1</b>	<b>+1</b>	<b>NC</b>	<b>-4</b>	<b>-6</b>	<b>-8</b>	<b>-7</b>	<b>-7</b>	<b>not clear</b>	<b>not clear</b>

**Source:** FY2012 and FY2013 budget submissions.

**Notes:** **TBD** is to be determined; **NC** is no change.

- Navy budget-justification documents for FY2012 showed the DDG-51 procured in FY2010 entering service in FY2016, not FY2015 as shown in this table.
- Figures taken from Navy's FY2013 budget submission. MDA shows two ships as being in service by FY2016 (as opposed to the one ship shown in the Navy's budget submission as being in service by then).

As can be seen **Table 4**, under the FY2013 budget, there are to be 36 BMD-capable Aegis ships by FY2018, or 7 less than projected under the FY2012 budget for FY2018.

The proposal under the FY2013 budget to retire seven Aegis cruisers early, in FY2013 and FY2014 (see "Ticonderoga (CG-47) Class Aegis Cruisers" in "Background"), may explain part of the difference between the ramp-up rates under the two budget plans: as mentioned earlier, one of these seven ships has been given a capability for BMD operations, and some or all of the other six were scheduled to be modified for BMD operations at some point.

Some observers have been concerned that demands for BMD-capable Aegis ships are growing faster than the number of BMD-capable Aegis ships. The reduction in the ramp-up rate for

numbers of BMD-capable Aegis ships under the proposed FY2013 budget compared to the FY2012 budget might, other things held equal, reinforce such concerns. On the other hand, as mentioned earlier (see “October 5, 2011, Announcement of Homeporting in Spain” in “Background”), a DOD official has been quoted in the press as saying that the EPAA mission to be performed by the four BMD-capable Aegis ships to be homeported at Rota, Spain, would instead require 10 U.S.-homeported BMD-capable Aegis ships to perform. On that basis, it would appear that homeporting four BMD-capable Aegis ships at Rota, Spain, would, other things held equal, reduce demands for BMD-capable Aegis ships by a net six ships. On that basis, in terms of the balance between demands for BMD-capable Aegis ships and available numbers of BMD-capable Aegis ships, the decline in the ramp-up rate in the number of BMD-capable Aegis ships under the proposed FY2013 budget compared to the FY2012 budget might be viewed as offset to a substantial degree, at least in certain years, by the plan to forward-homeport four BMD-capable Aegis ships at Rota.

Concerning demands for BMD-capable Aegis ships in general, a September 16, 2011, press report stated:

“The BMD ships between now and 2017 are basically deployed for seven months, home for seven months, deployed for seven months, home for seven months for the next six years,” [Chief of Naval Operations Admiral Gary Roughead] said. “With the retention environment we’re in now, we’re not seeing the effects of that on our people yet, but when the economy turns, that’s a pretty brutal pace.”<sup>31</sup>

An April 2011 Navy report to Congress on naval force structure and BMD stated the following:

The Navy currently has sufficient capacity to meet the most critical demands for multi-mission surface combatants. However, the Navy does not have the capacity to meet all GCC [Global Combatant Commander] demands for BMD-capable surface combatants without breaking currently established Chief of Naval Operations Personnel Tempo program limits for deployment lengths, dwell and homeport tempo. Navy’s funded BMD upgrade plan is structured to balance the need to meet current multi-mission and Aegis BMD operational requirements against the need to increase Aegis BMD capacity and upgrade existing BMD-capable Aegis ships to pace the future threat.

The Navy, in conjunction with the Missile Defense Agency (MDA), has established a plan to increase the number of BMD-capable Aegis ships from 23 in FY2011 to 41 in FY2016 to begin to address this shortfall. This plan increases capacity through a combination of installing Aegis BMD 3.6.1 / 4.0.1 / 5.0 suites in existing Aegis ships (Aegis Modernization Program) and new construction commencing with DDG-113. This combined upgrade/new construction approach is designed to mitigate both the near term operational demand for multi-mission (including BMD) large surface combatants and the increasing Aegis BMD capability and capacity demand in the future.

The analytical work associated with the Navy’s ongoing Force Structure Analysis has progressed to the point that a FY2024 requirement for 94 multi-mission large surface combatants has been established. The global proliferation of land-attack ballistic missiles and the anticipated proliferation of anti-ship ballistic missiles underpins a related requirement for all multi-mission large surface combatants with Aegis weapon systems to be BMD-capable beyond ~2025....

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<sup>31</sup> Dan Taylor, “CNO: Biggest Concern Is That Shrinking Budgets Will Stretch Force Thin,” *Inside the Navy*, September 19, 2011.

The Navy and Missile Defense Agency (MDA) have concluded that the Geographic Combatant Commanders' (GCCs) demand for surface combatants with Aegis BMD capability will outpace capacity through approximately 2018. This conclusion was reached based on an assessment that considered the current and projected ballistic missile threat; current and projected requests from the GCCs including the Phased Adaptive Approach (PAA) for defense of Europe directed by the President; other force generation factors such as maintenance availabilities necessary to ensure the ships reach their expected service lives, training requirements and deployment lengths; and the deployment of Aegis Ashore to offset some of the growing demand for BMD capability....

BMD-capable large surface combatant requirements are independently determined by each GCC based on theater operational planning and mission analyses that consider unique regional factors such as the ballistic missile threat, threat dispersal, geography, size of the defended area, and the specific number and disposition of defended assets. Each GCC submits their fiscal year Aegis BMD requirement to the Joint Staff for validation. Once validated, U.S. Fleet Forces Command provides a consolidated sourcing solution for large surface combatants, to include those that are BMD-capable. The annual requirements and sourcing solutions are reviewed by a Global Force Management Board which ensures competing GCC requirements are properly prioritized based on overarching global defense priorities and that the Navy's limited BMD capacity is applied to the most critical needs.

The Global Force Management Board submits its requirements/sourcing recommendation to SECDEF for approval, in the form of a Global Force Management Allocation Plan which allocates Aegis BMD surface combatants to the GCC's for specified timeframes. Emergent GCC requirements for Aegis BMD combatants in response to unforeseen crises are subject to a similar approval process, without the Global Force Management Board review. In this case, SECDEF decisions represent adjustments to the annual Global Force Management Allocation Plan.

The total number of ships required to support the Phased Adaptive Approach to ballistic missile defense of Europe will be based on the operational planning and mission analysis factors noted above, combined with force generation factors such as maintenance, training and forward stationing or rotational model considerations. US European Command's operational plan for the ballistic missile defense of Europe has not been approved as of the date of this report....

US European Command's operational plan for the ballistic missile defense of Europe has not yet been approved, but could incorporate up to two Aegis Ashore batteries. Using a standard rotational BMD force structure model of five ships to sustain 1.0 presence, each Aegis Ashore battery could make up to five ships available to service Aegis BMD combatant requirements that would otherwise go unresourced....

All Aegis BMD surface combatants undergo the training, deployment and maintenance phases that comprise the Fleet Response Plan. These phases are balanced to ensure each crew is proficient across the full spectrum of missions the ship is capable of performing; to meet the operational requirements of the GCCs; and to ensure these capital assets reach their expected service life. In the near term, this balance will entail deployments for BMD-capable surface combatants of about seven months.<sup>32</sup>

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<sup>32</sup> U.S. Navy, Office of the Chief of Naval Operations, Director of Strategy and Policy (N51), *Report to Congress On Naval Force Structure and Missile Defense*, April 2011, 12 pp.



## **Demands for Aegis Ships in General**

Another potential oversight issue for Congress concerns demands from U.S. regional military commanders for Aegis ships in general. Some observers are concerned that demands for Aegis ships for conducting BMD operations could strain the Navy's ability to provide regional military commanders with Aegis ships for performing non-BMD missions in various locations around the world.

The Navy's Aegis ships are multi-mission platforms that are used for performing a range of non-BMD missions, including forward-deployed presence for regional deterrence, reassurance, and stabilization; partnership-building activities; humanitarian assistance and disaster response (HADR) operations; maritime security operations (including anti-piracy operations in the Gulf of Aden); intelligence, surveillance, and reconnaissance (ISR) operations; counter-terrorism operations; and (if need be) conventional warfighting operations. In conventional warfighting operations, Aegis ships could be called upon to perform a variety of non-BMD functions, including anti-air warfare, anti-surface warfare, strike warfare and naval surface fire support, and antisubmarine warfare. Locations that are good for performing BMD operations might not be good for performing non-BMD operations, and vice versa.

The Navy's force-level goal for cruisers and destroyers is to achieve and maintain a force of about 90 ships. The Navy's FY2013 30-year (FY2013-FY2042) shipbuilding plan does not contain enough destroyers to maintain a force of about 90 cruisers and destroyers consistently over the long run. The Navy projects that implementing the 30-year plan would result in a cruiser-destroyer force that remains below 90 ships every year in the 30-year plan except FY2027, and that reaches a minimum of 78 ships (i.e., 12 ships, or about 13%, below the required figure of about 90 ships) in FY2014-FY2015 and again in FY2034. The projected cruiser-destroyer shortfall is the largest projected shortfall of any ship category in the Navy's 30-year shipbuilding plan. Another CRS report discusses the projected cruiser-destroyer shortfall in greater detail.<sup>33</sup>

Rear Admiral Archer Macy, the director of the Joint Integrated Air and Missile Defense Organization, testified to the Senate Armed Services Committee on April 20, 2010, that DOD does not plan to give BMD-capable Aegis ships a strict role of performing BMD operations only. He also stated, however, that it was possible, depending on ballistic missile threats, that BMD-capable Aegis ships might sometimes be constrained to certain operating areas.<sup>34</sup>

As mentioned earlier (see "October 5, 2011, Announcement of Homeporting in Spain" in "Background"), Secretary of Defense Leon Panetta stated the following as part of the October 5, 2011, joint announcement about homeporting four BMD-capable Aegis ships at Rota, Spain, as part of the EPAA:

Beyond missile defense, the Aegis destroyers will perform a variety of other important missions, including participating in the Standing NATO Maritime Groups, as well as joining in naval exercises, port visits, and maritime security cooperation activities....

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<sup>33</sup> CRS Report RL32109, *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*, by Ronald O'Rourke.

<sup>34</sup> Dan Taylor, "Macy: Navy Increases Total Aegis BMD Assets Over FYDP To 38 Ships," *Inside the Navy*, April 26, 2010.

The agreement also enables the United States to provide rapid and responsive support to the U.S. Africa and U.S. Central Commands, as needed.<sup>35</sup>

An April 2011 Navy report to Congress on naval force structure and BMD stated the following:

The Navy's operating concept for maritime BMD features a graduated readiness posture that allows BMD-capable Aegis ships to be on a BMD mission tether and employed concurrently in other missions such as strike warfare, air defense, anti-submarine warfare, surface warfare, information warfare, high value asset protection, or maritime interdiction to contribute to overall GCC [Global Combatant Commander] naval requirements. While Aegis ships performing a BMD mission do not lose the capability to conduct these other missions, specific mission effectiveness may be affected by optimizing the ships' position for BMD and/or application of the ship's radar resources to the BMD mission.

The Navy currently has sufficient capacity to meet the most critical demands for multi-mission surface combatants....

The analytical work associated with the Navy's ongoing Force Structure Analysis has progressed to the point that a FY2024 requirement for 94 multi-mission large surface combatants has been established. This requirement assumed that the Phased Adaptive Approach for the ballistic missile defense of Europe would incorporate two Aegis Ashore batteries....

Each GCC's multi-mission surface combatant requirement, including the BMD mission, is constantly evolving to reflect changes in the global security environment, our National Military Strategy, and other Department of Defense guidance related to operations and contingency plans. Within this context, BMD-capable surface combatant requirements are independently determined by each GCC based on mission analyses that consider unique regional factors such as the ballistic missile threat, threat dispersal, geography, size of the defended area, and the specific number and disposition of defended assets. Other mission requirements are similarly derived and the GCC's total surface combatant requirement is ultimately determined considering specific operational objectives and the extent to which supporting schemes of maneuver accommodate multi-mission employment of Aegis BMD surface combatants.<sup>36</sup>

A January 4, 2010, news report stated:

No sooner did the Aegis ballistic missile defense (BMD) system become operational in 2008 than U.S. combatant commanders started asking for BMD-equipped ships to begin patrolling their areas.

Central Command needed a "shooter" in the northern Arabian Gulf. European Command wanted one in the eastern Mediter-ranean. Pacific Command already had Aegis ships with limited BMD capabilities on guard around Japan for a potential launch from North Korea.

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<sup>35</sup> "Announcement on missile defence cooperation by NATO Secretary General Anders Fogh Rasmussen, the Prime Minister of Spain, Jose Luis Rodriguez Zapatero and US Defense Secretary Leon Panetta," October 5, 2011, accessed October 6, 2011, at [http://www.nato.int/cps/en/SID-107ADE55-FF83A6B8/natolive/opinions\\_78838.htm](http://www.nato.int/cps/en/SID-107ADE55-FF83A6B8/natolive/opinions_78838.htm). See also "SECDEF Announces Stationing of Aegis Ships at Rota, Spain," accessed October 6, 2011, at [http://www.navy.mil/search/display.asp?story\\_id=63109](http://www.navy.mil/search/display.asp?story_id=63109).

<sup>36</sup> U.S. Navy, Office of the Chief of Naval Operations, Director of Strategy and Policy (N51), *Report to Congress On Naval Force Structure and Missile Defense*, April 2011, 12 pp.

The demand for BMD ships is only expected to increase, driven in part by rising concerns about Iran's intentions and the U.S. decision in September to cancel an anti-missile system in Poland and the Czech Republic and rely instead on Aegis.

But the Navy has a relatively small number of such ships, and those destroyers and cruisers are designed to carry out a wide range of war-fighting tasks.

As a result, while Navy commanders are pleased with the expanding capabilities of their Aegis ships, they're also somewhat guarded about trumpeting the advances.

"We can't constrain assets to one mission," a senior officer said last month. "They need to do a variety of other missions." Worries that valuable Aegis ships might be locked into the BMD mission were discussed in December at a two-day seminar at the National Defense University (NDU) in Washington. Reporters were allowed to quote comments made at the seminar under the condition that no speaker be identified.

"Sea-based ballistic missile defense is a necessary component of any theater defense," said the senior officer. "We need to find ways to get folks to use the ships in ways consistent with their being a ship—to realize they are not a point-defense asset." One analyst added, "The demand signal is ahead of the pot of ships." U.S. Navy spokesman Lt. Tommy Buck said the service is working to manage the demand.

"Combatant commanders need to understand BMD-capable ships are multimission-capable. BMD is one available asset," Buck said Dec. 18.

The Navy is also working on how to respond, said Vice Adm. Samuel Locklear, director of the Navy Staff.

"We have a small Navy today—the smallest since 1916—yet we have a growing global demand for maritime forces, maritime security operations. And now we have a growing demand for maritime ballistic missile defense. Our ships and our crews and our systems are up to the challenge, but it's a capacity issue for us," Locklear said to a reporter during the NDU seminar.

"As the capacity grows faster than we can grow the number of ships we have—which is always difficult, particularly in the demanding fiscal environment we're in—we have to look at ways to deploy these ships so that we can get the job done and still have a reasonable expectation that we can take care of the ship and the crew," Locklear said. "So we're looking at a lot of different options as to how we'll do that as this demand grows. But we are limited in capacity." Locklear said that despite meeting demands from joint commanders, the Navy has "to some degree preserved the command and control. Navy component commanders still command and control these ships." But, he added, "What we've had to do is to spread these multimission platforms more thinly across a growing number of demands globally."

### 27 BMD Ships By 2013

Twenty-one cruisers and destroyers will have been upgraded with the Aegis BMD capability by early 2010, and six more destroyers are to receive the upgrade in 2012 and 2013. But at least one senior officer at the seminar noted "there will be no more new ships for missile defense." The demand has already affected deployments. Early in 2009, for example, The Sullivans, a Florida-based destroyer on deployment with a carrier group, moved to Japan for a few weeks to pick up the exercise schedule of a Japan-based BMD destroyer that was called on by Central Command to guard the northern Arabian Gulf.

This fall, a San Diego-based ship, the destroyer Higgins, deployed to the eastern Mediterranean to provide BMD defense for European Command and take part in exercises.

Both moves are unusual, as it's rare for an Atlantic Fleet ship to visit Japan or for a Pacific ship to patrol the Mediterranean. Such cross-deployments require more coordination by fleet planners.

"Effective global force management requires global visibility on requirements," Buck said. "U.S. Fleet Forces Command [headquartered in Norfolk, Va.] and Pacific Fleet [headquartered in Pearl Harbor, Hawaii] collaborate, coordinate and communicate to have more complete knowledge of location and status of fleet capabilities and work to best employ those capabilities to meet global combatant commander requirements to include BMD." The senior officer said one way to manage demand is to encourage combatant commanders to give "sufficient warning to have ships on station. We need to remind [combatant commanders] that these are multimission ships." The BMD cruisers and destroyers are also equipped to handle anti-submarine, land-attack, air-defense and other tasks.<sup>37</sup>

## Cost Effectiveness and U.S. Economic Impact of Shifting Four Aegis Ships to Rota, Spain

Another potential oversight issue for Congress concerns the cost effectiveness and U.S. economic impact of the plan to shift the homeport of four BMD-capable Aegis ships to Rota, Spain (see "October 5, 2011, Announcement of Homeporting in Spain" in "Background").

### Cost Effectiveness

Regarding the potential cost effectiveness of shifting the four BMD-capable Aegis ships to Rota, a June 2012, Government Accountability Office (GAO) report stated:

The Navy considered and compared three options in order to determine the most appropriate way to address the operational requirements for ballistic missile defense in Europe: (1) deploying ships to the region from U.S. bases, (2) forward stationing ships and crews within the U.S. European Command area of responsibility, and (3) deploying ships to the region and rotating crews from U.S. bases. The Navy concluded that forward stationing ships represented the most efficient and strategically beneficial of the three options. We reviewed the Navy's documentation associated with the decision and found two key issues. First, the Navy did not fully consider the rotational crewing option. Second, the Navy used different operational assumptions for the remaining two options and did not control for those differences prior to comparing the analytical results.

- *Limited analysis of the rotational crewing option.* The Navy provided little documentation for its analysis of the option to forward station ships and rotate crews from U.S. bases—also known as rotational crewing. This option avoids permanently relocating ship crews and their families. Navy officials stated that rotational crewing was undesirable because of its deleterious effect on crew efficiency and morale. Our previous reports found that the Navy had not developed comprehensive guidance for implementing rotational crewing initiatives or a systemic approach for analyzing

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<sup>37</sup> Christopher P. Cavas, "U.S. Navy Juggles Ships To Fill BMD Demands," *Defense News*, January 4, 2010. Material in brackets as in original.

rotational crewing alternatives and lessons learned. Moreover, as we reported in 2008, initial Navy rotational crewing efforts had provided greater forward presence for Navy ships by eliminating ship transits and maintaining more on-station time in distant operating areas. Therefore, a rotational crewing approach for this posture decision could potentially provide a strategically effective and cost-effective option. However, the Navy provided less analysis of this option than the other two options, which may have prevented the Navy from determining the potential operational value of this approach.

- *Different operational assumptions not controlled for in analysis of alternatives.* The Navy provided more documentation and analysis for its comparison of the forward stationing option to the current approach of U.S.-based deployments to the region. As a result of its analysis, the Navy concluded that the forward stationing option requires significantly fewer ships to meet European ballistic missile defense mission requirements and therefore represents the more efficient and cost-effective option. However, we found that the Navy applied different assumptions to the two options and did not demonstrate that it had controlled for those differences, both of which could affect the outcome of the analysis. Further, Navy officials did not demonstrate that they had considered the long-term life cycle effect and associated costs for each forward deployed ship. Such factors may represent significant costs, without which DOD may lack the comprehensive analysis needed to determine the most efficient approach for meeting ballistic missile defense mission requirements.

GAO's *Cost Estimating and Assessment Guide* states that a business case analysis or a cost-benefit analysis seeks to find the best value solution by linking each alternative to how it satisfies a strategic objective. This linkage is achieved by developing business cases that present facts and supporting details among competing alternatives, including the life cycle costs and quantifiable and nonquantifiable benefits. Specifically, each alternative should identify (1) relative life cycle costs and benefits; (2) methods and rationale for quantifying the life cycle costs and benefits; (3) effect and value of cost, schedule, and performance trade-offs; (4) sensitivity to changes in assumptions; and (5) risk factors. Finally, the analysis should be unbiased, consider all possible alternatives, and be rigorous enough that independent auditors can review it and clearly understand why a particular alternative was chosen. DOD guidance regarding economic analysis similarly encourages the use of sensitivity analysis, a tool that can be used to determine the extent to which costs and benefits change or are sensitive to changes in key factors; this analysis can produce a range of costs and benefits that may provide a better guide or indicator than a single estimate.

In contrast, the Navy's choice to forward station ships in Europe was informed by cost and strategic factors. The Navy considered a number of basing options in or near the Mediterranean and developed a decision matrix that included both strategic and cost factors, such as the proximity of each site to the planned deployment regions and the amount of military construction that would be required at each site to support the ships and their crews. Based on these factors, Navy officials determined that Naval Station Rota provided the best option. From a strategic and operational perspective, Naval Station Rota provides the U.S. Navy with a large maritime port and an associated airfield close to current and potential future operating areas. Additionally, since it is a home port for the Spanish Navy and currently houses Spanish military ships of similar size, there is no need to expand the port pier space to accommodate the incoming ships....

While Naval Station Rota can accommodate the expanded mission, some costs will be incurred. The infrastructure at Rota was initially designed to accommodate a much larger contingent of military personnel and family members than it does currently. Its capacity, according to Navy officials, is sufficient to accommodate the personnel numbers expected once the ships, their crews, and the crews' families are stationed there. As such, although some military construction will be required, less would be required at Rota than at any of the

other sites in the U.S. European Command area of responsibility that were considered. Specifically, the Navy estimated it would cost approximately \$33 million for construction of new facilities and upgrades to existing infrastructure. Further, Naval Station Rota officials explained, and we observed, that the base currently has sufficient galley, medical, and housing facilities and that there are no plans to expand the physical footprint of on-base support infrastructure. The Navy also considered estimated up-front and recurring increases in operational and personnel expenses, including those for additional support personnel and increased utilities costs. In total, the Navy estimated that it would incur approximately \$166 million in up-front military construction, personnel, and maintenance costs; an annual increase in operations and maintenance; and personnel costs of approximately \$179 million....

By asserting that cost savings associated with decreasing overseas presence are often offset through costs incurred and operational impacts elsewhere, DOD has tempered expectations for savings associated with such reductions. However, in an increasingly constrained budget era, DOD and congressional decision makers need precise estimates so that they can more readily balance resources against strategic requirements. To this end, estimates associated with global posture decisions should be backed by rigorous analysis based on information that is as complete and comprehensive as possible. The potential costs or cost savings that may arise from recent posture decisions in the U.S. European Command area of responsibility will remain uncertain without additional analysis. Specifically, the decision to forward station Aegis-equipped ships at Naval Station Rota may allow the Navy to meet the ballistic mission with fewer ships overall but could cost DOD approximately \$1 billion over a 5-year period. And, until a more rigorous analysis of the decision is conducted, the costs of the other options considered will remain unknown. Further, costs and cost savings associated with the decision to reduce Army forces in Europe and adjust the Army's basing footprint in the region will remain unknown until options related to rotational forces and their associated costs are identified and assessed....

To identify future funding requirements and improve the posture planning process, we recommend that the Secretary of Defense take the following three actions:

Direct the Secretary of the Navy to conduct a comprehensive analysis for each course of action the Navy has considered to address mission requirements for ballistic missile defense in the Mediterranean that compares all options the Navy considered and either applies consistent operational assumptions or controls for different operational assumptions and includes the long-term life cycle costs and annual operating costs associated with forward stationing....

In response to our recommendation that the Secretary of Defense direct the Secretary of the Navy to conduct a comprehensive analysis for each course of action the Navy has considered to address mission requirements for ballistic missile defense in the Mediterranean, that compares all options the Navy considered and either applies consistent operational assumptions or controls for different operational assumptions and includes the long-term life cycle costs and annual operating costs associated with forward stationing, DOD partially concurred, but did not identify additional actions to address the recommendation. Specifically, DOD agreed that analysis should be conducted prior to making posture decisions, but does not agree that additional analysis is needed to support the decision to forward station four ships in Rota, Spain.<sup>38</sup>

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<sup>38</sup> Government Accountability Office, *Force Structure[.] Improved Cost Information and Analysis Needed to Guide Overseas Military Posture Decisions*, GAO-12-711, June 2012, pp. 9-13, 20-22.

## U.S. Economic Impact

Regarding the economic impact of shifting the four BMD-capable Aegis ships to Rota, the Prime Minister of Spain, as part of the October 5, 2011, joint announcement of this plan, stated, as mentioned earlier, that

this initiative will have a positive impact, in socio-economic terms, on our country, and most especially on the Bay of Cadiz [area near Rota].

Permanently basing four vessels in Rota will require investing in the Base’s infrastructure, and contracts with service providers, thus generating approximately a thousand new jobs, both directly and indirectly.

For the shipyards, and for Spain’s defence industry, the foreseeable impact will also be highly positive, as the USA is considering conducting the vessels’ maintenance and upkeep at the nearby San Fernando shipyards, in the province of Cadiz. In addition, there will be significant transfer of state-of-the-art technology, from which Spain can benefit.<sup>39</sup>

Assessing the U.S. economic impact of the plan to shift the homeport of four BMD-capable Aegis ships to Rota, Spain, could include accounting for, among other things, the economic impact of

- U.S. personnel and their families spending their paychecks in Spain rather than in the current home port areas;
- the Navy performing overhaul, maintenance, and repair work on the ships in Spain rather than in the United States; and
- the Navy purchasing supplies for these ships in Spain rather than from sources in the current home port areas.

Regarding the first item above, CRS asked the Navy for the total dollar value of personnel pay and allowances per year associated with the four destroyers designated to be homeported at Rota. The Navy replied that:

The annual military personnel cost for the four DDGs designated to deploy as Forward Deployed Naval Forces (FDF) in Rota is provided below. All personnel are ships force [i.e., ship crew members].

\$ millions	FY 2013	FY 2014	FY 2015	FY 2016	FY2017
MPN/RPN	\$0	\$67.1	\$131.6	\$134.0	\$137.7 <sup>40</sup>

Regarding second item above, the Navy states that

The annual ship maintenance cost [in millions] for the four DDGs designated to deploy as Forward Deployed Naval Forces (FDF) in Rota is provided in Table 1.

<sup>39</sup> “Announcement on missile defence cooperation by NATO Secretary General Anders Fogh Rasmussen, the Prime Minister of Spain, Jose Luis Rodriguez Zapatero and US Defense Secretary Leon Panetta,” October 5, 2011, accessed October 6, 2011, at [http://www.nato.int/cps/en/SID-107ADE55-FF83A6B8/natolive/opinions\\_78838.htm](http://www.nato.int/cps/en/SID-107ADE55-FF83A6B8/natolive/opinions_78838.htm).

<sup>40</sup> Source: Navy information paper dated February 29, 2012, provided by Navy Office of Legislative Affairs to CRS on March 19, 2012. MPN and RPN are the Military Personnel, Navy, and Reserve Personnel, Navy, appropriations accounts.

	FY14	FY15	FY16	FY17
FDNF-based <sup>1, 2</sup>	\$40.79	\$44.99	\$47.50	\$43.06
CONUS-based	\$49.04	\$51.10	\$40.85	\$38.77
Cost Differential	-\$8.25	-\$6.11	\$6.65	\$4.29

Table 1. Total Annual Maintenance Cost for Four DDGs Deploying as FDNF-based Forces vs. their Total Annual Maintenance Cost as CONUS-based Forces.

Notes:

1. Prior to FDNF deployment, all vessels receive a large maintenance availability to correct known deficiencies and groom Ballistic Missile Defense systems. Consequently, some of the depot maintenance work originally scheduled for accomplishment in FY14 and FY15 has been moved to FY12 and/or FY13, and the cost differential is lower than normal. Cost differentials in FY16 and FY17 are more representative of expected future year differential maintenance costs.

2. Incremental maintenance costs are based on two ships deploying in FY14, followed by two additional ships in FY15, and account for a change in maintenance availability periodicity from 32 months CONUS-based to 17 months FDNF-based. Costs include continuous maintenance, emergent and other restricted technical availabilities, voyage repairs, fly-away teams and regional maintenance center support.<sup>41</sup>

Regarding the third item above, the Navy states that:

A Forward Deployed Naval Force of four DDGs is expected to spend a total of approximately \$7.2M per year on direct Navy purchases in Rota, Spain, that otherwise would have been spent in CONUS. These purchases consist of:

- Utilities \$6M per year
- Consumables \$1.2M per year (only open purchases made by ships' company)<sup>42</sup>

## U.S. vs. European Naval Contributions to European BMD

Another potential oversight issue for Congress concerns European naval contributions to European BMD capabilities and operations compared to U.S. naval contributions to European BMD capabilities and operations. Potential oversight issues for Congress include the following:

- How does the total value of European naval contributions to European BMD capabilities and operations compare to the total value of the U.S. contributions to European BMD capabilities and operations?
- Given anticipated reductions in planned levels of U.S. defense spending resulting from the Budget Control Act of 2011 (S. 365/P.L. 112-25 of August 2, 2011), as

<sup>41</sup> Source: Navy information paper dated March 19, 2012, provided by Navy Office of Legislative Affairs to CRS on March 19, 2012. The information paper expressed the cost figures in thousands (e.g., \$40,790 for FDNF-based in FY2014); they are converted here into millions (e.g., \$40.79 million). CONUS is continental United States.

<sup>42</sup> Source: Navy information paper dated March 8, 2012, provided by Navy Office of Legislative Affairs to CRS on March 9, 2012.



well as the potential for giving BMD capabilities to European navy ships (see “Allied Participation and Interest in Aegis BMD Program” in “Background”), should the United States seek increased investment by European countries in their naval BMD capabilities so as to reduce the need for assigning BMD-capable U.S. Navy Aegis ships to the EPAA?

## **Target for Simulating Endo-Atmospheric Flight of DF-21 ASBM**

Another potential oversight issue for Congress concerns the lack of a target for simulating the endo-atmospheric (i.e., final) phase of flight of China’s DF-21 anti-ship ballistic missile. DOD’s Director, Operational Test and Evaluation (DOT&E), in a December 2001 report (DOT&E’s annual report for FY2011), stated:

### **Anti-Ship Ballistic Missile Target**

A threat representative Anti-Ship Ballistic Missile (ASBM) target for operational open-air testing has become an immediate test resource need. China is fielding the DF-21D ASBM, which threatens U.S. and allied surface warships in the Western Pacific. While the Missile Defense Agency has exo-atmospheric targets in development, no program currently exists for an endo-atmospheric target. The endo-atmospheric ASBM target is the Navy’s responsibility, but it is not currently budgeted. The Missile Defense Agency estimates the non-recurring expense to develop the exo-atmospheric target was \$30 million with each target costing an additional \$30 million; the endo-atmospheric target will be more expensive to produce according to missile defense analysts. Numerous Navy acquisition programs will require an ASBM surrogate in the coming years, although a limited number of targets (3-5) may be sufficient to validate analytical models.<sup>43</sup>

A February 28, 2012, press report stated:

“Numerous programs will require” a test missile to stand in for the Chinese DF-21D, “including self-defense systems used on our carriers and larger amphibious ships to counter anti-ship ballistic missiles,” [Michael Gilmore, the Pentagon’s director of operational test and evaluation] said in an e-mailed statement....

“No Navy target program exists that adequately represents an anti-ship ballistic missile’s trajectory,” Gilmore said in the e-mail. The Navy “has not budgeted for any study, development, acquisition or production” of a DF-21D target, he said.

Lieutenant Alana Garas, a Navy spokeswoman, said in an e-mail that the service “acknowledges this is a valid concern and is assessing options to address it. We are unable to provide additional details.”...

Gilmore, the testing chief, said his office first warned the Navy and Pentagon officials in 2008 about the lack of an adequate target. The warnings continued through this year, when the testing office for the first time singled out the DF-21D in its annual public report....

The Navy “can test some, but not necessarily all, potential means of negating anti-ship ballistic missiles,” without a test target, Gilmore said.<sup>44</sup>

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<sup>43</sup> Department of Defense, Director, Operational Test and Evaluation, *FY 2011 Annual Report*, December 2011, p. 294.

<sup>44</sup> Tony Capaccio, “Navy Lacks Targets To Test U.S. Defenses Against China Missile,” *Bloomberg Government* (continued...)

## Capability of SM-3 Block IIB Interceptor

Another potential oversight issue for Congress concerns the prospective capability of the SM-3 Block IIB interceptor for conducting certain kinds of intercepts called “early intercepts” as part of the EPAA. A June 13, 2011, press report stated:

When asked what the Pentagon’s plan is for countermeasures if early intercept does not materialize with the [SM-3 Block] IIB in 2020, Missile Defense Agency (MDA) officials simply state: “We fully expect to have a viable early-intercept capability with the SM-3 Block IIB in the 2020 time period.”...

At issue today is whether the architecture as envisioned is achievable; and the piece most critics question is the plan to achieve early intercept and protect the Eastern U.S. from an Iranian ICBM attack.

USAF Gen. (ret.) Lester Lyles, who led the MDA when it was called the Ballistic Missile Defense Organization, is co-chairing a Defense Science Board task force review of the early-intercept strategy with Adm. (ret.) William Fallon, who headed U.S. Pacific Command. The report is being written and will likely be briefed to Pentagon leaders in the fall.

Lyles declines to discuss his findings until they are briefed to the Pentagon. Industry and government sources familiar with the study have different views on what the findings will be. Some say the task force questions the ability to achieve early intercept with the time and money available. Others say the report will outline what can be achieved with the current strategy.

Whatever the outcome, the results are likely to influence the SM-3 IIB program, whether it moves forward and, if it does, what the missile will look like. The IIB is the notional long-range missile killer that will be fielded in Phase IV by 2020 for early intercept to fulfill the promise of protecting the Eastern U.S. and most of Europe from an Iranian ICBM attack....

GMD advocates point to the option of placing interceptors at Fort Drum, N.Y., to provide a deeper magazine and coverage for the Eastern U.S.....

The question of whether a IIB missile can achieve early intercept, and how to do it, is likely to be sorted out this summer. The Defense Science Board will report its findings, and the MDA is likely to request funding for the IIB strategy in the fiscal 2013 budget proposal that is due to Congress next February.<sup>45</sup>

A June 17, 2011, press report states:

A Defense Science Board (DSB) report on early missile intercept is already prompting discussion on Capitol Hill over how U.S. strategic forces are funded.

The Obama administration is pursuing the European Phased Adaptive Approach to missile defense, which by 2020 would develop the SM-3 Block IIB interceptor to protect the U.S. and Europe against long-range missiles from North Korea and Iran. In April, Boeing,

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(...continued)

(*bgov.com*), February 28, 2012.

<sup>45</sup> Amy Butler, “End Game,” *Aviation Week & Space Technology*, June 13, 2011: 40.

Lockheed Martin and Raytheon each won concept definition and program planning awards worth at least \$41 million.

But the DSB study, led by retired Air Force Gen. Lester Lyles and retired Navy Adm. William Fallon, casts doubt on a central capability of that interceptor—primarily the ability to hit an incoming missile before it deploys countermeasures, according to Senate Republican aides. The study's unclassified version also finds that the goal of early interception may lead to a less-capable system overall and rather than investing in the interceptor, improvements to radars, satellites and communications are also important, an aide says.

With that information, already a critical question is emerging on Capitol Hill: During a deficit crisis, should the government be spending \$1.7 billion over the next five years to develop the SM-3 Block IIB if its ultimate goal is in doubt?

At least the rationale for pursuing the interceptor—replacing a missile defense site based in Poland and the Czech Republic—is in line for scrutiny.

“If the administration continues to sell early interceptors as a way of going after countermeasures, that’s not going to work,” one aide says.

So in that case, does it make sense to continue working on the IIB missile for other reasons? And if not, what are the alternatives?

One camp could emerge in support of upgrades to the current Ground-based Midcourse Defense system or the creation of a site in the eastern United States. Another group may want to improve on the capabilities of the Raytheon-led SM-3 Block IIA.<sup>46</sup>

A July 6, 2011, letter to the editor from the two co-chairmen of the DSB task force in question and the chairman of the full DSB stated:

The Defense Science Board (DSB) is now completing a review on Science and Technology Issues of Early Intercept (EI) Ballistic Missile Defense Feasibility as a concept to enhance missile defense....

In previous work, the DSB found the EI concept helpful in national missile defense against long-range ballistic missiles. In the current review, EI, as defined by the study's terms of reference, was judged less helpful in regional missile defense against shorter range regional ballistic missiles....

The DSB concluded that the Missile Defense Agency is on the right track in developing European Phased Adapted Approach (EPAA) options, including continued evolution of the SM-3 family of missiles, which will expand the battle space and provide more engagement opportunities in the regional defense provided by the EPAA. The DSB also examined the potential in the EPAA context for EI in regional defense against short-range missiles before threat payloads could be deployed, and concluded that this was not a viable option because of technical constraints - primarily related to the very short payload deployment times and the present absence of adequate sensors/Ballistic Missile C3 to overcome this.

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<sup>46</sup> Jen DiMascio, “DSB Report Raises Questions About SM-3 Block IIB Costs,” *Aerospace Daily & Defense Report*, June 17, 2011: 4.

The fact that this form of EI is not viable in shorter-range regional applications does not imply that either SM-3 family interceptors or the EPAA concept are flawed. In general, EI, including intercepts of longer-range missiles before the threat missile reaches apogee, can provide for multiple engagement opportunities and more effective defenses.

MDA is on the right track in pursuing this capability for national missile defense, and examining the potential application in regional defense as a function of the range of threat missiles.

The DSB did not conclude that EI is flawed. Nor did they conclude that the EPAA approach or the SM-3 family were flawed. The DSB did conclude that EI would have a very limited role in regional defense against shorter range missile threats.<sup>47</sup>

## **Concurrency and Technical Risk in Aegis BMD Program**

Another potential oversight issue for Congress is development-production concurrency and technical risk there is in the Aegis BMD program. Below are comments from March 2012 and April 2012 GAO reports on concurrency and technical risk in certain parts of program.<sup>48</sup>

### **SM-3 Block IB Missile**

A March 2012 GAO report stated the following regarding the SM-3 Block IB missile:

The SM-3 IB will be at continued risk of cost growth, schedule delays, and performance shortfalls unless it demonstrates that the missile's critical technologies and design perform as expected before committing to further production. In 2011, the SM-3 IB failed during its first developmental flight test. At the time of the failure, MDA had contracted for 25 SM-3 IB interceptors, 18 of which were dedicated to flight testing. As a result of the flight test failure, MDA halted acceptance of SM-3 IB deliveries, convened a failure review board, and delayed key program decisions. In addition, two critical technologies—the throttleable divert attitude control system and third-stage rocket motor—still may not be mature. The attitude control system has not completed developmental testing or been successfully flight tested and the third-stage rocket motor may need to be redesigned....

According to the program, all five of its critical technologies—the third-stage rocket motor, throttleable divert attitude control system, reflective optics, two-color warhead seeker, and kinetic warhead advanced signal processor—are mature. However, the attitude control system has not completed qualification testing or been demonstrated in a realistic flight environment. In addition, the third-stage rocket motor, which was previously considered the most mature technology, may need to be redesigned to address issues discovered in flight testing. In its first developmental flight test in September 2011, the SM-3 IB experienced a

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<sup>47</sup> Letter to the editor from Admiral William J. Fallon, U.S. Navy, retired, task force co-chairman; General Lester Lyles, U.S. Air Force, retired, task force co-chairman and DSB vice chairman; and Paul G. Kaminski, DSB chairman, published under the title "'Early Intercept' Not Flawed," *Washington Times*, July 6, 2011: B2.

<sup>48</sup> Government Accountability Office: *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-12-400SP, March 2012, 188 pp.; Government Accountability Office, *Missile Defense[:] Opportunity Exists to Strengthen Acquisitions by Reducing Concurrency*, GAO-12-486, April 2012, 100 pp. See also Government Accountability Office, *Missile Defense[:] Opportunities Exist to Strengthen Acquisitions by Reducing Concurrency and Improving Parts Quality, Testimony Before the Subcommittee on Strategic Forces, Committee on Armed Services, U.S. Senate, Statement of Cristina Chaplain, Director Acquisition and Sourcing Management*, GAO-12-600T, April 25, 2012, 16 pp.

failure involving one of its critical technologies and did not intercept the target. A failure review board is investigating the cause. The program plans to redo the failed test and conduct two additional intercept flight tests in 2012. Program officials expect that all SM-3 IB technologies will be flight-qualified and demonstrated through testing by the program's planned fiscal year 2013 production decision.

### **Design Maturity**

The SM-3 IB's design has been relatively stable since its critical design review in May 2009, although design changes may be necessary to address issues discovered in testing. In addition, the program has not demonstrated that the missile's design can perform as intended through developmental testing. As a result, it remains at risk for further design changes, cost growth, and schedule delays.

### **Production Maturity**

MDA has delayed the official start of operational missile production from February 2010 to the fourth quarter of fiscal year 2013. According to officials, MDA will not make this production decision until it completes initial developmental testing with production-representative missiles and shipboard systems.

The program has already contracted for 25 missiles, 18 of which will be used for developmental testing. The seven additional missiles could require costly rework and retrofits if the program decides to use them as operational assets as planned. According to MDA, additional missiles will also be used to prove manufacturing processes and for other purposes. MDA is also planning to purchase 46 additional missiles in fiscal year 2012. Any additional missiles ordered in fiscal year 2012 before the completion of flight tests needed to validate the missile's performance would be at higher risk of cost growth and schedule delays.

The flight-test failure investigation and possible redesigns are delaying both developmental and operational missile production. The program's acceptance of developmental missile deliveries and the production of certain missile components are on hold pending the results of the investigations. Program officials estimate that the failure investigations, design modifications, and additional testing will increase costs and they have not yet determined how many missiles may need to be refurbished.

### **Other Program Issues**

MDA originally planned to stop production of the SM-3 IA in 2010 and begin production of the SM-3 IB. However, SM-3 IB developmental issues have required MDA to twice delay the purchase of SM-3 IB missiles, purchase additional SM-3 IA missiles to avoid production gaps and keep SM-3 suppliers active, and reduce the planned initial purchase quantity of SM-3 IBs. The program's acceptance of SM-3 IA deliveries and the production of a missile component have been halted since April 2011, when an SM-3 IA missile experienced an anomaly during a flight test. The anomaly may have occurred in a component that is common to the SM-3 IA and SM-3 IB.

### **Program Office Comments**

In commenting on a draft of this assessment, MDA provided technical comments, which were incorporated as appropriate.<sup>49</sup>

An April 2012 GAO report stated the following regarding the SM-3 Block IB missile:

The SM-3 Block IB program, the second version of the SM-3 interceptor, is facing both developmental and production challenges that are exacerbated by its concurrent schedule.... This interceptor shares many components with the SM-3 Block IA, but the kinetic warhead is new technology that is being developed. The need to meet the presidential directive to field the Aegis BMD 4.0.1/SM-3 Block IB by the 2015 time frame for European missile defense is a key driver for the high levels of concurrency.

In response to previous developmental problems and to prevent a production break, MDA has twice had to purchase additional SM-3 Block IA interceptors and faces a similar decision in fiscal year 2012. According to MDA, the additional SM-3 Block IA missiles were purchased to avoid a production gap as well as to keep suppliers active, and to meet combatant command SM-3 missile quantity requirements. The program, according to program management officials, was scheduled to purchase the last SM-3 Block IA in fiscal year 2010 and transition to procurement production of the SM-3 Block IB missiles in fiscal year 2011.

MDA began purchasing the SM-3 Block IB in 2009 beyond the numbers needed for flight testing while a critical maneuvering technology was immature and prior to a successful flight test. According to the Director, MDA these missiles support development and operational testing; prove out manufacturing processes; provide information on reliability, maintainability and supportability; verify and refine cost estimates; and ensure that the missile will meet its performance requirements on a repeatable basis. MDA has determined that 18 of the 25 SM-3 Block IB missiles ordered are to be used for developmental testing; the remaining 7 interceptors are currently unassigned for tests and may be available for operational use. According to program management officials, these unassigned rounds represent a small portion of the total planned purchases.

MDA is also planning to purchase 46 additional SM-3 Block IB missiles in fiscal year 2012. Meanwhile, testing has yet to validate the missile's performance, the cause of the test failures is not yet determined, and remaining tests may not be completed until 2013. Consequently, purchasing additional interceptors beyond those needed for development remains premature. The first SM-3 Block IB developmental flight test failed in September 2011, and an anomaly occurred in an April 2011 flight test of the SM-3 Block IA. The flight test failure and the test anomaly occurred in components that are shared between the SM-3 Block IA and IB. Program officials are still investigating the reason for these failures. The program was unable to validate initial SM-3 Block IB capability during the failed September test, and program officials hope to conduct a series of three intercept tests in fiscal year 2012 needed to validate SM-3 Block IB capability. Depending on the timing and content of the failure review board results, this schedule could change further. According to program management officials, these unassigned rounds represent a small portion of the total planned purchases.

Any SM-3 Block IB missiles ordered in fiscal year 2012 before mitigations for the anomaly and the failure, if needed, are determined and before the three flight tests confirm the design works as intended would be at higher risk of cost growth and schedule delays. In addition, SM-3 Block IB missiles already manufactured but not delivered also are at higher risk of

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<sup>49</sup> Government Accountability Office: *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-12-400SP, March 2012, pp. 53-54.

requiring a redesign depending on the results of the failure review. Program management officials stated MDA has slowed SM-3 Block IB manufacturing until the outcome of the failure review board is known. It remains unclear whether the additional 46 missiles will be ordered before the failure reviews are complete and the interceptor is able to demonstrate that it works as intended. Recognizing the critical importance of completing the planned fiscal year 2012 intercept tests, the operational need for SM-3 missiles, the relative success of the SM-3 Block IA, as well as the potential for a production break, the Senate Committee on Appropriations directed MDA to use the fiscal year 2012 SM-3 Block IB funds for additional Block IA missiles should the test and acquisition schedule require any adjustments during fiscal year 2012. However, a decision to purchase additional SM-3 Block IA missiles in fiscal year 2012 to help avoid a production break may be affected by the SM-3 Block IA failure investigation that has not yet been completed. Program management officials stated most deliveries of the SM-3 Block IA have been suspended pending the results of the failure review.<sup>50</sup>

The April 2012 GAO report recommended that the Secretary of Defense direct MDA to

verify the SM-3 Block IB engagement capability through the planned three developmental flight tests before committing to additional production beyond those needed for developmental testing and .... report to the Office of the Secretary of Defense and to Congress the root cause of the SM-3 Block IB developmental flight test failure, path forward for future development, and the plans to bridge production from the SM-3 Block IA to the SM-3 Block IB before committing to additional purchases of the SM-3 Block IB.<sup>51</sup>

The report stated that DOD

concur with our recommendation for the Aegis BMD program to verify the SM-3 Block IB engagement capability through the planned three developmental flight tests before committing to additional production, stating that the final decision to purchase SM-3 Block IB missiles with DOD-wide procurement funding will be made after the next three planned flight tests. We remain concerned that MDA is planning to purchase 46 additional SM-3 Block IB missiles prematurely using research, development, test, and evaluation funds in fiscal year 2012 before validating the performance of the missile and before determining the root cause of test failures—risking disrupting the supply chain if testing reveals the need to make design changes. We continue to believe that the program should not purchase any additional missiles, regardless of the type of funding used to purchase them, until the SM-3 Block IB’s engagement capability has been verified through the three developmental flight tests currently planned for the program. We have modified the recommendation to focus on verifying the capability before committing to additional production beyond the missiles needed for developmental testing....

DOD partially concurred with our recommendation to report to the Office of the Secretary of Defense and to Congress the root cause of the SM-3 Block IB developmental flight test failure, path forward for future development, and the plans to bridge production from the SM-3 Block IA to the SM-3 Block IB before committing to additional purchases of the SM-3 Block IB. DOD commented that MDA will report the root cause of the SM-3 Block IB test failure and the path forward for future development to the Office of the Secretary of Defense and to Congress upon completion of the failure review in the third quarter of fiscal year

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<sup>50</sup> Government Accountability Office, *Missile Defense[:] Opportunity Exists to Strengthen Acquisitions by Reducing Concurrency*, GAO-12-486, April 2012, pp. 19-21; see also Appendix IV (pp. 46-52).

<sup>51</sup> Government Accountability Office, *Missile Defense[:] Opportunity Exists to Strengthen Acquisitions by Reducing Concurrency*, GAO-12-486, April 2012, pp. 28.

2012. However, DOD makes no reference to delaying additional purchases until the recommended actions are completed, instead stating that MDA is balancing the need to demonstrate technical achievement and also ensure that the system is thoroughly tested before fielding with the need to keep the industrial base and supply chain healthy to ensure that production transitions as quickly as possible. We believe that an appropriate balance between schedule and risk is necessary for development programs. However, our analysis has shown that MDA undertakes acquisition strategies of accelerated development and production that have led to disruptions in the supply chain and have increased costs to develop some BMDS assets. We maintain our position that MDA should take the recommended actions before committing to additional purchases of the SM-3 Block IB.<sup>52</sup>

## **SM-3 Block IIA Missile**

The March 2012 GAO report stated the following regarding the SM-3 Block IIA missile:

### **Technology Maturity**

The SM-3 Block IIA program faces significant technology development challenges. The majority of the SM-3 Block IIA components are new technology compared to the SM-3 Block IB. The program must develop a new propulsion system with a much greater thrust, a new divert and attitude control system, a more capable seeker, and use new solid fuel, all of which pose significant technological challenges. The development of similar components has been a challenge for previous SM-3 interceptors.

The SM-3 Block IIA program has identified eight critical technologies—six of which are immature and require additional development and testing before they can be demonstrated in a system prototype. The program held subsystem preliminary design reviews during fiscal year 2011, which demonstrated that some critical technologies required redesign or other adjustments. The program has plans in place to rebalance SM-3 Block IIA requirements or replace certain technology components. For example, the program has moved away from a component that has caused problems for the SM-3 Block IB. The program completed new reviews for the four technologies that failed to complete the initial reviews by early fiscal year 2012. In addition, two critical technologies—the second- and third-stage rocket motors—have experienced problems during testing. The program was investigating the causes of those problems and the potential effects at the end of fiscal year 2011. According to the program, all critical technologies will be nearing maturity by its planned September 2013 critical design review.

### **Other Program Issues**

The SM-3 Block IIA program has extended its development schedule by more than a year, which likely will increase program costs, but lower the risk of further cost growth and schedule delays in the future. The program adjusted its system-level preliminary and critical design reviews after several key components failed their preliminary design reviews. The adjustment may reduce acquisition risk and the potential for future cost growth by providing the program more time to reconcile gaps between requirements and resources; demonstrate technical knowledge; and ensure that requirements are defined, feasible, and achievable before committing to product development. The new schedule also lowers risk in other ways, such as building in more recovery time between program reviews and flight tests. Under the revised schedule, flight tests will be delayed from 2015 to late 2016. The SM-3 Block IIA is

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<sup>52</sup> Government Accountability Office, *Missile Defense[.] Opportunity Exists to Strengthen Acquisitions by Reducing Concurrency*, GAO-12-486, April 2012, pp. 29 and 31.



still planned to be deployed with Aegis Weapons System 5.1 as part of the European Phased Adaptive Approach Phase III in the 2018 time frame.

**Program Office Comments**

In commenting on a draft of this assessment, Aegis BMD program management officials noted the SM-3 Block IIA program held 60 component-level preliminary design reviews in fiscal year 2011, of which 4 did not receive a pass during the first evaluation. This result drove a schedule adjustment of 1 year. The officials further noted the program used this additional time to implement a more robust engineering process. Actions the program took resulted in the completion of the four component-level reviews and support the completion of the system-level preliminary design review in March 2012. The rebalancing of the component-level requirements that occurred has not affected system-level requirements. Finally, the officials note that the program is on schedule to achieve its European Phased Adaptive Approach objectives. MDA also provided technical comments, which were incorporated as appropriate.<sup>53</sup>

**SM-3 Block IIB Missile**

The March 2012 GAO report stated the following regarding the SM-3 Block IIB missile:

**Current Status**

The SM-3 Block IIB program entered technology development in July 2011 and awarded three contracts to conduct trade studies, define missile configurations, and produce development plans. One contractor will be selected for system development in 2013. The SM-3 Block IIB program is developing advance seeker and other technologies that cut across the SM-3's variants through a technology risk-reduction program.

According to a tentative schedule, the SM-3 Block IIB program plans to enter system development prior to holding a preliminary design review, raising the possibility of cost and schedule growth. The program is conducting a series of reviews to receive engineering insight into each contractor's design. While these reviews will provide important knowledge, we have reported that before starting system development, programs should hold key engineering reviews, culminating in the preliminary design review, to ensure that the proposed design can meet defined, feasible requirements within cost, schedule, and other system constraints. Beyond the crosscutting technologies the program is developing, it is taking steps to develop technology maturation plans that will include demonstrating technologies in a relevant environment using a representative model or prototype before the SM-3 Block IIB enters system development. The three contractors' plans are expected to outline the level of investment required to demonstrate this degree of technology maturity by 2014. Program officials have not yet defined the specific critical technologies for the SM-3 Block IIB, which could hamper these efforts. Unlike most major defense acquisition programs, MDA programs are not required to demonstrate technologies in a relevant environment prior to system development, so decision makers will have to hold the program accountable for ensuring the technologies mature as intended....

**Program Office Comments:** In commenting on a draft of this assessment, MDA noted the SM-3 Block IIB's primary mission is early intercept of long-range ballistic missiles. One

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<sup>53</sup> Government Accountability Office: *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-12-400SP, March 2012, p. 56. See also Government Accountability Office, *Missile Defense[:] Opportunity Exists to Strengthen Acquisitions by Reducing Concurrency*, GAO-12-486, April 2012, Appendix V (pp. 53-57).

system development contract will be competitively awarded in fiscal year 2014. MDA has identified key missile technologies and made investments to reduce development risks. Prior to system development, there will be a government-only system requirements review. MDA also provided technical comments, which were incorporated as appropriate.<sup>54</sup>

The April 2012 GAO report stated the following regarding the SM-3 Block IIB missile:

The program has high levels of concurrency because it plans to commit to product development prior to holding a PDR [preliminary design review]...

The need to meet the 2020 time frame announced by the President to field the SM-3 Block IIB for European PAA Phase IV is a key driver for the high levels of concurrency. The program is following some sound acquisition practices by awarding competitive contracts to multiple contractors to develop options for missile configurations and mature key technologies as well as planning to compete the product development contract. However, while the program is holding a series of reviews that will provide engineering insight into the SM-3 Block IIB design, we have previously reported that before starting development, programs should hold key system engineering events, culminating in the PDR, to ensure that requirements are defined and feasible and that the proposed design can meet those requirements within cost, schedule, and other system constraints. In addition, based on the initial schedule developed by the program and prior history of SM-3 interceptor development, the SM-3 Block IIB program will need to commit to building the first flight test vehicle prior to holding the PDR in order to remain on the planned test schedule. According to MDA, this approach is a low risk development if the program is funded at requested levels. The agency stated that the achievement of an initial operating capability will be based on technical progress and execution of a “fly before buy” approach.<sup>55</sup>

The April 2012 GAO report recommended that the Secretary of Defense direct MDA to “ensure that the SM-3 Block IIB requirements are defined and feasible and that the proposed design can meet those requirements within cost, schedule, and other system constraints by delaying the commitment to product development until the program completes a successful preliminary design review.”<sup>56</sup>

## **Aegis Ashore**

The March 2012 GAO report stated the following regarding the Aegis Ashore sites:

Aegis Ashore is following a concurrent acquisition approach by entering system development prior to holding a preliminary design review and purchasing operational components prior to completing testing—both of which increase the risk of cost growth and schedule delays. The program office has now assessed its five critical technologies as mature or nearing maturity. However, several of these technologies may be less mature than reported. The system’s design was stable by February 2012, but the risk of design changes will remain until it demonstrates the design can perform as expected by flight testing, which will not occur until 2014. Program management stated that the development is low risk

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<sup>54</sup> Government Accountability Office: *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-12-400SP, March 2012, p. 140.

<sup>55</sup> Government Accountability Office, *Missile Defense[:] Opportunity Exists to Strengthen Acquisitions by Reducing Concurrency*, GAO-12-486, April 2012, pp. 22-23; see also Appendix VI (pp. 58-64).

<sup>56</sup> Government Accountability Office, *Missile Defense[:] Opportunity Exists to Strengthen Acquisitions by Reducing Concurrency*, GAO-12-486, April 2012, pp. 28.

because the technologies are already used by Aegis BMD ships and the program's ground and flight test schedule will confirm the capability by the time it is deployed....

### **Technology Maturity**

According to the Aegis Ashore program office, all five of its critical technologies are mature or nearing maturity. The program has assessed the SPY-1 radar, command and control system, SM-3 Block IB interceptor, and vertical launching system as mature and the multimission signal processor as nearing maturity. However, the maturity of some of these technologies may be overstated. The SPY-1 radar requires modifications for its use on land and other changes may be necessary due to host nation radar frequency issues. Program management officials stated at least some of these changes are software modifications, but the frequency issues may require other changes. The launch system must also be modified for use both on land and at a greater distance from the deckhouse. In addition, the maturity of SM-3 Block IB may be overstated because some of its component technologies have not been flight tested or have experienced failures in testing. The multimission signal processor also faces development challenges, and the Defense Contract Management Agency has identified its schedule as high risk. We have previously reported that a significant percentage of its software still needs to be integrated.

### **Design Maturity**

The deckhouse design was 100 percent complete in February 2012, prior to the planned award of the deckhouse fabrication contract in the third quarter of fiscal year 2012. However, the program does not plan to demonstrate the design can perform as expected by flight testing until 2014, although there will be ground testing to demonstrate Aegis Ashore component integration prior to the flight test. As a result, the risk of design changes will remain until developmental testing is complete.

### **Other Program Issues**

The Aegis Ashore program is following an acquisition approach that increases the risk of cost growth and schedule delays. The program began system development 14 months before completing its preliminary design review. We have previously reported that this review should be held prior to starting development to ensure that requirements are defined, feasible, and achievable within cost, schedule, and other system constraints. The program also contains concurrency between development and production, which increases the risk of late and costly design changes and retrofits. For example, the program is simultaneously acquiring the developmental test deckhouse and the operational deckhouse and is constructing the operational deckhouse first. In addition, the first developmental flight test of Aegis Ashore is scheduled for the second quarter of fiscal year 2014, at which point two deckhouses will have been constructed and other components will already be in production. Program management officials stated its concurrent schedule is low risk given its use of technology already used by Aegis BMD and modifications can be made to the deckhouse before it is installed in Romania. In addition, it stated that the current strategy has cost benefits and construction and testing efficiency advantages.

The program has experienced cost growth because of additional requirement costs. In 2011, the unit cost of Aegis Ashore grew, which the program attributed to costs for the reconstitutable deckhouse design that were not included in its baseline and the addition of hardware for a third site in Poland.

### **Program Office Comments**

In commenting on a draft of this assessment, MDA provided technical comments, which were incorporated as appropriate.<sup>57</sup>

The April 2012 GAO report stated the following regarding the Aegis Ashore sites:

The program initiated product development and established a cost, schedule, and performance baseline early; included high levels of concurrency in its construction and procurement plan; and has not aligned its flight testing schedule with construction and component procurement decisions. The need to meet the 2015 time frame announced by the President to field the Aegis Ashore for European PAA Phase II is a key driver for the high levels of concurrency....

Aegis Ashore began product development and set the acquisition baseline before completing the PDR. This sequencing increased technical risks and the possibility of cost growth by committing to product development with less technical knowledge than recommended by acquisition best practices and without ensuring that requirements were defined, feasible, and achievable within cost and schedule constraints.

The program has initiated procurement of components for the installation and plans to start fabricating two enclosures called deckhouses—one for operational use at the Romanian Aegis Ashore installation and one for testing at the Pacific Missile Range Facility—in fiscal year 2012, but does not plan to conduct the first intercept test of an integrated Aegis Ashore installation until fiscal year 2014. Further, the program plans to build the operational deckhouse first, meaning any design modification identified through system testing in the test deckhouse or the intercept test will need to be made on an existing deckhouse and equipment. As we have previously reported, such modifications on an existing fabrication may be costly.

According to the Director of MDA, Aegis Ashore is a land adaptation of the Aegis weapons system sharing identical components. However, we previously have reported on the modifications to existing Aegis BMD technology that must be made to operate in a new land environment. In addition, some of the planned components for Aegis Ashore are being developed for future Aegis weapon system upgrades and are still undergoing development. Aegis BMD program management officials stated that the risks of concurrency in the program schedule are low due to the program's reliance on existing technology and the ground testing that will be completed prior to the first intercept test. Nevertheless, the program has a limited ability to accommodate delays in construction or testing.<sup>58</sup>

## Legislative Activity for FY2013

### Summary of Action on FY2013 MDA Funding Request

**Table 5** summarizes congressional action on the FY2013 request for MDA procurement and research and development funding for the Aegis BMD program.

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<sup>57</sup> Government Accountability Office: *Defense Acquisitions[:] Assessments of Selected Weapon Programs*, GAO-12-400SP, March 2012, pp. 51-52.

<sup>58</sup> Government Accountability Office, *Missile Defense[:] Opportunity Exists to Strengthen Acquisitions by Reducing Concurrency*, GAO-12-486, April 2012, pp. 24-25; see also Appendix VII (pp. 65-72).

**Table 5. Summary of Congressional Action on FY2013 Request for MDA Procurement and RDT&E Funding for Aegis BMD Program**

(In millions of dollars, rounded to nearest tenth; totals may not add due to rounding)

	Authorization			Appropriation			
	Request	HASC	SASC	Conf.	HAC	SAC	Conf.
<b>Procurement</b>							
Aegis BMD (Line 31)	389.6	389.6	389.6		389.6		
<b>Research, development, test and evaluation (RDT&amp;E)</b>							
Next-generation Aegis missile (SM-3 IIB) (PE 0603902C, line 65)	224.1	224.1	224.1		204.1		
Aegis BMD (PE 0603892C, line 86)	992.4	992.4	992.4		992.4		
Land-based SM-3 (LBSM3) (PE0604881C, line 107)	276.3	276.3	276.3		266.3		
Aegis SM-3 IIA Co-development (PE0604881C, line 108)	420.6	420.6	420.6		420.6		
<b>Subtotal RDT&amp;E</b>	<b>1,913.4</b>	<b>1,913.4</b>	<b>1,913.4</b>		<b>1,883.4</b>		
<b>TOTAL</b>	<b>2,303.0</b>	<b>2,303.0</b>	<b>2,303.3</b>		<b>2,273.0</b>		

**Source:** For request: FY2013 budget-justification books for MDA for Research, Development, Test & Evaluation, Defense-Wide (Volume 2a) and for Procurement, Defense-Wide (Volume 2b). For HASC: H.Rept. 112-479. For SASC: S.Rept. 112-173. For HAC: H.Rept. 112-493.

**Notes:** **HASC** is House Armed Services Committee; **SASC** is Senate Armed Services Committee; **HAC** is House Appropriations Committee; **SAC** is Senate Appropriations Committee; **Conf.** is conference.

## FY2013 National Defense Authorization Act (H.R. 4310/S. 3254)

### House

**Section 222** of H.R. 4310 as reported by the House Armed Services Committee (H.Rept. 112-479 of May 11, 2012) states:

SEC. 222. DEVELOPMENT OF ADVANCED KILL VEHICLE.

Not later than 180 days after the date of the enactment of this Act, the Director of the Missile Defense Agency shall submit to the congressional defense committees a report that includes—

(1) a plan to provide that the new advanced kill vehicle on the standard missile-3 block IIB interceptor shall have the capability of being used for the ground-based midcourse defense program; and

(2) a description of the technology of and concept behind applying the former multiple kill vehicle concept to the new vehicle described in paragraph (1).

**Section 223** states:

SEC. 223. MISSILE DEFENSE SITE ON THE EAST COAST.

(a) Operational Site- The Secretary of Defense shall ensure that a covered missile defense site on the East Coast of the United States is operational by not later than December 31, 2015.

(b) Consideration of Location-

(1) STUDY- Not later than December 31, 2013, the Secretary of Defense shall conduct a study evaluating three possible locations selected by the Director of the Missile Defense Agency for a covered missile defense site on the East Coast of the United States.

(2) EIS- The Secretary shall prepare an environmental impact statement in accordance with the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) for each location evaluated under paragraph (1).

(3) LOCATION- In selecting the three possible locations for a covered missile defense site under paragraph (1), the Secretary should—

(A) take into consideration—

- (i) the strategic location of the proposed site; and
- (ii) the proximity of the proposed site to major population centers; and

(B) give priority to a proposed site that—

- (i) is operated or supported by the Department of Defense;
- (ii) lacks encroachment issues; and
- (iii) has a controlled airspace.

(c) Plan-

(1) IN GENERAL- The Director of the Missile Defense Agency shall develop a plan to deploy an appropriate missile defense interceptor for a missile defense site on the East Coast.

(2) MATTERS INCLUDED- In developing the plan under paragraph (1), the Director shall evaluate the use of—

(A) two- or three-stage ground-based interceptors; and

(B) standard missile-3 interceptors, including block IA, block IB, and for a later deployment, block IIA or block IIB interceptors.

(3) SUBMISSION- The Director shall submit to the President the plan under paragraph (1) for inclusion with the budget materials submitted to Congress under section 1105(a) of title 31, United States Code, for fiscal year 2014.

(4) FUNDING- Of the funds authorized to be appropriated by this Act or otherwise made available for fiscal year 2013 for the Missile Defense Agency, \$100,000,000 may be obligated or expended to carry out the plan developed under paragraph (1) after a period of

30 days has elapsed following the date on which the congressional defense committees receive the plan pursuant to paragraph (3).

(d) Covered Missile Defense Site- In this section, the term `covered missile defense site` means a missile defense site that uses—

- (1) ground-based interceptors; or
- (2) standard missile-3 interceptors.

**Section 226** states:

SEC. 226. DEPLOYMENT OF SM-3 IIB INTERCEPTORS ON LAND AND SEA.

(a) Sense of Congress- It is the sense of Congress that standard missile-3 block IIB interceptors should be deployable in both land-based and sea-based modes by the date on which such interceptors achieve initial operating capability.

(b) Land and Sea Modes- The Secretary of Defense shall ensure that standard missile-3 block IIB interceptors are deployable using both land-based and sea-based systems by the date on which such interceptors achieve initial operating capability.

(c) Report-

(1) FORCE STRUCTURE- Not later than 180 days after the date of the enactment of this Act, the Secretary shall submit to the congressional defense committees a report on how the deployment of standard missile-3 block IIB interceptors affects the force structure of the Navy.

(2) MATTERS INCLUDED- The report under paragraph (1) shall include the following:

(A) The implications for the force structure of the Navy if standard missile-3 block IIB interceptors cannot fit in the standard vertical launching system configuration for the Aegis ballistic missile defense system, including the implications regarding—

- (i) ship deployments;
- (ii) cost; and
- (iii) ability to respond to raids.

(B) An explanation for how standard missile-3 block IIB interceptors would be used, at initial operating capability, for the defense of the United States from threats originating in the Pacific region if such interceptors are not deployable in a sea-based mode, including an explanation of cost and force structure requirements.

**Section 230** states:

SEC. 230. LIMITATION ON AVAILABILITY OF FUNDS FOR PHASED, ADAPTIVE APPROACH TO MISSILE DEFENSE IN EUROPE.

(a) Limitation- Of the funds authorized to be appropriated by this Act or otherwise made available for fiscal year 2013 for covered missile defense activities, not more than 75 percent may be obligated or expended until—

(1) the Secretary of Defense and the Secretary of State jointly submit to the appropriate congressional committees—

(A) a report on the cost-sharing arrangements for the phased, adaptive approach to missile defense in Europe; and

(B) written certification that a proportional share, as determined by the Secretaries, of the costs for such approach to missile defense will be provided by members of the North Atlantic Treaty Organization other than the United States; and

(2) the Secretary of Defense—

(A) submits a NATO prefinancing request for consideration of expenses regarding such approach to missile defense (excluding such expenses related to military construction described in section 2403(b)); and

(B) submits to the appropriate congressional committees the response by the NATO Secretary General or the North Atlantic Council to such request.

(b) Waiver- The President may waive the limitation in subsection (a) with respect to a specific project of a covered missile defense activity if the President submits to the appropriate congressional committees and the written certification that the waiver for such project is vital to the national security interests of the United States.

(c) Definitions- In this section:

(1) The term ‘appropriate congressional committees’ means the following:

(A) The congressional defense committees.

(B) The Committee on Foreign Affairs of the House of Representatives and the Committee on Foreign Relations of the Senate.

(2) The term ‘covered missile defense activities’ means, with respect to the phased, adaptive approach to missile defense in Europe, activities regarding—

(A) Aegis ashore sites; or

(B) an AN/TPY-2 radar located in Turkey.

**Section 236** states:

SEC. 236. TRANSFER OF AEGIS WEAPON SYSTEM EQUIPMENT TO MISSILE DEFENSE AGENCY.

(a) Transfer by Navy- In accordance with section 230, the Secretary of the Navy may—

(1) transfer to the Director of the Missile Defense Agency Aegis weapon system equipment with ballistic missile defense capability for use by the Director in the Aegis ashore site in the country the Director has designated as ‘Host Nation 1’;

(2) in ensuring the shipbuilding schedules of ships affected by this section—



(A) obligate or expend unobligated funds made available for fiscal year 2012 for shipbuilding and conversion, Navy, for the DDG-51 Destroyer to deliver complete, mission-ready Aegis weapon system equipment with ballistic missile defense capability to a DDG-51 Destroyer for which funds were made available for fiscal year 2012 under shipbuilding and conversion, Navy; or

(B) use any Aegis weapon system equipment acquired using such funds to deliver complete, mission-ready Aegis weapon system equipment with ballistic missile defense capability to a DDG-51 Destroyer for which funds were made available for fiscal year 2012 under shipbuilding and conversion, Navy; and

(3) treat equipment transferred to the Secretary under subsection (b) as equipment acquired using funds made available under shipbuilding and conversion, Navy, for purposes of completing the construction and outfitting of such equipment.

(b) Transfer by MDA- In accordance with section 230, upon the receipt of any equipment under subsection (a), the Director of the Missile Defense Agency shall transfer to the Secretary of the Navy Aegis weapon system equipment with ballistic missile defense capability procured by the Director for installation in a shore-based Aegis weapon system for use by the Secretary in the DDG-51 Destroyer program.

Regarding Section 222, H.Rept. 112-479 states:

#### Section 222—Development of Advanced Kill Vehicle

The section would require that the Director, Missile Defense Agency submit a plan within 180 days after the date of the enactment of the Act to ensure that the kill vehicle for the Next Generation Aegis Missile can be adapted to also serve as an improved kill vehicle for the Ground-based Midcourse Defense System. The committee also believes that for this purpose, the Director should provide a description of the technology of and concept behind applying the former Multiple Kill Vehicle proposal to the Next Generation Kill Vehicle, which was terminated in the budget request for fiscal year 2010.

The committee believes this plan is consistent with the recommendation of the National Academies' Assessment of Concepts and Systems for U.S. Boost-Phase Missile Defense in Comparison to Other Alternatives, which was conducted pursuant to the Duncan Hunter National Defense Authorization Act for Fiscal Year 2009 (P.L. 110-417). (Page 109)

Regarding Section 223, the report states:

#### Section 223—Missile Defense Site on the East Coast

This section would require the Secretary of Defense to conduct an environmental impact statement by December 31, 2013, on possible locations on the East Coast of the United States for the deployment of a missile defense site.

This section would also require the Director, Missile Defense Agency to develop a plan for the deployment of an East Coast site to be operational not later than the end of 2015; the plan would evaluate the use of two-stage and three-stage ground-based interceptors, as well as the SM-3 block IA, block IB, and later blocks of the SM-3 missile. This section would require the plan to be included in the fiscal year 2014 budget submission, but it would also authorize \$100.0 million in PE 63882C in fiscal year 2013 to be available 30 days after the plan is presented to the congressional defense committees.

The section would also add criteria for the selection of the location of the missile defense site on the East Coast of the United States.

The committee is aware that a cost effective missile defense site located on the East Coast of the United States could have advantages for the defense of the United States from ballistic missiles launched from the Middle East. The committee is also aware that several reviews, including studies by the Commander, U.S. Northern Command in 2007–08 (which do not reflect current command recommendations in view of the 2010 Ballistic Missile Defense Review), the Institute for Defense Analyses, and the National Academies have all examined the potential contribution of an East Coast missile defense site, and certain of these studies have recommended that work begin on the development and deployment of such a site. The committee encourages the Department to provide to the defense committees an interim analysis on feasibility and cost no later than February 1, 2013. (Pages 109-110)

Regarding Section 226, the report states:

Section 226—Deployment of SM–3 IIB Interceptors on Land and Sea

This section would express the sense of the Congress that the Standard Missile 3 (SM–3) IIB missile defense interceptors should be deployed at initial deployment, currently planned for 2020, in a land-based and sea-based mode. This provision would also require the Secretary of Defense to provide a report within 180 days after the date of the enactment of this Act on the implications for the force structure of the Navy if the SM–3 IIB cannot fit in the standard Vertical Launching System configuration for the Aegis BMD system, including the effect on Navy ship deployments, cost, and overall magazine depth to respond to missile raids. This section would also require that the report include an explanation if the interceptors cannot be deployed in a sea-based mode at initial deployment, including cost and force structure requirements, related to the use of the IIB missile for the defense of the United States from threats originating in the Pacific region. (Pages 110-111)

Regarding Section 230, the report states:

Section 230—Limitation on Availability of Funds for Phased, Adaptive Approach to Missile Defense in Europe

This section would require the Secretary of Defense and the Secretary of State to jointly submit a plan to the congressional defense committees on cost-sharing with the North Atlantic Treaty Organization (NATO) the expenses of the fixed European Phased Adaptive Approach (EPAA) assets, including the Aegis Ashore sites and the forward-deployed AN/TPY–2 radar. The committee believes other expenses should also be included, though it notes it has not received a complete explanation from the Department of all of the U.S. capabilities that will be available to support the EPAA. This section would also require the Secretary of Defense to submit a NATO pre-financing request for the expenses of this missile defense equipment, as is required for EPAA military construction expenses elsewhere in this bill. This section would limit the obligation or expenditure of 25 percent of the costs of the specified EPAA expenses for missile defense equipment until NATO responds to the U.S. pre-financing request. Mindful of the highly ambitious timelines for deployment of the EPAA and the rising long-range missile threat from the Islamic Republic of Iran, this section would provide the President a waiver if he determines the use of that authority is vital to the national security of the United States.

The committee is aware that the Administration decided that the European Phased Adaptive Approach to missile defense should be a U.S. contribution to NATO as announced at the Lisbon Summit in November 2010. The committee is concerned that when this commitment was made, there was no clear understanding of the cost of the EPAA deployment; the

committee notes that there has not yet been a detailed assessment of the cost of the deployment. The committee understands that the Cost Assessment and Program Evaluation office in the Office of the Secretary of Defense is now attempting to provide a comprehensive and detailed cost estimate for the EPAA. The committee notes that in a letter in February of this year, Acting Under Secretary of Defense, stated that a briefing on the interim findings of the cost estimate would be provided in March of this year to support the committee's oversight activities; that briefing was not provided.

The committee is aware that some of the command and control arrangements are being sorted out now in anticipation of the NATO summit in May of 2012 in Chicago. As noted elsewhere in this report, the committee expects to be briefed on these arrangements, which should assist the committee in better understanding the extent to which the EPAA is providing for the missile defense of Europe and the missile defense of the United States and its interests, including its deployed forces. Such understanding is key to the appropriate cost-sharing of the EPAA.

The committee also notes significant budget challenges to the United States missile defense program in view of the budget cuts under the Budget Control Act (P.L. 112-25) and the President's budget requests since his fiscal year 2010 budget request. The committee is aware that the budget request for the Missile Defense Agency for fiscal year 2013 is approximately \$400.0 million less than the request for fiscal year 2012, and the projected requests between fiscal year 2013–16 are approximately \$3.6 billion less in the fiscal year 2013 Future Years Defense Program (FYDP) than they were in the fiscal year 2012 FYDP.

The committee notes that such reductions have had an impact on the budgets for the national missile defense programs, including the ground-based midcourse defense program, the sea-based X-band radar system, and forward deployed AN/TPY-2 radars, which can have significant capability for homeland and regional missile defense. The committee also notes significant reductions in systems like the Terminal High Altitude Area Defense system. The committee notes, however, that plans for the EPAA remain unchanged and, in many cases, the budget requests have been increased by the fiscal year 2013 budget request and FYDP. The committee recommends NATO provide financial support for the U.S. contribution to Europe's missile defense given the budget environment. (Pages 112-113)

Regarding Section 236, the report states:

*Section 236—Transfer of Aegis Weapon System Equipment to Missile Defense Agency*

This section would authorize the Secretary of the Navy, in accordance with section 230 of this Act, to transfer to the Director of the Missile Defense Agency, Aegis weapon system equipment for use in the Aegis Ashore Site in Romania, with certain authorities to preserve shipbuilding schedules. The Director of the Missile Defense Agency would be authorized to transfer Aegis weapon system equipment for installation in a shore-based Aegis weapon system to the Secretary of the Navy for use in the DDG-51 Destroyer program. (Page 116)

The report also states:

*Aegis Ashore Program*

The budget request contained \$276.3 million in PE 64880C for the Land Based SM-3 or "Aegis Ashore" concept.

The committee notes that the 2010 Ballistic Missile Defense Review (BMDR) generated a requirement by the Administration to provide an Aegis capability ashore as a key component

of the European Phased Adaptive Approach (EPAA). The committee further notes that two stalwart allies, Romania and Poland, have enthusiastically responded to United States plans to host an Aegis Ashore site in their countries.

The committee notes, in another section of this report, concerns expressed by the Government Accountability Office on the high concurrency and technological risk forced by the timeline for deployment of the Aegis Ashore system.

The committee recommends \$276.3 million, the full amount requested, in PE 64880C for the Land Based SM-3 or “Aegis Ashore” concept.

*Aegis Ballistic Missile Defense Combat System*

The budget request contained \$260.60 million in PE 64307N for the Surface Combatant Combat Systems Engineering for the Aegis Ballistic Missile Defense (BMD) Weapons System.

The committee notes that the Aegis BMD Weapons System is the world’s premier proven naval defense system and the sea-based element of the U.S. Ballistic Missile Defense System. Aegis BMD plays an active role in protecting U.S. deployed forces and allies from enemy ballistic missile attack. The committee further notes that the Aegis BMD system has been included in the Administration’s European Phased Adaptive Approach to missile defense and has undergone extensive and successful missile defense testing.

The committee recommends \$260.6 million, the full amount requested, in PE 64307N for the Surface Combatant Combat Systems Engineering for the Aegis Ballistic Missile Defense (BMD) Weapons System.

*Aegis Ballistic Missile Defense*

The budget request contained \$992.2 million in PE 63892C for the Aegis Ballistic Missile Defense (BMD) system.

The committee also supports the initiation of a Service Life Extension Program (SLEP) by the Director of the Missile Defense Agency, which could result in a significant increase in the service life of the SM-3 IA interceptor and the retention of as many as 41 IA interceptors in the inventory by the end of 2017 that would have otherwise been transitioned out of the fleet. The committee is aware combatant commander interest in ensuring the largest possible inventory of Aegis BMD interceptors.

The committee recommends \$992.2 million, the full amount requested, in PE 63892C for the BMD system. (Pages 77-78)

The report also states:

*Concerns Related to High Concurrency and Technical Risk Associated with the EPAA*

The committee is aware that each year, the Government Accountability Office (GAO) prepares a report for the congressional defense committees on the missile defense programs of the United States pursuant to a mandate in the national defense authorization acts since 2002.

The committee was pleased to see in the report prepared for fiscal year 2011 that the GAO found that MDA has achieved successes in areas like the delivery and performance of its targets, which has been a concern in the past.

The committee is, however, concerned by GAO's findings in its draft fiscal year 2012 report that "during 2011, the Ground-Based Midcourse Defense (GMD) system, the Aegis Standard Missile 3 Block IB, and the Terminal High Altitude Area Defense experienced significant ill effects from concurrency."

For nearly every missile defense program the GAO found high levels of concurrency, which is defined as "the overlap between technology development or between product development and production." GAO found that the discovery of a design problem in the ground-based midcourse defense (GMD) interceptors, mod CE2, while production was under way increased costs, may require retrofit of fielded equipment, and delayed delivery of those interceptors. As a result, flight and other test-related costs to confirm capability have increased from \$236 million to about \$1 billion; the committee notes these costs involve four flight tests of the CE2 equipped interceptor.

GAO also noted concurrency problems with regard to the many systems and programs that relate to the European Phased Adaptive Approach (EPAA) to deploy missile defense in Europe: specifically the Aegis Ashore system, and potential implications for the Romania Aegis Ashore deployment to Romanian civil systems; the Precision Tracking Space System; and the SM-3 IB, IIA, and IIB missiles.

The committee notes that concurrency has affected many areas of the missile defense system and no system appears to have been spared that concurrency, including the GMD system. Regarding GMD, the committee is aware of the compressed timelines to deploy missile defenses when the United States withdrew from the Anti-ballistic Missile Treaty in 2002. In that circumstance, the United States had no homeland missile defense and raced to deploy it to defend the homeland.

In the case of other systems, such as the EPAA's SM-3 IIB, the committee notes that the GAO has stated that "the need to meet the presidential directive to field the SM-3 Block IIB by the 2020 timeframe for European PAA Phase IV is a key driver for the high levels of concurrency." The committee encourages MDA to learn from these past mistakes.

The committee directs the Missile Defense Executive Board (MDEB) to report to the congressional defense committees not later than September 15, 2012, on its plans to address the risks noted by the GAO in its April 2012 draft report; this report should include an evaluation of mitigations and their costs that may be necessary if the risks highlighted by GAO are not resolved on a schedule consistent with the timelines articulated in the Ballistic Missile Defense Review of 2010 concerning the EPAA's four-phased deployment and consistent with the plan to update and field additional GMD systems.

The committee further notes that the OSD Cost Assessment and Program Evaluation office is currently working to develop a comprehensive cost of the EPAA. The Committee expects the final cost projection to be provided not later than the MDEB report required by this section. (Pages 82-83)

The report also states:

*Report by Secretary of Defense on SM-3 IIB Missile*

The committee believes the SM-3 IIB interceptor that is being developed by the Missile Defense Agency, should be capable of providing missile defense coverage to the continental United States from locations in Europe.

The Committee directs the Secretary to report within 90 days on how the SM-3 IIB interceptor in design and development will provide missile defense coverage to the continental United States from locations in Europe. Such report shall be unclassified, with a classified annex as necessary. (Page 100)

The report also states:

*Report on U.S. European Phased Adaptive Approach Spending and U.S. Export Controls*

The committee is concerned that U.S. funds may have been expended in a contract with a firm currently under investigation for violation of the U.S. International Trafficking in Arms Regulations. Therefore, the committee directs the Secretary of Defense to provide a report to the congressional defense committees by August 1, 2012, on whether any U.S. Department of Defense funds have been used, directly or indirectly, to obtain missile defense command and control systems from a contractor that is under investigation, per the most recent Blue Lantern report, for violation of U.S. International Trafficking in Arms Regulations. If U.S. funds were expended in a contract involving an entity currently under investigation for violating U.S. export control laws, the Secretary is directed to include in the report an explanation of why that company was allowed to receive such U.S. funds and when the U.S. funds were provided to the contractor that is under investigation. (Page 102)

The report also states:

*SM-3 IB Missile*

The committee is concerned by the recent failure of the SM-3 IB missile's first test, which the committee approved \$565 million in procurement funding last year to procure 42 interceptors. The committee notes that the Missile Defense Agency (MDA) has planned three more flight tests in fiscal year 2012 to prove out the SM-3 IB missile, along with two additional flight tests in fiscal year 2013 prior to authorization to begin procurement activities.

The committee is very supportive of the more capable IB interceptor being available for the ballistic missile defense system upon the completion of appropriate testing. The committee is aware that the IB missile is a necessary component of the European Phased Adaptive Approach to missile defense, specifically phase II, and that other combatant commanders are planning to have this interceptor available for their missile defense requirements.

The committee is also aware that as the MDA is attempting to resolve problems with the IB, it is also attempting to complete development of the IIA missile and review design proposals of the IIB missile. The committee urges MDA to ensure adequate focus to the sequence of these development efforts, especially in a time of constrained budgets.

*SM-3 IIA Development*

The budget request contained \$399.3 million in PE 64881C for the SM-3 Block IIA co-development program.

The committee notes that the President's budget request is intended to maintain the U.S. commitment with Japan to meet the planned 2018 Initial Operating Capability (IOC) and the

deployment of Phase III of the European Phased Adaptive Approach to missile defense. The committee understands that procurement will commence in fiscal year 2017 with 12 rounds.

The committee recommends \$399.3 million, the full amount requested, in PE 64881 for the SM-3 Block IIA co-development program.

#### *SM-3 IIB Missile*

The budget request contained \$212.7 million in PE 63902C for the Standard Missile 3 (SM-3) IIB missile defense interceptor, and \$1913.3 million over the course of the Future Years Defense Plan (FYDP) for fiscal years 2013–2017. The committee supports the request for fiscal year 2013.

The committee notes that the Government Accountability Office expressed several concerns about the SM-3 IIB missile development path in its annual report on missile defense acquisition; the committee addresses these concerns in another section of this report.

The committee is aware that the Defense Science Board and the National Academies have all noted the technical challenges with the IIB missile in terms of how it will, or will not, be able to perform the mission for which it is intended. The committee is aware that one recent report has recommended the termination of Phase IV of the European Phased Adaptive Approach, which would include the deployment of the SM-3 IIB and the Precision Tracking Space System. The committee is not ready to support that recommendation at this time. The committee is however deeply concerned about the \$1.9 billion dollars programmed for the IIB missile in the FYDP. The committee considers that such investment may not be justified if the interceptor concept ultimately selected in fiscal year 2012 is only modestly more capable than the IIA missile. (Pages 103-104)

The report also states:

#### Report on Command and Control Arrangements of the European Phased Adaptive Approach and NATO Ballistic Missile Defense Systems

The committee is aware that the European Phased Adaptive Approach (EPAA), which is a U.S. contribution to the North Atlantic Treaty Organization (NATO), will at times be under the command of the Commander, U.S. European Command (EUCOM), and at times be under the command of NATO. The committee is concerned that it is not yet clear as to how this command structure will work in practice. The concern is amplified by the committee's understanding that the NATO system, of which the EPAA is an element, will be declared to have achieved interim operating capability at the May 2012 Chicago Summit.

Therefore, the committee directs the Secretary of Defense to provide a briefing to the congressional defense committees by July 15, 2012, specifying the command and control arrangements for U.S. missile defense systems deployed in Europe when under U.S. command and under NATO command. The plan should focus on who will maintain fire control authority, when such authority will change hands between EUCOM and NATO, and what the concept of operations will be for the defense of Europe, including priority of defense of U.S. deployed forces and NATO territory using available missile defense interceptor inventory. (Page 225)

## **Senate**

**Section 126** of S. 3254 as reported by the Senate Armed Services Committee (S.Rept. 112-173 of June 4, 2012) states:

SEC. 126. AUTHORITY FOR RELOCATION OF CERTAIN AEGIS WEAPON SYSTEM ASSETS BETWEEN AND WITHIN THE DDG-51 CLASS DESTROYER AND AEGIS ASHORE PROGRAMS IN ORDER TO MEET MISSION REQUIREMENTS.

(a) Authority-

(1) TRANSFER TO AEGIS ASHORE SYSTEM- Notwithstanding any other provision of law, the Secretary of the Navy may transfer AEGIS Weapon System (AWS) equipment with ballistic missile defense (BMD) capability to the Missile Defense Agency for use in the AEGIS Ashore System of the Agency for installation in the country designated as Host Nation #1 (HN-1) by transferring to the Agency such equipment procured with amounts authorized to be appropriated to the SCN account for fiscal years 2010 and 2011 for the DDG-51 Class Destroyer Program.

(2) ADJUSTMENTS IN EQUIPMENT DELIVERIES-

(A) USE OF FY12 FUNDS FOR AWS SYSTEMS ON DESTROYERS PROCURED WITH FY11 FUNDS- Amounts authorized to be appropriated to the SCN account for fiscal year 2012, and any AEGIS Weapon System assets procured with such amounts, may be used to deliver complete, mission-ready AEGIS Weapon Systems with ballistic missile defense capability to any DDG-51 class destroyer for which amounts were authorized to be appropriated for the SCN account for fiscal year 2011.

(B) USE OF AWS SYSTEMS PROCURED WITH RDTE FUNDS ON DESTROYERS- The Secretary may install on any DDG-51 class destroyer AEGIS weapon systems with ballistic missile defense capability transferred pursuant to paragraph (3).

(3) TRANSFER FROM AEGIS ASHORE SYSTEM- The Director of the Missile Defense Agency shall transfer AEGIS Weapon System equipment with ballistic missile defense capability procured for installation in the AEGIS Ashore System to the Department of the Navy for the DDG-51 Class Destroyer Program to replace any equipment transferred to Agency under paragraph (1).

(4) TREATMENT OF TRANSFER IN FUNDING DESTROYER CONSTRUCTION- Notwithstanding the source of funds for any equipment transferred under paragraph (3), the Secretary shall fund all work necessary to complete construction and outfitting of any destroyer in which such equipment is installed in the same manner as if such equipment had been acquired using amounts in the SCN account.

(5) SCN ACCOUNT DEFINED- In this subsection, the term 'SCN account' means the Shipbuilding and Conversion, Navy account.

(b) Relationship to Other Law- Nothing in this section shall be construed to repeal or otherwise modify in any way the limitation on obligation or expenditure of funds for missile defense interceptors in Europe as specified in section 223 of the Ike Skelton National Defense Authorization Act for Fiscal Year 2011 P.L. 111-383; 124 Stat. 4168).

**Section 231** states:

SEC. 231. HOMELAND BALLISTIC MISSILE DEFENSE.

(a) Findings- Congress makes the following findings:



(1) The Ballistic Missile Defense Review of February 2010 stated as its first policy priority that 'the United States will continue to defend the homeland against the threat of limited ballistic missile attack' and that 'an essential element of the United States' homeland ballistic missile defense strategy is to hedge against future uncertainties, including both the uncertainty of future threat capabilities and the technical risks inherent to our own development plans'.

(2) The United States currently has an operational Ground-based Midcourse Defense (GMD) system with 30 Ground-Based Interceptors (GBIs) deployed in Alaska and California, protecting the United States against the potential future threat of limited ballistic missile attack from countries such as North Korea and Iran.

(3) As Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy Bradley Roberts testified before the Committee on Armed Services of the Senate on April 25, 2012, '[w]ith 30 GBIs in place, the United States is in an advantageous position vis-a-vis the threats from North Korea and Iran,' and 'neither has successfully tested an ICBM or demonstrated an ICBM-class warhead'.

(4) Deputy Assistant Secretary Roberts testified that maintaining this advantageous position 'requires continued improvement to the GMD system, including enhanced performance by the GBIs and the deployment of new sensors. It also requires the development of the Precision Tracking Space System (PTSS) to handle larger raid sizes and the Standard Missile-3 (SM-3) Block IIB as the ICBM threat from states like Iran and North Korea matures. These efforts will help to ensure that the United States possesses the capability to counter the projected threat for the foreseeable future'.

(5) As its highest priority, the Missile Defense Agency is designing a correction to the problem that caused a December 2010 flight test failure of the Ground-based Midcourse Defense system using the Capability Enhancement II (CE-II) model of exo-atmospheric kill vehicle, and plans to demonstrate the correction in two flight tests before resuming production or assembly of additional Capability Enhancement II kill vehicles.

(6) The Department of Defense has a program to improve the performance and reliability of the Ground-based Midcourse Defense system, including a plan to test every component of the Ground-Based Interceptors for reliability. According to Department of Defense officials, the goal of the Ground-Based Interceptor reliability program is to double the number of threat Intercontinental Ballistic Missiles (ICBMs) that our current inventory of Ground-Based Interceptors could defeat, thereby effectively doubling the capability of our current Ground-based Midcourse Defense system.

(7) The Missile Defense Agency, working with the Director of Operational Test and Evaluation and with United States Strategic Command, has developed a comprehensive Integrated Master Test Plan (IMTP) for missile defense, with flight tests for the Ground-based Midcourse Defense system planned through fiscal year 2022, including salvo testing, multiple simultaneous engagement testing, and operational testing.

(8) The Director of Operational Test and Evaluation, who must review, approve, and sign each semi-annual version of the Integrated Master Test Plan, testified that the Test Plan is 'a robust and rigorous test plan'. He also testified that the current pace of Ground-based Midcourse Defense system testing of one flight test per year is the 'best that we've been able to achieve over a decade'.

(9) The Director of the Missile Defense Agency testified before the Committee on Armed Services of the Senate on April 25, 2012, that flight testing the Ground-based Midcourse

Defense system more often than once per year could cause 'greater risk of further failure and setbacks to developing our homeland defense capability as rapidly as possible'.

(10) As part of its homeland defense hedging strategy, the Department of Defense has already decided upon or implemented a number of actions to improve the missile defense posture of the United States in case the threat of Intercontinental Ballistic Missiles from North Korea or Iran emerges sooner or in greater numbers than anticipated. These include the following actions:

(A) The Missile Defense Agency has completed construction of Missile Field-2 at Fort Greely, Alaska, with eight extra silos available to deploy additional operational Ground-Based Interceptors, if needed.

(B) With its request for 5 additional Ground-Based Interceptors in the budget of the President for fiscal year 2013, the Missile Defense Agency plans to have enough test and spare Ground-Based Interceptors to emplace in the 8 extra silos from 2014 through 2025, and will keep the Ground-Based Interceptor production line active for 5 additional years, thus allowing additional Ground-Based Interceptor purchases in the future, if needed.

(C) The Department has decided not to decommission prototype Missile Field-1 at Fort Greely but, instead, to keep it in a storage status that would permit it to be refurbished and reactivated within a few years if future threat developments make that necessary.

(D) The Missile Defense Agency plans to build an in-flight interceptor communications terminal at Fort Drum, New York, to enhance the performance of Ground-Based Interceptors defending the eastern United States against possible future missile threats from Iran.

(E) The Missile Defense Agency is continuing the development and testing of the two-stage Ground-Based Interceptor for possible deployment in the future, if needed.

(F) The Missile Defense Agency is upgrading early warning radars in Clear, Alaska, and Cape Cod, Massachusetts, to enhance the ability to defend against potential multiple future Intercontinental Ballistic Missile threats from North Korea and Iran.

(G) The Missile Defense Agency is pursuing development of the Standard Missile-3 Block IIB interceptor for Phase 4 of the European Phased Adaptive Approach. It is intended to augment the Ground-based Midcourse Defense system as a cost-effective first layer of defense of the homeland against a possible future Intercontinental Ballistic Missile threat from Iran.

(H) The Missile Defense Agency is pursuing development of the Precision Tracking Space System, a satellite sensor system to provide persistent tracking of large numbers of missiles in flight, and fire-control quality targeting data to various missile defense interceptor systems. According to the Director of the Missile Defense Agency, 'the greatest future enhancement for both homeland and regional defense in the next ten years is the development of the Precision Tracking Space System satellites'.

(11) As part of its homeland defense hedging strategy review, the Department of Defense is considering other options to enhance the future United States posture to defend the homeland, including the feasibility, advisability and affordability of deploying additional Ground-Based Interceptors, either in Alaska or at a missile defense site on the East Coast of the United States.

(b) Sense of Congress- It is the sense of Congress that—

(1) it is a national priority to defend the homeland against the potential future threat of limited ballistic missile attack from countries such as North Korea and Iran;

(2) the currently deployed Ground-based Midcourse Defense system, with 30 Ground-Based Interceptors deployed in Alaska and California, provides protection of the United States homeland against the potential future threat of limited ballistic missile attack from North Korea and Iran;

(3) it is essential for the Ground-based Midcourse Defense system to achieve the levels of reliability, availability, sustainability, and operational performance that will allow it to continue providing protection of the United States homeland against limited ballistic missile attack;

(4) the Missile Defense Agency should, as its highest priority, correct the problem that caused the December 2010 Ground-based Midcourse Defense system flight test failure and demonstrate the correction in flight tests before resuming production of the Capability Enhancement-II kill vehicle, in order to provide confidence that the system will work as intended;

(5) the Department of Defense should continue to enhance the performance and reliability of the Ground-based Midcourse Defense system, and enhance the capability of the Ballistic Missile Defense System, to provide improved capability to defend the homeland against possible increased future missile threats from North Korea and Iran;

(6) the Missile Defense Agency should continue its robust, rigorous, and realistic testing of the Ground-based Midcourse Defense system at a pace of one flight test per year, as described in the Integrated Master Test Plan, including salvo testing, multiple simultaneous engagement testing, and operational testing;

(7) if successfully developed, the Standard Missile-3 Block IIB interceptor would provide an essential first layer of defense of the homeland against an emerging Intercontinental Ballistic Missile threat from Iran, using a cost-effective forward-based early intercept system that could permit holding Ground-Based Interceptors in reserve, and if such interceptor could be deployed on ships, it would also provide a significant enhancement to defense against possible future threats from North Korea;

(8) the Precision Tracking Space System has the potential to improve dramatically the capability of homeland and regional missile defense systems against large numbers of missiles launched simultaneously, and should remain a high priority for development;

(9) the Department of Defense has taken a number of prudent, affordable, cost-effective, and operationally significant steps to hedge against the possibility of future growth in the missile threat to the homeland from North Korea and Iran; and

(10) the Department of Defense should continue to evaluate the evolution of the long-range missile threat from North Korea and Iran and consider other possibilities for prudent, affordable, cost-effective, and operationally significant steps to improve the posture of the United States to defend the homeland against possible future growth in the threat.

(c) Report-

(1) REPORT REQUIRED- Not later than 180 days after the date of the enactment of this Act, the Secretary of Defense shall submit to the congressional defense committees a report on the status of efforts to improve the homeland ballistic missile defense capability of the United States.

(2) ELEMENTS OF REPORT- The report required by paragraph (1)) shall include the following:

(A) A detailed description of the actions taken or planned to improve the reliability, availability, and capability of the Ground-based Midcourse Defense system.

(B) A description of any improvements achieved as a result of the actions described in subparagraph (A).

(C) A description of the results of the two planned flight tests of the Ground-based Midcourse Defense system (Control Test Vehicle flight test-1, and GMD Flight Test-06b) intended to demonstrate the success of the correction of the problem that caused the flight test failure of December 2010, and the status of any decision to resume production of the Capability Enhancement-II kill vehicle.

(D) A detailed description of actions taken or planned to improve the homeland defense posture of the United States to hedge against potential future Intercontinental Ballistic Missile threat growth from North Korea and Iran.

(E) Any other matters the Secretary considers appropriate.

(3) FORM OF REPORT- The report shall be submitted in unclassified form, but may include a classified annex.

**Section 232** states:

SEC. 232. REGIONAL BALLISTIC MISSILE DEFENSE.

(a) Findings- Congress makes the following findings:

(1) In the introduction to the Ballistic Missile Defense Review of February 2010, Secretary of Defense Robert Gates states that 'I have made defending against near-term regional threats a top priority of our missile defense plans, programs and capabilities'.

(2) In describing the threat of regional ballistic missiles, the report of the Ballistic Missile Defense Review states that 'there is no uncertainty about the existence of regional threats. They are clear and present. The threat from short-range, medium-range, and intermediate-range ballistic missiles (SRBMs, MRBMs, and IRBMs) in regions where the United States deploys forces and maintains security relationships is growing at a particularly rapid pace'.

(3) In testimony before the Committee on Armed Services of the Senate on April 25, 2012, Dr. Bradley Roberts, Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy stated, with respect to regional missile defense, that 'the need arises from the rapidly emerging threats to our armed forces in Europe, the Middle East, and East Asia from regional missile proliferators and the basic challenge such proliferation poses to the safety and security of our forces and allies and to our power projection strategy'.

(4) Iran has the largest inventory of regional ballistic missiles in the Middle East, with hundreds of missiles that can reach southeastern Europe and all of the Middle East, including Israel. Iran is improving its existing missiles and developing new and longer-range missiles.

(5) North Korea has a large and growing inventory of short-range and medium-range ballistic missiles that can reach United States forces and allies in South Korea and Japan. North Korea is improving its existing missiles and developing new and longer-range missiles.

(6) In September 2009, President Barack Obama announced that he had accepted the unanimous recommendation of the Secretary of Defense and the Joint Chiefs of Staff to establish a European Phased Adaptive Approach to missile defense, designed to protect deployed United States forces and allies and partners in Europe against the large and growing threat of ballistic missiles from Iran.

(7) In November 2010, at the Lisbon Summit, the North Atlantic Treaty Organization (NATO) decided to adopt the core mission of missile defense of its population, territory and forces. The North Atlantic Treaty Organization agreed to enhance its missile defense command and control system, the Active Layered Theater Ballistic Missile Defense, to provide a North Atlantic Treaty Organization command and control capability. This is in addition to contributions of missile defense capability from individual nations.

(8) During 2011, the United States successfully implemented Phase 1 of the European Phased Adaptive Approach, including deployment of an AN/TPY-2 radar in Turkey, deployment of an Aegis Ballistic Missile Defense ship in the eastern Mediterranean Sea with Standard Missile-3 Block IA interceptors, and establishment of a missile defense command and control system in Germany.

(9) During 2011, the United States successfully negotiated all the international agreements with North Atlantic Treaty Organization allies needed to permit future phases of the European Phased Adaptive Approach, including agreements with Romania and Poland to permit the deployment of Aegis Ashore missile defense systems on their territory, an agreement with Turkey to permit deployment of an AN/TPY-2 radar on its territory, and an agreement with Spain to permit the forward stationing of four Aegis Ballistic Missile Defense ships at Rota.

(10) Phase 2 of the European Phased Adaptive Approach is planned for deployment in 2015, and is planned to include the deployment of Standard Missile-3 Block IB interceptors on Aegis Ballistic Missile Defense ships and at an Aegis Ashore site in Romania.

(11) Phase 3 of the European Phased Adaptive Approach is planned for deployment in 2018, and is planned to include the deployment of Standard Missile-3 Block IIA interceptors on Aegis Ballistic Missile Defense ships and at an Aegis Ashore site in Poland.

(12) Phase 4 of the European Phased Adaptive Approach is planned for deployment in 2020, and is planned to include the deployment of Standard Missile-3 Block IIB interceptors at Aegis Ashore sites. This interceptor is intended to protect both Europe and the United States against potential future long-range ballistic missiles from Iran.

(13) At the North Atlantic Treaty Organization Summit in Chicago in 2012, the North Atlantic Treaty Organization plans to announce it has achieved an 'interim capability' for the North Atlantic Treaty Organization missile defense system, including initial capability of its Active Layered Theater Ballistic Missile Defense system at a command and control facility in Germany.

(14) The United States has a robust program of missile defense cooperation with Israel, including joint development of the Arrow Weapon System and the new Arrow-3 upper tier interceptor, designed to defend Israel against ballistic missiles from Iran. These jointly developed missile defense systems are designed to be interoperable with United States ballistic missile defenses, and these interoperable systems are tested in large military exercises. The United States has deployed an AN/TPY-2 radar in Israel to enhance missile defense against missiles from Iran.

(15) The United States is working with the nations of the Gulf Cooperation Council on enhanced national and regional missile defense capabilities against growing missile threats from Iran. As part of this effort, the United Arab Emirates plans to purchase two batteries of the Terminal High Altitude Air Defense (THAAD) system, as well as other equipment.

(16) The United States has a strong program of missile defense cooperation with Japan, including the co-development of the Standard Missile-3 (SM-3) Block IIA interceptor for the Aegis Ballistic Missile Defense system, intended to be deployed by Japan and in Phase 3 of the European Phased Adaptive Approach, Japan's fleet of Aegis Ballistic Missile Defense ships using the SM-3 Block IA interceptors, and the United States deployment of an AN/TPY-2 radar in Japan.

(b) Sense of Congress- It is the sense of Congress that—

(1) the threat from regional ballistic missiles, particularly from Iran and North Korea, is serious and growing, and puts at risk forward-deployed United States forces and allies and partners in Europe, the Middle East, and the Asia-Pacific region;

(2) the Department of Defense has an obligation to provide force protection of forward-deployed United States forces, assets, and facilities from regional ballistic missile attack;

(3) the United States has an obligation to meet its security commitments to its allies, including ballistic missile defense commitments;

(4) the Department of Defense has a balanced program of investment and capabilities to provide for both homeland defense and regional defense against ballistic missiles, consistent with the Ballistic Missile Defense Review and with the prioritized and integrated needs of the commanders of the combatant commands;

(5) the European Phased Adaptive Approach to missile defense is an appropriate and necessary response to the existing and growing ballistic missile threat from Iran to forward deployed United States forces and allies and partners in Europe;

(6) the Department of Defense—

(A) should, as a high priority, continue to develop, test, and plan to deploy all four phases of the European Phased Adaptive Approach, including all variants of the Standard Missile-3 interceptor; and

(B) should also continue with its other phased and adaptive regional missile defense efforts tailored to the Middle East and the Asia-Pacific region;

(7) European members of the North Atlantic Treaty Organization are making valuable contributions to missile defense in Europe, by hosting elements of United States missile defense systems on their territories, through individual national contributions to missile defense capability, and by collective funding and development of the Active Layered Theater Ballistic Missile Defense system; and

(8) the Department of Defense should continue with the development of the key enablers of enhanced regional missile defense, including the Precision Tracking Space System.

(c) Report-

(1) IN GENERAL- Not later than 180 days after the date of enactment of this Act, the Secretary of Defense shall submit to the congressional defense committees a report describing the status and progress of regional missile defense programs and efforts.

(2) ELEMENTS OF REPORT- The report required by paragraph (1) shall include the following:

(A) An assessment of the adequacy of the existing and planned European Phased Adaptive Approach to provide force protection for forward deployed United States forces in Europe against ballistic missile threats from Iran, and an assessment whether adequate force protection would be available absent the European Phased Adaptive Approach.

(B) An assessment whether the European Phased Adaptive Approach and other planned regional missile defense approaches of the United States meet the integrated priorities of the commanders of the regional combatant commands in an affordable and balanced manner.

(C) A description of the progress made in the development and testing of elements of systems intended for deployment in Phases 2 through 4 of the European Phased Adaptive Approach, including the Standard Missile-3 Block IB interceptor and the Aegis Ashore system.

(D) A description of the manner in which elements of regional missile defense architectures, such as forward-based X-band radars in Turkey and Japan, contribute to the enhancement of homeland defense of the United States.

(E) A description of the current and planned contributions of North Atlantic Treaty Organization allies, both collectively and individually, to missile defense in Europe.

(3) FORM- The report required by paragraph (1) shall be submitted in unclassified form, but may include a classified annex.

**Section 234** states:

SEC. 234. NEXT GENERATION EXO-ATMOSPHERIC KILL VEHICLE.

(a) Plan for Next Generation Kill Vehicle- The Director of the Missile Defense Agency shall develop a long-term plan for the Exo-atmospheric Kill Vehicle (EKV) that addresses both modifications and enhancements to the current Exo-atmospheric Kill Vehicle and options for the competitive development of a next generation Exo-atmospheric Kill Vehicle for the Ground-Based Interceptor (GBI) of the Ground-based Midcourse Defense (GMD) system and any other interceptor that might be developed for the defense of the United States against long-range ballistic missiles.

(b) Definition of Parameters and Capabilities-

(1) ASSESSMENT REQUIRED- The Director shall define the desired technical parameters and performance capabilities for a next generation Exo-atmospheric Kill Vehicle using an assessment conducted by the Director for that purpose that is designed to ensure that a next generation Exo-atmospheric Kill Vehicle design—

(A) enables ease of manufacturing, high tolerances to production processes and supply chain variability, and inherent reliability;

(B) will be optimized to take advantage of the Ballistic Missile Defense System architecture and sensor system capabilities;

(C) leverages all relevant kill vehicle development activities and technologies, including from the current Standard Missile-3 Block IIB (SM-3 IIB) program and the previous Multiple Kill Vehicle technology development program;

(D) seeks to maximize, to the greatest extent practicable, commonality between subsystems of a next generation Exo-atmospheric Kill Vehicle and other exo-atmospheric kill vehicle programs; and

(E) meets Department of Defense criteria, as established in the February 2010 Ballistic Missile Defense Review, for affordability, reliability, suitability, and operational effectiveness to defend against limited attacks from evolving and future threats from long-range missiles.

(2) EVALUATION OF PAYLOADS- The assessment required by paragraph (1) shall include an evaluation of the potential benefits and drawbacks of options for both unitary and multiple Exo-atmospheric Kill Vehicle payloads.

(3) STANDARD MISSILE-3 BLOCK IIB INTERCEPTOR- As part of the assessment required by paragraph (1), the Director shall evaluate whether there are potential options and opportunities arising from the Standard Missile-3 Block IIB interceptor development program for development of an exo-atmospheric kill vehicle, or kill vehicle technologies or components, that could be used for potential upgrades to the Ground-Based Interceptor or for a next generation Exo-atmospheric Kill Vehicle.

(c) Report-

(1) IN GENERAL- Not later than one year after the date of the enactment of this Act, the Director shall submit to the congressional defense committees a report setting forth the plan developed under subsection (a), including the results of the assessment under subsection (b), and an estimate of the cost and schedule of implementing the plan.

(2) FORM- The report required by paragraph (1) shall be submitted in unclassified form, but may include a classified annex.

Regarding Section 126, S.Rept. 112-173 states:

**Authority for relocation of certain Aegis weapon system assets between and within the DDG-51 class destroyer and Aegis Ashore Programs in order to meet mission requirements (sec. 126)**

The committee recommends a provision that would allow the Defense Department to transfer AEGIS weapon systems (AWS) equipment between ships in the DDG-51 class destroyer program, or between the DDG-51 class destroyer program and Missile Defense Agency's (MDA) AEGIS Ashore Program, part of the European Phased, Adaptive Approach to missile defense. The Department anticipates that under the current budgets, MDA will be unable to obtain AWS equipment with ballistic missile defense (BMD) capability to support its first planned Aegis Ashore deployment in December 2015. If MDA is going to maintain that schedule, MDA would have to take delivery of AWS equipment with BMD capability in February 2013, to complete appropriate system integration and testing prior to shipment to the deployment site. MDA is requesting research, development, test, and evaluation funds in the fiscal years 2012 and 2013 budgets for the AWS equipment for the first deployment, but



AWS equipment production lead times will not support delivery of an AWS with BMD capability in 2013 using those MDA funds alone. This provision would allow the Department to support the first MDA deployment by diverting AWS equipment from the DDG-51 program to support the MDA, and, using the MDA contract dollars to replace that diverted AWS equipment, still support the planned delivery dates of the AEGIS destroyers. (Pages 14-15)

Regarding Section 231, the report states:

**Homeland ballistic missile defense (sec. 231)**

The committee recommends a provision that would express the sense of Congress on homeland ballistic missile defense, and would require a report on the status of efforts to improve the homeland defense capability of the United States.

The committee notes that the first policy priority described in the February 2010 Ballistic Missile Defense Review is to continue providing homeland ballistic missile defense against the potential future threat of limited ballistic missile attack from nations such as North Korea and Iran. The currently deployed Ground-based Midcourse Defense (GMD) system, with 30 Ground-Based Interceptors deployed in Alaska and California, provides protection of the United States against such future threats. This policy relies on two approaches: 1) improving the reliability and performance of the GMD system, particularly its Ground-Based Interceptors; and 2) taking prudent steps to hedge against the possibility that the threat might grow faster or larger than anticipated. The Department of Defense is taking significant steps on both approaches. The provision would require the Department to report on the steps it is taking on both approaches, including the results of its efforts to demonstrate in flight testing the correction to the problem that caused the GMD flight test failure of December 2010. (Pages 41-42)

Regarding Section 232, the report states:

**Regional ballistic missile defense (sec. 232)**

The committee recommends a provision that would express the sense of Congress on regional ballistic missile defense, and would require a report on the European Phased Adaptive Approach to missile defense and other regional missile defense efforts of the United States.

The committee notes that the threat to forward-deployed U.S. forces, allies and partners from regional ballistic missiles, particularly from Iran and North Korea, is serious and growing rapidly. Consequently, the Department of Defense has “made defending against near-term regional threats a top priority in our missile defense plans, programs and capabilities,” as Secretary of Defense Robert Gates stated in the Ballistic Missile Defense Review of February 2010.

The committee believes the Department of Defense has an obligation to provide force protection to forward-deployed U.S. forces, assets, and facilities, and to defend allies, from the threat of regional ballistic missile attack. The Department is implementing a set of programs and efforts to enhance U.S. and allied capabilities to defend against such regional ballistic missiles, especially against Iran and North Korea. These efforts, which include the European Phased Adaptive Approach to missile defense and similar phased and adaptive efforts tailored to the Middle East and the Asia-Pacific region, are essential to providing force protection for our deployed forces. These efforts are balanced with programs to enhance homeland defense, and are designed to meet the integrated missile defense priorities

of the geographic combatant commands. Some of the regional missile defense capabilities, such as forward-deployed AN/TPY-2 missile defense radars in Japan and Turkey, and development of the Standard Missile-3 Block IIB interceptor missile, are intended to enhance homeland defense.

The Department also has numerous programs of cooperation with international partners to improve regional missile defense capabilities, including our North Atlantic Treaty Organization allies, Israel, and Japan, among others. The committee supports these regional missile defense programs and partnerships, and believes they are an important component of regional security and stability. (Page 42)

Regarding Section 234, the report states:

**Next-generation Exo-atmospheric Kill Vehicle (sec. 234)**

The committee recommends a provision that would require the Director of the Missile Defense Agency to develop a long-term plan for the Exo-atmospheric Kill Vehicle (EKV) that addresses both modifications and enhancements to the current EKV and options for the competitive development of a next-generation EKV for the Ground-Based Interceptor of the Ground-Based Midcourse Defense system and any other interceptor that might be developed for the defense of the United States against long-range ballistic missiles. The provision would also require the Director to submit a report to Congress setting forth the plan and an estimate of the cost and schedule of implementing the plan. (Page 43)

The report also states:

The core capability of the EPAA will be the Aegis BMD system, both at sea and on land, with four increasingly capable variants of the SM-3 interceptor missile, the SM-3 Blocks IA, IB, IIA and IIB. As indicated previously, the committee strongly supports the development, testing, production, and deployment of operationally effective Aegis BMD and SM-3 capabilities in sufficient numbers to support the needs of the regional combatant commanders to implement the PAA in Europe and other regions, and to help protect the Homeland....

The last planned variant of the SM-3 missile is the Block IIB, which is intended for deployment in Phase 4 of the EPAA in the 2021 timeframe. The SM-3 IIB is intended to defend against possible future long-range Iranian missiles that could reach the United States. This system would augment the GMD system for homeland defense and would provide an early intercept capability that could permit a “shoot-look-shoot” option to permit GBIs [ground-based interceptors] being held in reserve. The committee believes it is important to develop a second type of interceptor system to defend the Homeland, in addition to the GBI system. By pursuing a competitive approach to the concept development phase, MDA has engaged the significant engineering and design talent of the industrial base. The committee believes it is important to maintain this competitive approach, particularly since it could produce the most innovative, cost-effective, and operationally effective results. (Pages 64 and 65)

## **FY2013 DOD Appropriations Act (H.R. 5856)**

### **House**

As shown in **Table 5**, the House Appropriations Committee, in its report (H.Rept. 112-493 of May 25, 2012) on H.R. 5856, recommends reducing by \$20 million the FY2013 funding request

for Next-generation Aegis missile (SM-3 IIB) (PE 0603902C, line 65), with the reduction being for “SM-3 Block IIB—Program Reduction.” (Page 252) As also shown in **Table 5**, the report recommends reducing by \$10 million the FY2013 funding request for Land-based SM-3 (LBSM3) (PE0604881C, line 107), with the reduction being for “Aegis Ashore test—early to need.” (Page 253)

The report also states:

STANDARD MISSILE-3 RISK REDUCTION FOR THE MISSILE DEFENSE  
AGENCY

The Committee is concerned that there are certain components for missile defense systems that only have one or two suppliers in the area of design and production. This is especially true for the producers of the Standard Missile-3 (SM-3) interceptor’s Divert and Attitude Control System which guides the kill vehicle during the final phase of its intercept operations. The Committee encourages the Director, Missile Defense Agency to fund risk reduction activities for the continued development of components essential to the production of SM-3 interceptors. (Pages 255-256)

## **Appendix. Aegis BMD Flight Tests**

### **Summary of Test Flights**

**Table A-1** presents a DOD summary of Aegis BMD flight tests since January 2002. As shown in the table, DOD states that since January 2002, the Aegis BMD system has achieved 20 successful exo-atmospheric intercepts in 25 attempts using the SM-3 missile (including 3 successful intercepts in 4 attempts by Japanese Aegis ships), and 3 successful endo-atmospheric intercepts in 3 attempts using the SM-2 Block IV missile, making for a combined total of 23 successful intercepts in 28 attempts.

In addition, on February 20, 2008, a BMD-capable Aegis cruiser operating northwest of Hawaii used a modified version of the Aegis BMD system to shoot down an inoperable U.S. surveillance satellite that was in a deteriorating orbit—an operation called Burnt Frost. Including this intercept in the count increases the totals to 21 successful exo-atmospheric intercepts in 26 attempts using the SM-3 missile, and 24 successful exo- and endo-atmospheric intercepts in 29 attempts using both SM-3 and SM-2 Block IV missiles.

Table A-1. Aegis BMD Flight Tests Since January 2002

Date	Country	Name of flight test	Target	Successful?	Cumulative successes	Cumulative attempts
<b>Exo-atmospheric (using SM-3 missile)</b>						
1/25/02	US	FM-2	Unitary TTV short-range target	Yes	1	1
6/13/02	US	FM-3	Unitary TTV short-range target	Yes	2	2
11/21/02	US	FM-4	Unitary TTV short-range target	Yes	3	3
6/18/03	US	FM-5	Unitary TTV short-range target	No	3	4
12/11/03	US	FM-6	Unitary TTV short-range target	Yes	4	5
2/24/05	US	FTM 04-1 (FM-7)	Unitary TTV short-range target	Yes	5	6
11/17/05	US	FTM 04-2 (FM-8)	Separating medium-range target	Yes	6	7
6/22/06	US	FTM 10	Separating medium-range target	Yes	7	8
12/7/06	US	FTM 11	Unitary TTV short-range target	No	7	9
4/26/07	US	FTM 11 Event 4	Unitary ARAV-A short-range target	Yes	8	10
6/22/07	US	FTM 12	Separating medium-range target	Yes	9	11
8/31/07	US	FTM-11a	Classified	Yes	10	12
11/6/07	US	FTM 13	Unitary ARAV-A short-range target	Yes	11	13
			Unitary ARAV-A short-range target	Yes	12	14
12/17/07	Japan	JFTM-1	Separating medium-range target	Yes	13	15
11/1/08	US	Pacific Blitz	Short-range missile target	Yes	14	16
			Short-range missile target	No	14	17
11/19/08	Japan	JFTM-2	Separating medium-range target	No	14	18
7/30/09	US	FTM-17	Unitary ARAV-A short-range target	Yes	15	19
10/27/09	Japan	JFTM-3	Separating medium-range target	Yes	16	20
10/28/10	Japan	JFTM-4	Separating medium-range target	Yes	17	21
4/14/11	US	FTM-15	LV-2 intermediate range target	Yes	18	22
9/1/11	US	FTM-16	Short-range missile target	No	18	23
5/9/12	US	FTM-16 E2a	Unitary ARAV-A short-range target	Yes	19	24
6/26/12	US		Separating ballistic missile target	Yes	20	25
<b>Endo-atmospheric (using SM-2 missile)</b>						
5/24/06	US	Pacific Pheonix	Unitary short-range target	Yes	1	1
6/5/08	US	FTM-14	Unitary short-range target	Yes	2	2
3/26/09	US	Stellar Daggers	Short-range ballistic missile target	Yes	3	3
<b>Combined total for exo- and endo-atmospheric above tests</b>					<b>23</b>	<b>28</b>

**Source:** Table adapted from table presented in MDA fact sheet, "Aegis Ballistic Missile Defense Testing," dated November 2010, accessed on November 19, 2010, at [http://www.mda.mil/global/documents/pdf/aegis\\_tests.pdf](http://www.mda.mil/global/documents/pdf/aegis_tests.pdf).

**Notes:** TTV is target test vehicle; ARAV is Aegis Readiness Assessment Vehicle. In addition to the flight tests shown above, there was a successful use of an SM-3 on February 20, 2008, to intercept an inoperative U.S. satellite—an operation called Burnt Frost. Including this intercept in the count increases the totals to 19 successful exo-atmospheric intercepts in 24 attempts using the SM-3 missile, and 22 successful exo- and endo-atmospheric intercepts in 27 attempts using both SM-3 and SM-2 Block IV missiles.

## May 2010 Criticism of Claimed Successes in Flight Tests

In a May 2010 magazine article and supplementary white paper, two professors with scientific backgrounds—George Lewis and Theodore Postol—criticized DOD claims of successes in Aegis (and other DOD) BMD flight tests, arguing that

the Defense Department's own test data show that, in combat, the vast majority of "successful" SM-3 experiments would have failed to destroy attacking warheads. The data also show potential adversaries how to defeat both the SM-3 and the GMD [ground-based missile defense] systems, which share the same serious flaws that can be readily exploited by adversaries.<sup>59</sup>

The criticisms made by Lewis and Postol were reported in a May 18, 2010, *New York Times* article.<sup>60</sup> In response to the criticisms and the *New York Times* article, MDA issued a press release and other information defending the flight tests and arguing that the criticisms are based on inaccurate or incomplete information.<sup>61</sup>

## **Details on Selected Exo-Atmospheric (SM-3) Flight Tests Since June 2006**

**June 22, 2006, Test.** This was the first test to use the 3.6 version of the Aegis BMD system.<sup>62</sup>

**December 7, 2006, Test.** This was the first unsuccessful flight test since June 2003. MDA stated that the ninth test

was not completed due to an incorrect system setting aboard the Aegis-class cruiser USS Lake Erie prior to the launch of two interceptor missiles from the ship. The incorrect configuration prevented the fire control system aboard the ship from launching the first of the two interceptor missiles. Since a primary test objective was a near-simultaneous launch of two missiles against two different targets, the second interceptor missile was intentionally not launched.

The planned test was to involve the launch of a Standard Missile 3 against a ballistic missile target and a Standard Missile 2 against a surrogate aircraft target. The ballistic missile target was launched from the Pacific Missile Range Facility, Kauai, Hawaii and the aircraft target was launched from a Navy aircraft. The USS Lake Erie (CG 70), USS Hopper (DDG 70) and the Royal Netherlands Navy frigate TROMP were all successful in detecting and tracking their respective targets. Both targets fell into the ocean as planned.

After a thorough review, the Missile Defense Agency and the U.S. Navy will determine a new test date.<sup>63</sup>

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<sup>59</sup> George N. Lewis and Theodore A. Postol, "A Flawed and Dangerous U.S. Missile Defense Plan," *Arms Control Today*, May 2010: 24-32. The quoted passage appears on p. 26. The associated white paper is George N. Lewis and Theodore A. Postol, *A Technically Detailed Description of Flaws in the SM-3 and GMD Missile Defense Systems Revealed by the Defense Department's Ballistic Missile Test Data*, May 3, 2010, 13 pp.

<sup>60</sup> William J. Broad and David E. Sanger, "Review Cites Flaws In U.S. Antimissile Program," *New York Times*, May 18, 2010: 1.

<sup>61</sup> Missile Defense Agency news release entitled "Missile Defense Agency Responds to New York Times Article," 10-News-0005, May 18, 2010; Missile Defense Agency, *Missile Defense Agency Response to Request for Information, Standard Missile – 3 Interceptor Testing*, May 18, 2010, 2 pp.; Missile Defense Agency, *Missile Defense Agency Response to Request for Information, Response to New York Times May 18, 2010, Article Regarding SM-3 Testing*, May 18, 2010, 3 pp.; Richard Lehner, "Missile Defense Agency Responds to New York Times Article," *DOD Live* (<http://www.dodlive.mil>), May 18, 2010; Transcript of Department of Defense Bloggers Roundtable With Richard Lehner, Spokesman, Missile Defense Agency (MDA), Subject: Standard Missile 3 Test Program, May 18, 2010.

<sup>62</sup> Missile Defense Agency, "Missile Defense Test Results in Successful 'Hit To Kill' Intercept," June 22, 2006 (06-NEWS-0018).

<sup>63</sup> Untitled Missile Defense Agency "For Your Information" statement dated December 7, 2006 (06-FYI-0090).

A news article about the ninth test stated:

“You can say it’s seven of nine, rather than eight of nine,” Missile Defense Agency spokesman Chris Taylor said of the second failure in tests of the system by the agency and the Navy....

The drill was planned to demonstrate the Navy’s ability to knock down two incoming missiles at once from the same ship.

“In a real world situation it is possible, maybe even probable, that in addition to engaging a ballistic missile threat that was launched, you may be engaging a surface action,” said Joe Rappisi before the test. He is director for the Aegis Ballistic Missile Defense system at Lockheed Martin, the primary contractor for the program.

The test would have marked the first time a ship has shot down one target in space and another target in the air at the same time.

The test presented a greater challenge to the ship’s crew and the ballistic missile defense system than previous tests, Rappisi said. The multiple target scenario is also closer to what sailors might actually face in battle.

The U.S. Pacific Fleet has been gradually installing missile surveillance and tracking technology on many of its destroyers and cruisers amid concerns about North Korea’s long-range missile program.

It is also installing interceptor missiles on many of its ships, even as the technology to track and shoot down incoming missiles is being developed and perfected.

The Royal Netherlands Navy joined the tracking and monitoring off Kauai to see how its equipment works. The Dutch presence marked the first time a European ally has sent one of its vessels to participate in a U.S. ballistic missile defense test.<sup>64</sup>

A subsequent news article stated:

the test abort of the Aegis Ballistic Missile Defense system Dec. 7 resulted from human error, [MDA Director USAF Lt. Gen. Henry] Obering says.... Both the ballistic missile and aircraft targets launched as planned, but the first interceptor failed to fire because an operator had selected an incorrect setting for the test. Officials then aborted before the second could boost.

Aegis missile defense system tests are at a standstill until officials are able to identify an appropriate ballistic missile target. The one used Dec. 7 was the last of its kind, Obering says, leaving them empty handed in the near future.<sup>65</sup>

Another article stated:

Philip Coyle, a former head of the Pentagon’s testing directorate, gives the Navy credit for “discipline and successes so far” in its sea-based ballistic missile defense testing program. Coyle is now a senior adviser at the Center for Defense Information.

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<sup>64</sup> David Briscoe, “Test Interceptor Missile Fails To Launch,” *NavyTimes.com*, December 8, 2006.

<sup>65</sup> Amy Butler, “GMD Trial Delayed Until Spring; Aegis Failure Human Error,” *Aerospace Daily & Defense Report*, December 19, 2006.

“The U.S. Navy has an enviable track record of successful flight intercept tests, and is making the most of its current, limited Aegis missile defense capabilities in these tests,” Coyle told [*Inside the Navy*] Dec. 7.

“Difficulties such as those that delayed the latest flight intercept attempt illustrate the complexity of the system, and how everything must be carefully orchestrated to achieve success,” Coyle added. “Nevertheless, this particular setback won’t take the Navy long to correct.”<sup>66</sup>

**April 26, 2007, Test.** MDA states that this test:

involved the simultaneous engagements of a ballistic missile “unitary” target (meaning that the target warhead and booster remain attached) and a surrogate hostile air target....

The test demonstrated the [Aegis ship’s] ability to engage a ballistic missile threat and defend itself from attack at the same time. The test also demonstrated the effectiveness of engineering, manufacturing, and mission assurance changes in the solid divert and attitude control system (SDACS) in the kinetic kill weapon. This was the first flight test of all the SM-3 Block IA’s upgrades, previously demonstrated in ground tests.<sup>67</sup>

A press report on the test stated that the hostile air target was an anti-ship cruise missile. The article stated that the scenario for the test

called for the [Aegis ship] to come under attack from a cruise missile fired by an enemy plane.... A Navy plane fired the cruise missile target used in the test.<sup>68</sup>

**June 22, 2007, Test.** MDA states that this test

was the third intercept involving a separating target and the first time an Aegis BMD-equipped destroyer was used to launch the interceptor missile. The USS Decatur (DDG 73), using the operationally-certified Aegis Ballistic Missile Defense Weapon System (BMD 3.6) and the Standard Missile-3 (SM-3) Block IA missile successfully intercepted the target during its midcourse phase of flight....

An Aegis cruiser, USS Port Royal (CG 73), a Spanish frigate, MÉNDEZ NÚÑEZ (F-104), and MDA’s Terminal High Altitude Area Defense (THAAD) mobile ground-based radar also participated in the flight test. USS Port Royal used the flight test to support development of the new Aegis BMD SPY-1B radar signal processor, collecting performance data on its increased target detection and discrimination capabilities. MÉNDEZ NÚÑEZ, stationed off Kauai, performed long-range surveillance and track operations as a training event to assess the future capabilities of the F-100 Class. The THAAD radar tracked the target and exchanged tracking data with the Aegis BMD cruiser.

This event marked the third time that an allied military unit participated in a U.S. Aegis BMD test, with warships from Japan and the Netherlands participating in earlier tests.<sup>69</sup>

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<sup>66</sup> Zachary M. Peterson, “Sea-Based Missile Defense Test Fails Due To ‘Incorrect Configuration,’” *Inside the Navy*, December 11, 2006.

<sup>67</sup> Missile Defense Agency, “Successful Sea-Based Missile Defense ‘Hit to Kill’ Intercept,” April 26, 2007 (07-NEWS-0032).

<sup>68</sup> Audrey McAvoy, “Aegis Missile Test Successful,” *NavyTimes.com*, April 27, 2007.

<sup>69</sup> Missile Defense Agency, “Sea-Based Missile Defense ‘Hit to Kill’ Intercept Achieved,” June 22, 2007 (07-NEWS-(continued...))



**August 31, 2007, Test.** MDA has publicly noted the occurrence of this test and the fact that it resulted in a successful intercept,<sup>70</sup> but states that the details about the test are classified.<sup>71</sup> MDA does not appear to have issued a news release about this flight test following the completion of the test, as it has for other Aegis BMD flight tests.<sup>72</sup>

**November 6, 2007, Test.** MDA states that this test involved:

a multiple simultaneous engagement involving two ballistic missile targets.... For the first time, the operationally realistic test involved two unitary “non-separating” targets, meaning that the target’s warheads did not separate from their booster rockets....

At approximately 6:12 p.m. Hawaii Standard Time (11:12 p.m. EST), a target was launched from the Pacific Missile Range Facility (PMRF), Barking Sands, Kauai, Hawaii. Moments later, a second, identical target was launched from the PMRF. The USS Lake Erie’s Aegis BMD Weapon System detected and tracked the targets and developed fire control solutions.

Approximately two minutes later, the USS Lake Erie’s crew fired two SM-3 missiles, and two minutes later they successfully intercepted the targets outside the earth’s atmosphere more than 100 miles above the Pacific Ocean and 250 miles northwest of Kauai....

A Japanese destroyer also participated in the flight test. Stationed off Kauai and equipped with the certified 3.6 Aegis BMD weapon system, the guided missile destroyer JS Kongo performed long-range surveillance and tracking exercises. The Kongo used the test as a training exercise in preparation for the first ballistic missile intercept test by a Japanese ship planned for later this year. This event marked the fourth time an allied military unit participated in a U.S. Aegis BMDS test.<sup>73</sup>

**December 17, 2007, Test.** In this flight test, a BMD-capable Japanese Aegis destroyer used an SM-3 Block IA missile to successfully intercept a ballistic missile target in a flight test off the coast of Hawaii. It was the first time that a non-U.S. ship had intercepted a ballistic missile using the Aegis BMD system.<sup>74</sup>

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(...continued)

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<sup>70</sup> See for example, slide 8 in the 20-slide briefing entitled “Ballistic Missile Defense Program Overview For The Congressional Breakfast Seminar Series,” dated June 20, 2008, presented by Lieutenant General Trey Obering, USAF, Director, Missile Defense Agency. Source for briefing: *InsideDefense.com* (subscription required). Each slide in the briefing includes a note indicating that it was approved by MDA for public release on June 13, 2008. Slide 8 lists Aegis BMD midcourse flight tests conducted since September 2005, including a test on August 31, 2007. The slide indicates with a check mark that the flight test was successful. A success in this test is also needed to for the total number of successful intercepts to match the reported figure.

<sup>71</sup> An e-mail from MDA to CRS dated June 30, 2008, states that the flight test “was a hit to kill intercept test but details about the test are classified.”

<sup>72</sup> MDA’s website, when accessed on June 30, 2008, did not show a news release issued on or soon after August 31, 2007, that discusses this test.

<sup>73</sup> Missile Defense Agency, “Sea-Based Missile Defense “Hit to Kill” Intercept Achieved,” November 6, 2007 (07-NEWS-0051).

<sup>74</sup> John Liang, “Japanese Destroyer Shoots Down Ballistic Missile Test Target,” *Inside Missile Defense*, December 19, 2007; “Japanese Aegis Destroyer Wins Test By Killing Target Missile With SM-3 Interceptor,” *Defense Daily*, December 18, 2007; Reuters, “Japanese Ship Downs Missile In Pacific Test,” *New York Times*, December 18, 2007: 8; Audrey McAvoy, “Japan Intercepts Missile In Test Off Hawaii,” *NavyTimes.com*, December 17, 2007.

**November 1, 2008, Test.** This flight test was reportedly the first U.S. Navy Aegis BMD flight test conducted by the Navy, without oversight by MDA. The test involved two Aegis ships, each attempting to intercept a ballistic missile. The SM-3 fired by the first Aegis ship successfully intercepted its target, but the SM-3 fired by the second Aegis ship did not intercept its target. A press release from the U.S. Third Fleet (the Navy's fleet for the Eastern Pacific) states that:

Vice Adm. Samuel J. Locklear, Commander, U.S. Third Fleet announced today the successful Navy intercept of a ballistic missile target over the Pacific Ocean during Fleet Exercise Pacific Blitz. This was the first Fleet operational firing to employ the Standard Missile-3 (SM-3) against a ballistic missile target. Command and control of this mission resided with Commander, U.S. Third Fleet, based in San Diego, Calif.

Pearl Harbor-based Aegis destroyers, USS Paul Hamilton (DDG 60) and USS Hopper (DDG 70), which have been upgraded to engage ballistic missiles, fired SM-3 missiles at separate targets. During this event, a short-range ballistic missile target was launched from the Pacific Missile Range Facility (PMRF), Barking Sands, Kauai, Hawaii. Upon detecting and tracking the target, USS Paul Hamilton, launched a SM-3 missile, resulting in a direct-hit intercept. Following USS Paul Hamilton's engagement, PMRF launched another target. USS Hopper successfully detected, tracked and engaged the target. The SM-3 followed a nominal trajectory, however intercept was not achieved. Extensive analysis of the flight mission will be used to improve the deployed Aegis BMD system.<sup>75</sup>

**November 19, 2008, Test.** This was the second Japanese flight test, and involved a single ballistic missile target. The test did not result in a successful intercept. MDA states that:

Rear Admiral Tomohisa Takei, Director General of Operations and Plans, for the Japanese Maritime Staff Office (MSO), Japan Maritime Self Defense Force (JMSDF), and Lt. General Henry "Trey" Obering, United States Missile Defense Agency director, announced the completion today of a cooperative sea-based Aegis Ballistic Missile Defense intercept flight test off the coast of Kauai in Hawaii. The event, designated Japan Flight Test Mission 2 (JFTM-2), marked the second attempt by an Allied naval ship to intercept a ballistic missile target with the sea-based midcourse engagement capability provided by Aegis Ballistic Missile Defense. Target performance, interceptor missile launch and flyout, and operation of the Aegis Weapon System by the crew were successful, but an intercept was not achieved.

The JFTM-2 was a test of the newest engagement capability of the Aegis Ballistic Missile Defense configuration of the recently upgraded Japanese destroyer, JS CHOKAI (DDG-176). At approximately 4:21 pm (HST), 11:21 am (Tokyo time) a ballistic missile target was launched from the Pacific Missile Range Facility, Barking Sands, Kauai, Hawaii. JS CHOKAI crew members detected and tracked the target using an advanced on-board radar. The Aegis Weapon System then developed a fire control solution, and at approximately 4:24 pm (HST), 11:24 am (Tokyo time) on Nov 20, a single Standard Missile -3 (SM-3) Block IA was launched. Approximately two minutes later, the SM-3 failed to intercept the target. There is no immediate explanation for the failed intercept attempt. More information will be available after a thorough investigation. The JS CHOKAI crew performance was excellent in executing the mission. JFTM-2 was the second time that a Japanese ship was designated to

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<sup>75</sup> Commander, U.S. Third Fleet, Public Affairs Office, press release 23-08, dated November 1, 2008, entitled "Navy Intercepts Ballistic Missile Target in Fleet Exercise Pacific Blitz." See also Dave Ahearn, "One of Two Missiles Hit In Aegis Test; Navy For First Time Runs Test Instead of MDA," *Defense Daily*, November 4, 2008: 1-2.

launch the interceptor missile, a major milestone in the growing cooperation between Japan and the U.S.<sup>76</sup>

A November 21, 2008, press report states that:

An Aegis ballistic missile defense (BMD) test by the Japanese destroyer Chokai (DDG-176) ended in failure when the Standard Missile-3 Block 1A interceptor lost track of the target missile in the final seconds before a planned hit-to-kill.

The Chokai and its crew performed well throughout the test, and the SM-3 also performed flawlessly through its first three stages, according to Rear Adm. Brad Hicks, the U.S. Navy Aegis ballistic missile defense program director. He spoke with several reporters in a teleconference around midnight ET Wednesday-Thursday, after the test in the area of the Pacific Missile Range Facility, Barking Sands, Kauai, Hawaii.

This was the second Aegis BMD test failure in less than a month.

These latest two failures come as some Democrats in Congress are poised to cut spending on missile defense programs when they convene next year to consider the Missile Defense Agency budget for the fiscal year ending Sept. 30, 2010....

Still, in the coming money debates next year, missile defense advocates will be able to point out that even including the Hopper and Chokai failures, the record for the Aegis tests is an overwhelming 16 successful hits demolishing target missiles out of 20 attempts.

Those successes included the first Japanese attempt. The Japanese destroyer Kongo (DDG-173) successfully used its SM-3 interceptor to kill a target missile. The difference in tests is that the Kongo crew was advised beforehand when the target missile would be launched, while the Chokai crew wasn't....

[Hicks] said a board will be convened to examine why the latest test failed. Hicks declined to speculate on why the SM-3 interceptor missed the target. "I'm confident we'll find out the root cause" of the Chokai interceptor failure to score a hit, he said.

However, he was asked by *Space & Missile Defense Report* whether the prior SM-3 successes make it unlikely the Chokai failure stems from some basic design flaw in all SM-3s, and whether it is more likely that the Chokai SM-3 failed because of some flaw or glitch in just that one interceptor.

Hicks said that is likely.

"Obviously, we believe this is hopefully related to this one interceptor," and doesn't reflect any basic design flaw in the SM-3 interceptors, he said.

The Chokai test failure cost Japan a \$55 million loss, he said, adding, "It wasn't cheap."...

In the Chokai test, the target missile was launched from Barking Sands, and about three minutes later the Chokai crew had spotted the target, the Aegis system had developed a tracking and hit solution, and the SM-3 interceptor was launched.

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<sup>76</sup> Missile Defense Agency press release 08-News-0087, dated November 19, 2008, entitled "Japan/U.S. Missile Defense Flight Test Completed."

The first, second and third stages of the interceptor performed nominally, without problems, but then came the fourth stage. The nosecone components opened to expose the kill vehicle area, and somehow the program to track the target missile failed.

“It lost track,” Hicks said, only seconds before the hit would have been achieved.

If the kill had occurred, it would have been about 100 nautical miles (roughly 115 statute miles) above Earth, and some 250 miles away from Barking Sands, Hicks said.

It took the interceptor about two minutes flight time to reach the near miss with the target missile.

Meanwhile, the Hamilton was nearby watching the test. The Hamilton Aegis system successfully spotted and tracked the target, and developed a simulated solution and simulated interceptor launch that, if it had been real, would have resulted in a successful hit on the target, Hicks said. The Hamilton didn’t cue the Chokai, however. “It was strictly Chokai’s engagement,” Hicks said.<sup>77</sup>

**July 30, 2009, Test.** MDA states that:

In conjunction with the Missile Defense Agency (MDA), U.S. Pacific Fleet ships and crews successfully conducted the latest Aegis Ballistic Missile Defense (BMD) at-sea firing event on July 30. During this event, entitled Stellar Avenger, the Aegis BMD-equipped ship, USS Hopper (DDG 70), detected, tracked, fired and guided a Standard Missile -3 (SM-3) Block (Blk) IA to intercept a sub-scale short range ballistic missile. The target was launched from the Kauai Test Facility, co-located on the Pacific Missile Range Facility (PMRF), Barking Sands, Kauai. It was the 19<sup>th</sup> successful intercept in 23 at-sea firings, for the Aegis BMD Program, including the February 2008 destruction of the malfunctioning satellite above the earth’s atmosphere. Stellar Avenger was part of the continual evaluation of the certified and fielded Aegis BMD system at-sea today.

At approximately 5:40 pm (HST), 11:40 pm (EDT), a target was launched from PMRF. Three U.S. Navy Aegis BMD-equipped ships, the cruiser, USS Lake Erie (CG 70) and destroyers USS Hopper (DDG 70) and USS O’Kane (DDG 77) detected and tracked the target with their SPY radars. Each developed fire control solutions. At 5:42 pm (HST), 11:42 pm (EDT) the crew of USS Hopper fired one SM-3 Blk IA missile. The USS Hopper’s Aegis BMD Weapon System successfully guided the SM-3 to a direct body to body hit, approximately two minutes after leaving the ship. The intercept occurred about 100 miles above the Pacific Ocean. USS O’Kane conducted a simulated engagement of the target. USS Lake Erie, with its recently installed upgraded Aegis BMD 4.0.1 Weapons System, detected and tracked the same target.<sup>78</sup>

A July 31, 2009, press report states:

The test was the first Aegis BMD exercise to feature two versions of the software in a single event, according to Lisa Callahan, Lockheed’s vice president for ballistic missile defense programs.

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<sup>77</sup> Dave Ahearn, “Japanese Aegis Missile Defense Test Fails, But Aegis Record Is 16 Hits In 20 Tries,” Defense Daily, November 21, 2008: 5-6.

<sup>78</sup> Missile Defense Agency press release 09-News-0015, dated July 31, 2009, entitled “Aegis Ballistic Missile Defense Test Successful.”

A goal of the exercises was to test the Aegis system's ability to discern all the different parts and pieces of a ballistic missile, Nick Bucci, Lockheed's director for Aegis BMD development programs, told reporters July 29 during a pre-exercise conference call.

Three more flight tests this fall will further test the system's discrimination capabilities, Bucci added, with each test becoming more complex. The last test will "be against a pretty darn complex target," he said.

The July 30 tests also validated fixes put in place after a BMD test last November involving a missile launched from the Aegis BMD Japanese destroyer Chokai failed to intercept its target, according to MDA spokesman Chris Taylor. The improvements—which were successful in the most recent test—involved fixes to the Solid Divert Attitude Control System.

The Chokai is the second of four Japanese Aegis ships being upgraded with BMD capability. A third ship, the Myoko, is scheduled to carry out a BMD test this fall.<sup>79</sup>

An August 3, 2009, press report states:

This test was added to the schedule to evaluate changes made after last year's failed attempt to intercept a target with an SM-3 Block IA launched by a Japanese Aegis-equipped ship .... After the Nov. 19 test, MDA officials said, "Target performance, interceptor missile launch and flyout, and operation of the Aegis Weapon System by the crew were successful, but an intercept was not achieved."

A root cause has not been identified, and an MDA spokesman did not say whether fixes have been made to hardware or operational procedures resulting from the failure review. It is also unclear why a subscale target was used in the July 30 trial.<sup>80</sup>

An August 4, 2009, press report states:

[Rear Admiral Alan "Brad" Hicks, Aegis/SM-3 program manager for MDA], said that a November [2008] failure of an SM-3 Block IA... during a flight-test was attributable to poor adherence to processes on Raytheon's assembly line in Tucson, Ariz.

This was isolated to that missile, and it was the result of perturbations to the build process encountered when shifting from development to production operations.

During the November test, a Japanese Aegis-equipped ship fired the interceptor and it flew "perfectly," Hicks said. In the endgame, a failure of the divert and attitude control system on the unitary kill vehicle led to a miss.

The July 30 demonstration using a U.S. ship "restored confidence" for the Japanese that the miss last fall was an isolated incident, he says.<sup>81</sup>

**October 27, 2009, Test.** This was the third Japanese flight test, and it involved a single ballistic missile target. MDA states that:

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<sup>79</sup> Christopher P. Cavas, "Aegis BMD Test Successful," *DefenseNews.com*, July 31, 2009.

<sup>80</sup> Amy Butler, "SM-3 Scores Hit After Fixes Implemented," *Aerospace Daily & Defense Report*, August 3, 2009: 5.

<sup>81</sup> Amy Butler, "SM-3 Upgrade Program Cost Increases," *Aerospace Daily & Defense Report*, August 4, 2009: 1-2. See also Dan Taylor, "Navy Conducts Aegis BMD Test, New Baseline System Participates," *Inside the Navy*, August 3, 2009; Daniel Wasserbly, "US Aegis BMD System Achieves Trial Success," *Jane's Defence Weekly*, August 5, 2009: 8.

The Japan Maritime Self-Defense Force (JMSDF) and the United States Missile Defense Agency (MDA) announced the successful completion of an Aegis Ballistic Missile Defense (BMD) intercept flight test, in cooperation with the U.S. Navy, off the coast of Kauai in Hawaii. The event, designated Japan Flight Test Mission 3 (JFTM-3), marked the third time that a JMSDF ship has successfully engaged a ballistic missile target, including two successful intercepts, with the sea-based midcourse engagement capability provided by Aegis BMD.

The JFTM-3 test event verified the newest engagement capability of the Japan Aegis BMD configuration of the recently upgraded Japanese destroyer, JS MYOKO (DDG-175). At approximately 6:00pm (HST), 1:00 pm Tokyo time on Oct 28, a separating, medium-range ballistic missile target was launched from the Pacific Missile Range Facility, Barking Sands, Kauai, Hawaii. JS MYOKO crew members detected and tracked the target. The Aegis Weapon System then developed a fire control solution and, at approximately 6:04pm (HST), 1:04 pm Tokyo time a Standard Missile-3 (SM-3) Block IA interceptor missile was launched. Approximately 3 minutes later, the SM-3 successfully intercepted the target approximately 100 miles above the Pacific Ocean. JFTM-3 is a significant milestone in the growing cooperation between Japan and the U.S. in the area of missile defense.

Also participating in the test, were the Pearl Harbor-based USS Lake Erie (CG 70) and USS Paul Hamilton (DDG 60) which detected and tracked the target and conducted a simulated engagement.<sup>82</sup>

**October 28, 2010, Test.** This was the fourth Japanese flight test, and it involved a single ballistic missile target. MDA states that:

The Japan Maritime Self-Defense Force (JMSDF) and the United States Missile Defense Agency (MDA) announced the successful completion of an Aegis Ballistic Missile Defense (BMD) intercept flight test, in cooperation with the U.S. Navy, off the coast of Kauai in Hawaii.

The event marked the fourth time that a JMSDF ship has engaged a ballistic missile target, including three successful intercepts, with the sea-based midcourse engagement capability provided by Aegis BMD.

The JFTM-4 test event verified the newest engagement capability of the Japan Aegis BMD configuration of the recently upgraded Japanese destroyer, JS KIRISHIMA. At approximately 5:06 p.m. (HST), 12:06 p.m. Tokyo time on Oct. 29, 2010, a separating 1,000 km class ballistic missile target was launched from the Pacific Missile Range Facility at Barking Sands, Kauai, Hawaii.

JS KIRISHIMA crew members detected and tracked the target. The Aegis Weapon System then developed a fire control solution and launched a Standard Missile -3 (SM-3) Block IA missile. Approximately three minutes later, the SM-3 successfully intercepted the target approximately 100 miles above the Pacific Ocean. JFTM-4 is a significant milestone in the growing cooperation between Japan and the U.S. in the area of missile defense.

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<sup>82</sup> Missile Defense Agency press release 09-News-0021, dated October 28, 2009, entitled "Japan/U.S. Missile Defense Flight Test Successful." See also Christopher P. Cavas, "Japanese Destroyer Conducts Successful BMD Test," *NavyTimes.com*, October 28, 2009; and Amy Butler and Michael Bruno, "SM-3 Scores Hit In Japanese Test," *Aerospace Daily & Defense Report*, October 29, 2009: 3.

Also participating in the test was USS LAKE ERIE and USS RUSSELL, Aegis ships which cooperated to detect, track and conduct a simulated intercept engagement against the same target.<sup>83</sup>

**April 15, 2011, Test.** MDA states that this flight test “was the most challenging test to date, as it was the first Aegis BMD version 3.6.1 intercept against an intermediate-range target (range 1,864 to 3,418 [statute] miles) and the first Aegis BMD 3.6.1 engagement relying on remote tracking data.” MDA states that:

The Missile Defense Agency (MDA), U.S. Navy sailors aboard the Aegis destroyer USS O’KANE (DDG 77), and Soldiers from the 94<sup>th</sup> Army Air and Missile Defense Command operating from the 613<sup>th</sup> Air and Space Operations Center at Hickam Air Force Base, Hawaii, successfully conducted a flight test of the Aegis Ballistic Missile Defense (BMD) element of the nation’s Ballistic Missile Defense System, resulting in the intercept of a separating ballistic missile target over the Pacific Ocean. This successful test demonstrated the capability of the first phase of the European Phased Adaptive Approach (EPAA) announced by the President in September, 2009.

At 2:52 a.m. EDT (6:52 p.m. April 15 Marshall Island Time), an intermediate-range ballistic missile target was launched from the Reagan Test Site, located on Kwajalein Atoll in the Republic of the Marshall Islands, approximately 2,300 miles southwest of Hawaii. The target flew in a northeasterly direction towards a broad ocean area in the Pacific Ocean. Following target launch, a forward-based AN/TPY-2 X-band transportable radar, located on Wake Island, detected and tracked the threat missile. The radar sent trajectory information to the Command, Control, Battle Management, and Communications (C2BMC) system, which processed and transmitted remote target data to the USS O’KANE. The destroyer, located to the west of Hawaii, used the data to develop a fire control solution and launch the SM-3 Block IA missile approximately 11 minutes after the target was launched.

As the IRBM target continued along its trajectory, the firing ship’s AN/SPY-1 radar detected and acquired the ballistic missile target. The firing ship’s Aegis BMD weapon system uplinked target track information to the SM-3 Block IA missile. The SM-3 maneuvered to a point in space as designated by the fire control solution and released its kinetic warhead. The kinetic warhead acquired the target, diverted into its path, and, using only force of a direct impact, destroyed the threat in a “hit-to-kill” intercept.

During the test the C2BMC system, operated by Soldiers from the 94<sup>th</sup> Army Air and Missile Defense Command, received data from all assets and provided situational awareness of the engagement to U.S. Pacific Command, U.S. Northern Command and U.S. Strategic Command.

The two demonstration Space Tracking and Surveillance Satellites (STSS), launched by MDA in 2009, successfully acquired the target missile, providing stereo “birth to death” tracking of the target.

Today’s event, designated Flight Test Standard Missile-15 (FTM-15), was the most challenging test to date, as it was the first Aegis BMD version 3.6.1 intercept against an intermediate-range target (range 1,864 to 3,418 [statute] miles) and the first Aegis BMD 3.6.1 engagement relying on remote tracking data. The ability to use remote radar data to

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<sup>83</sup> Missile Defense Agency press release 10-News-0016, dated October 29, 2010, entitled “Joint Japan-U.S. Missile Defense Flight Test Successful.” See also Marina Malenic, “Japanese Aegis Destroyer Successfully Completes Missile-Intercept Test,” *Defense Daily*, November 1, 2010: 6.

engage a threat ballistic missile greatly increases the battle space and defended area of the SM-3 missile.

Initial indications are that all components performed as designed. Program officials will spend the next several months conducting an extensive assessment and evaluation of system performance based upon telemetry and other data obtained during the test.<sup>84</sup>

**September 1, 2011, Test.** This flight test, which did not result in an intercept, was the first flight test of the SM-3 Block IB interceptor. MDA states that it

was unable to achieve the planned intercept of a ballistic missile target during a test over the Pacific Ocean exercising the sea-based element of the Ballistic Missile Defense System (BMDS).

At approximately 3:53 a.m. Hawaii Standard Time (9:53 a.m. EDT) a short-range ballistic missile target was launched from the U.S. Navy's Pacific Missile Range Facility on Kauai, Hawaii. Approximately 90 seconds later, a Standard Missile 3 (SM-3) Block 1B interceptor missile was launched from the cruiser USS LAKE ERIE (CG-70) but an intercept of the target was not achieved.

This was the first flight test of the advanced SM-3 Block 1B interceptor missile. Program officials will conduct an extensive investigation to determine the cause of the failure to intercept.<sup>85</sup>

**May 9, 2012, Test.** MDA states that this flight test “was the first successful live fire intercept test of the SM-3 Block IB interceptor and the second-generation Aegis BMD 4.0.1 weapon system.” MDA states that

The Missile Defense Agency (MDA) and U.S. Navy sailors aboard the USS LAKE ERIE (CG 70) successfully conducted a flight test of the Aegis Ballistic Missile Defense (BMD) system, resulting in the first intercept of a short-range ballistic missile target over the Pacific Ocean by the Navy's newest Missile Defense interceptor, the Standard Missile – 3 (SM-3) Block IB.

At 8:18 p.m. Hawaiian Standard Time (2:18 a.m. EDT May 10) the target missile was launched from the Pacific Missile Range Facility, located on Kauai, Hawaii. The target flew on a northwesterly trajectory towards a broad ocean area of the Pacific Ocean. Following target launch, the USS LAKE ERIE detected and tracked the missile with its onboard AN/SPY-1 radar. The ship, equipped with the second-generation Aegis BMD 4.0.1 weapon system, developed a fire control solution and launched the Standard Missile-3 (SM-3) Block IB interceptor.

The USS LAKE ERIE continued to track the target and sent trajectory information to the SM-3 Block IB interceptor in-flight. The SM-3 maneuvered to a point in space, as designated by the fire control solution, and released its kinetic warhead. The kinetic warhead acquired

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<sup>84</sup> Missile Defense Agency press release 11-News-0007, dated April 15, 2011, entitled “Sea-based Missile Defense Flight Test Results in Successful Intercept.”

<sup>85</sup> Missile Defense Agency press release 11-News-0016, dated September 1, 2011, entitled “Sea-Based Missile Defense Test Conducted.” See also Amy Butler, “Upgraded Ballistic Missile Killer Fizzles In First Flight Test,” *Aerospace Daily & Defense Report*, September 2, 2011: 3; and Mike McCarthy, “Sea-Based Missile Defense Test Fails,” *Defense Daily*, September 2, 2011: 2-3.



the target, diverted into its path, and, using only the force of a direct impact, engaged and destroyed the threat in a hit-to-kill intercept.

Today's event, designated Flight Test Standard Missile-16 (FTM-16) Event 2a, was the first successful live fire intercept test of the SM-3 Block IB interceptor and the second-generation Aegis BMD 4.0.1 weapon system. Previous successful intercepts were conducted with the Aegis BMD 3.6.1 weapon system and the SM-3 Block IA interceptor, which are currently operational on U.S. Navy ships deployed across the globe....

Initial indications are that all components performed as designed. Program officials will conduct an extensive assessment and evaluation of system performance based upon telemetry and other data obtained during the test.<sup>86</sup>

**June 26, 2012, Test.** MDA states that this flight test “was the second consecutive successful intercept test of the SM-3 Block IB missile and the second-generation Aegis BMD 4.0.1 weapon system.” MDA states that

The Missile Defense Agency (MDA) and U.S. Navy sailors in the USS LAKE ERIE (CG 70) successfully conducted a flight test of the Aegis Ballistic Missile Defense (BMD) system, resulting in the intercept of a separating ballistic missile target over the Pacific Ocean by the Navy's newest missile defense interceptor missile, the Standard Missile-3 (SM-3) Block IB.

At 11:15 pm Hawaii Standard Time, June 26 (5:15 am EDT June 27), the target missile was launched from the Pacific Missile Range Facility, located on Kauai, Hawaii. The target flew on a northwesterly trajectory towards a broad ocean area of the Pacific Ocean. Following target launch, the USS LAKE ERIE detected and tracked the missile with its onboard AN/SPY-1 radar. The ship, equipped with the second-generation Aegis BMD 4.0.1 weapon system, developed a fire control solution and launched the SM-3 Block IB missile.

The USS LAKE ERIE continued to track the target and sent trajectory information to the SM-3 Block IB missile in-flight. The SM-3 maneuvered to a point in space, as designated by the fire control solution, and released its kinetic warhead. The kinetic warhead acquired the target, diverted into its path, and, using only the force of a direct impact, engaged and destroyed the threat in a hit-to-kill intercept.

Today's test event was the second consecutive successful intercept test of the SM-3 Block IB missile and the second-generation Aegis BMD 4.0.1 weapon system. The first successful SM-3 Block IB intercept occurred on May 9, 2012. Today's intercept is a critical accomplishment for the second phase of the President's European Phased Adaptive Approach consisting of the SM-3 Block IB interceptor employed in an Aegis Ashore system in Romania in 2015.

Initial indications are that all components performed as designed resulting in a very accurate intercept.<sup>87</sup>

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<sup>86</sup> Missile Defense Agency press release 12-News-0007, dated May 9, 2012, entitled “Second-Generation Aegis Ballistic Missile Defense System Completes Successful Intercept Flight Test.”

<sup>87</sup> Missile Defense Agency press release 12-News-0008, dated June 27, 2012, entitled “Second-Generation Aegis Ballistic Missile Defense System Completes Second Successful Intercept Flight Test.”

## **Endo-Atmospheric (SM-2 Block IV) Flight Tests**

The Aegis BMD system using the SM-2 Block IV interceptor has achieved three successful endo-atmospheric intercepts in three at-sea attempts, the first occurring on May 24, 2006,<sup>88</sup> the second on June 5, 2008,<sup>89</sup> and the third between March 24 and March 26, 2009.<sup>90</sup>

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<sup>88</sup> See Missile Defense Agency, "First at-Sea Demonstration of Sea-Based Terminal Capability Successfully Completed," May 24, 2006 (06-FYI-0079); Gregg K. Kakesako, "Missile Defense System Makes History," *Honolulu Star-Bulletin*, May 25, 2006; Audrey McAvoy, "Ship Shoots Down Test Missile For The First Time," *NavyTimes.com*, May 25, 2006; "Navy, MDA Announce First Terminal Sea-Based Intercept," *Aerospace Daily & Defense Report*, May 26, 2006; Zachary M. Peterson, "Navy Conducts First Sea-Based Terminal Phase Missile Defense Test," *Inside the Navy*, May 29, 2006; and Jeremy Singer, "Sea-Based Terminal May Boost U.S. Missile Defense Capability," *Space News (www.space.com)*, June 12, 2006.

<sup>89</sup> See Missile Defense Agency, "Successful Sea-Based Missile Defense Intercept," June 5, 2008 (08-NEWS-0068); Dave Ahearn, "Aegis, SM-2 Interceptors Kill Target Missile In Terminal-Phase Success," *Defense Daily*, June 6, 2008.

<sup>90</sup> "Navy Completes Air and Ballistic Missile Exercise," *Navy News Service*, March 26, 2009.