



***AEGIS***

***BALLISTIC***

***MISSILE***

***DEFENSE***

***Aegis Ballistic Missile Defense Overview to the  
National Defense Industrial Association***

***RADM Alan B. Hicks  
Aegis BMD Program Director  
18 June 2008***

**DISTRIBUTION STATEMENT A.  
Approved for Public Release;  
Distribution is Unlimited**



# Integrated Ballistic Missile Defense System

**Aegis BMD**

## Sensors



Defense Support Program



Space Tracking and Surveillance System



Sea-Based Radars



Forward-Based Radar With Adjunct Sensor



Midcourse X-Band Radar



Early Warning Radar

## Boost Defense Segment

## Midcourse Defense Segment

## Terminal Defense Segment



Airborne Laser



Kinetic Energy Interceptor



Aegis Ballistic Missile Defense / Standard Missile-3



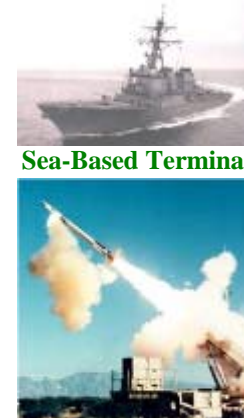
Multiple Kill Vehicle



Ground-Based Midcourse Defense



Terminal High Altitude Area Defense



Sea-Based Terminal



Patriot Advanced Capability-3

## Command, Control, Battle Management & Communications



NMCC USSTRATCOM USNORTHCOM USPACOM EUROM CENTCOM



**Aegis BMD**

## Link 16



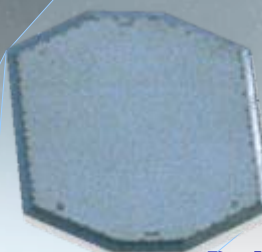
**Aegis Ballistic  
Missile Defense  
Signal Processor  
(BSP) Upgrade  
2010**



SM-3

Blk IIA  
2015+

# Open Architecture 2012



## Radar System AN/SPY-1



**Blk I / IA / IB**  
**2004/2006/2010**

## Sea-Based Terminal

SM-2 TBD

## Vertical Launching System Mark 41



**Blk IV**  
**2009**  
**Near**  
**Term**

**2015  
Far  
Term**

## Program of Record Quantities Thru 2013

	3
	15
	147
	2

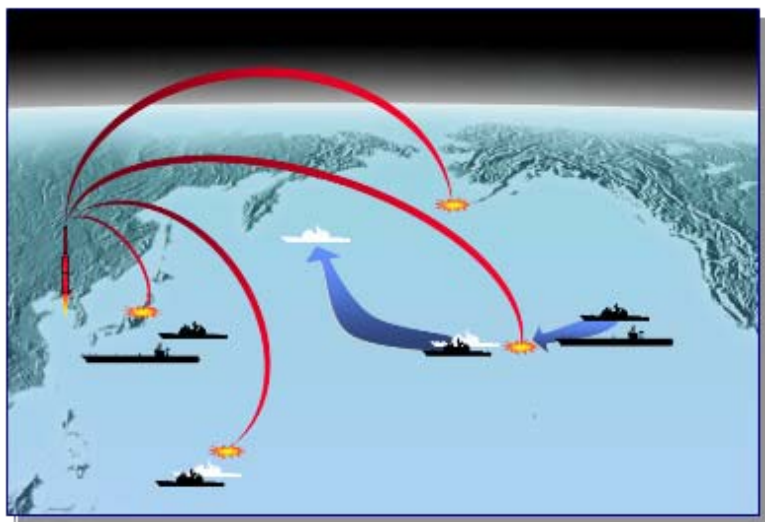




# Aegis BMD Contribution to the BMDS

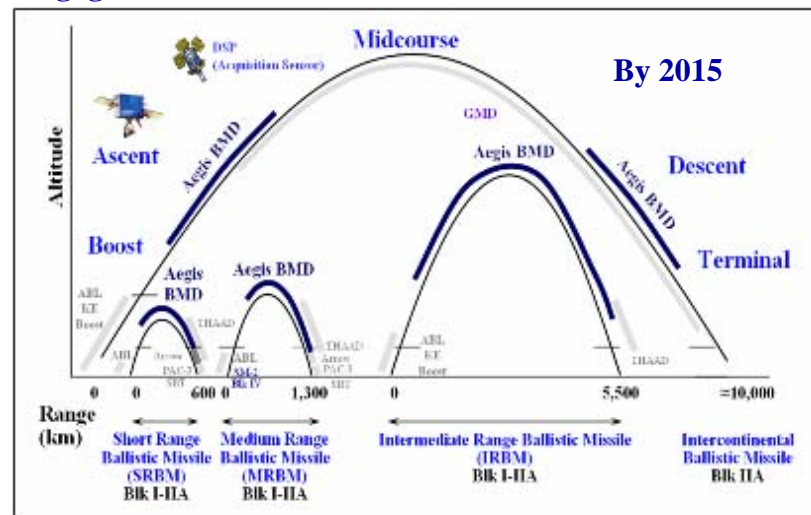
Aegis BMD

## Flexible Forward Defense vs. Ballistic Missile Threats



- Autonomous Operations in International Waters Moves Ballistic Missile Defense Forward From U.S.
- Counter-Ballistic Missile Strike, Forward Presence, and Multi-Mission Capabilities
- Surge Capability Scalable by Force Level and Geographical Considerations

### Engagement:



### Long Range Surveillance & Track (LRS&T)

— Fire Control Quality Track Data for Other BMDS Elements

### Global Presence

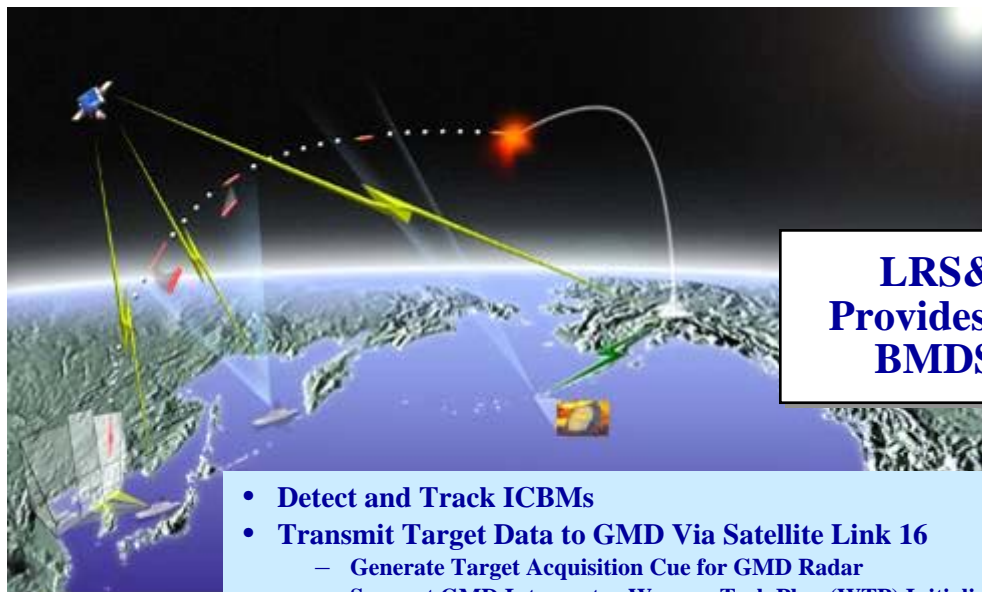




# Aegis BMD Block 04

*Aegis BMD*

- ✓ **Limited Defense Operations (LDO)**
- ✓ **Long Range Surveillance & Track (LRS&T)**
  - ✓ Sept 04
    - Destroyers “On Alert”
  - ✓ Aegis BMD 3.0E



**LRS&T Capability  
Provides Forward Based  
BMDS Surveillance**

- ✓ **Engagement**
  - ✓ **Preliminary Capability Spring 05**
    - Cruiser
    - Aegis BMD 3.0
    - SM-3 BLK I
  - ✓ **Block 04 Capability Spring 06**
    - Cruiser
    - Destroyer (End CY 06)
    - Aegis BMD 3.6
    - SM-3 BLK IA

- **Detect and Track ICBMs**
- **Transmit Target Data to GMD Via Satellite Link 16**
  - Generate Target Acquisition Cue for GMD Radar
  - Support GMD Interceptor Weapon Task Plan (WTP) Initialization



**Engagement  
Capability Defeats  
SRBMs, MRBMs, &  
Some IRBMs**

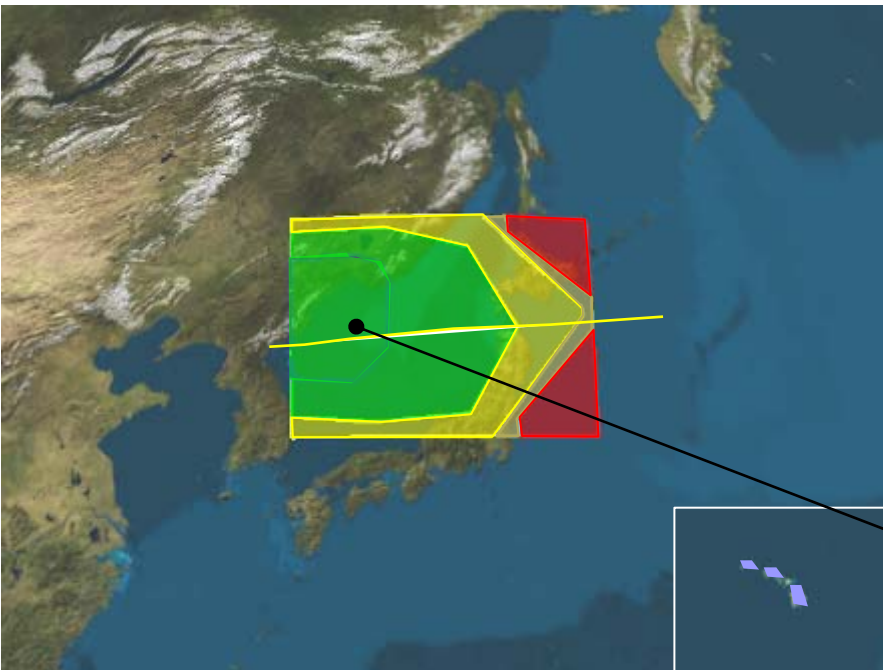


# Block 2.0 3.6 System Performance (Old "Block 04")

*Aegis BMD*

## Long Range Surveillance and Tracking

GMD Engage on Aegis



Aegis Organic Engagement \*



Includes defense of Okinawa

## Engagement

Launch on TADIL



Hawaii

Ship Locations Simultaneously  
Support All Three Operational Missions

\* Block 2.0 Threat Set

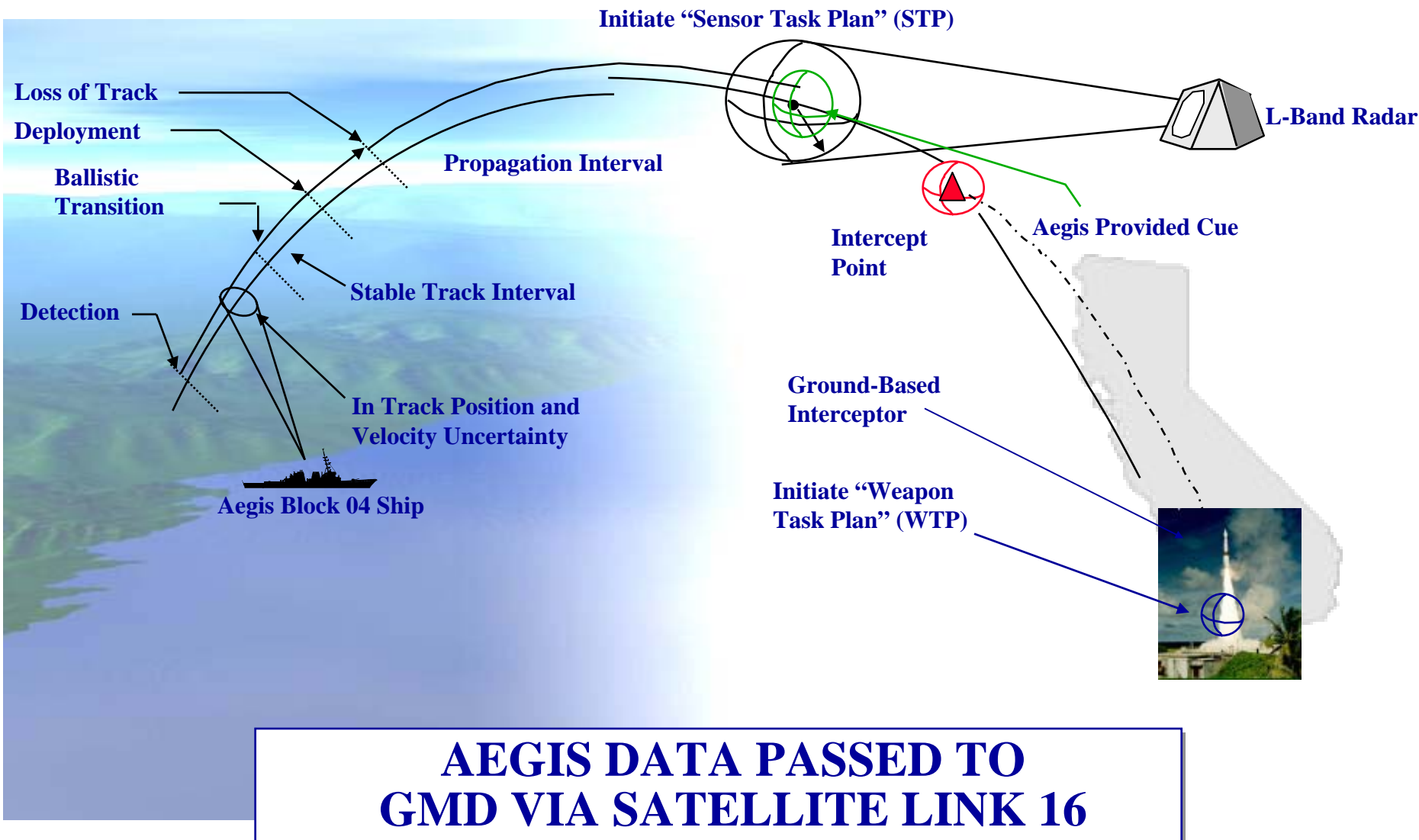
# AEGIS BMD BLOCK 2.0 CAPABILITY





# Long Range Surveillance Operations

Aegis BMD





# Aegis BMD SM-3 Evolution

## Spiral Development with Incremental Capability Improvements

**Aegis BMD**

### SM-3 Blk IA

- **Blk IA Kinetic Warhead (KW)**
  - 1-Color Seeker
  - Pulsed Divert/Attitude Control System (DACS)
- **13.5" Propulsion**
  - 2<sup>nd</sup> & 3<sup>rd</sup> Stage
- **MK 72 Booster**
- **MK 41 Vertical Launch System (VLS) Compatible**



### SM-3 Blk IB

- **Blk IB KW**
  - 2-Color Seeker
  - All-Reflective Optics
  - Advanced Signal Processor
  - Throttleable Divert/Attitude Control System (TDACS)
- **13.5" Propulsion**
  - 2<sup>nd</sup> & 3<sup>rd</sup> Stage
- **MK 72 Booster**
- **MK 41 VLS**



### SM-3 Blk II

- **21" Nosecone Japan Cooperative Research (JCR)**
- **Blk IB KW**
- **21" Propulsion**
  - 2<sup>nd</sup> & 3<sup>rd</sup> Stage
- **MK 72 Booster**
- **MK 41 VLS Compatible Light Weight (LW) Canister**



### SM-3 Blk IIA

- **21" Nosecone JCR**
- **Large Diameter KW**
  - Adv Discrim Seeker
  - High Divert DACS
- **21" Propulsion**
  - 2<sup>nd</sup> & 3<sup>rd</sup> Stage
- **MK 72 Booster**
- **MK 41 VLS LW Canister**



**(Part of IIA Development;  
Not Planned to be a Fielded Capability)**

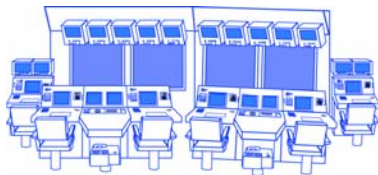




# Final Block 2004 Configuration

## - Aegis BMD 3.6 Engage / LRS&T Ships-

Rev: 3.0, 8/9/05

**Aegis BMD****Aegis Display System Mark 2**

- ✓ BMD 3.6 Computer Program

**Command & Decision System Mark 2**

- ✓ BMD 3.6 Computer Program
- C&D Adjunct Computer
- Joint Tactical Terminal
- ✓ Integrated Mission Planner

**Weapon Control System Mark 8**

- ✓ BMD 3.6 Computer Program
- ✓ SM-3 Blk IA Sustain Mode or Pulse DACS
- ✓ SM-3 Launch on TADIL
- SM-2 AAW

**Radar System AN/SPY-1**

- ✓ BMD 3.6 Computer Program
- Programmable Energy Sig Pro Mods
- ✓ Integrated Satellite System Calibration Computer

**Fire Control System Mark 99**

- Supports SM-2 Engagements

**Aegis Combat Training System Mark 50**

- ✓ Upgraded to Support BMD Training

**Missile Downlink System (T&E, CG Only)**

- Receives KW Downlink
- Supports Kill Assessment

**Operational Readiness Test System Mark 7**

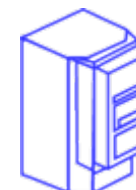
- ✓ Upgraded to Monitor SPY BMD Functions

**Vertical Launching System Mark 41**

- VLS – GPS Integration
- ✓ Upgraded Computer Program
- ✓ Supports any Missile – any cell
- ✓ SM-3, SM-2 (all variants), VLA, TLAM

**Standard Missile-3**

- ✓ SM-3 Blk I Sustain Mode DACS
- ✓ SM-3 Blk IA Sustain Mode or Pulse DACS

**Tactical Data Links**

- ✓ CDLMS v3.4
- ✓ Upgrade to Support JRE

**Delta to 5.3.8**

✓ = Changes from 3.0



# Ship Deliveries

## - As of June 08 -



**Aegis BMD**

### Engagement and Long Range Surveillance & Track (Aegis BMD 3.6)



USS PORT ROYAL (CG 73)



USS LAKE ERIE (CG 70)



USS RUSSELL (DDG 59)



USS PAUL  
HAMILTON (DDG 60)



USS O'KANE (DDG 77)



USS SHILOH (CG 67)



USS JOHN S. McCain (DDG 56)



USS STETHEM (DDG 63)



USS FITZGERALD  
(DDG 62)



USS CURTIS WILBUR (DDG 54)



USS RAMAGE (DDG 61)



USS STOUT (DDG 55)



USS DECATUR (DDG 73)



USS MILIUS (DDG 69)



USS BENFOLD (DDG 65)\*\*

### Long Range Surveillance & Track (Aegis BMD 3.6)



USS HOPPER (DDG 70)  
Sept 2008



USS HIGGINS (DDG 76)  
Aug 2008



USS JOHN PAUL JONES  
(DDG 53) Oct 2008

PHBR SHIP

YOKO SHIP

NORVA SHIP

SDGO SHIP

\*\*Upgrade Installation in Progress



# Aegis BMD At-Sea Operations

## Aegis BMD

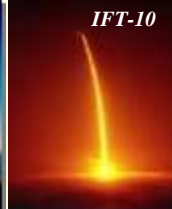
### LRS&T



GT-180  
Glory Boost  
First ICBM  
Tracking: 19 Sep 02



IFT-9



IFT-10

### Homeland Defense



PAC EX  
I, II, III



PAC EX IV

### JCTV-1



Joint Cooperative  
Research

### Pacific Phoenix



Sea Based Terminal

•Engage SRBM Threat  
(Teamwork Defense)

5 Jun 08  
FTM 14



20 Feb 08  
Intercept of  
Satellite

17 Dec 07  
JFTM 1



•First Launch  
on Remote  
Operation

6 Nov 07  
FTM 13



•First Firing from  
Japanese Destroyer

22 Jun 07  
FTM 12



26 Apr 07  
FTM 11 Event 4

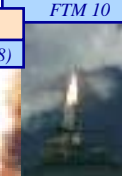


•Simultaneous BMD/AAW  
Engagements  
•Auto-BMD  
•Pulse DACS

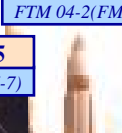
7 Dec 06  
FTM 11



22 Jun 06  
FTM 10



17 Nov 05  
FTM 04-2(FM-8)



24 Feb 05  
FTM 04-1(FM-7)



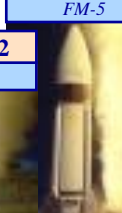
•Separating  
Warhead

11 Dec 03  
FM-6



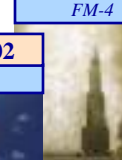
•No Notice  
Firing

17 Jun 03  
FM-5



•Descent Phase With  
Aim Point Adjust

21 Nov 02  
FM-4



•Ascent Phase  
Intercept

13 Jun 02  
FM-3



25 Jan 02  
FM-2



### Future Testing

- FTM-15 (2QFY09): Engage IRBM (Launch on TADIL)
- FTM-16 (4QFY10): SM-3 Block IB Engage MRBM

12 for 14 in SM-3 Midcourse Intercepts Including Japanese Intercept  
2 for 2 in SM-2 Block IV Terminal Intercepts  
1 for 1 in Real World Events





# FTM-14 Firing Event Description

*Aegis BMD*

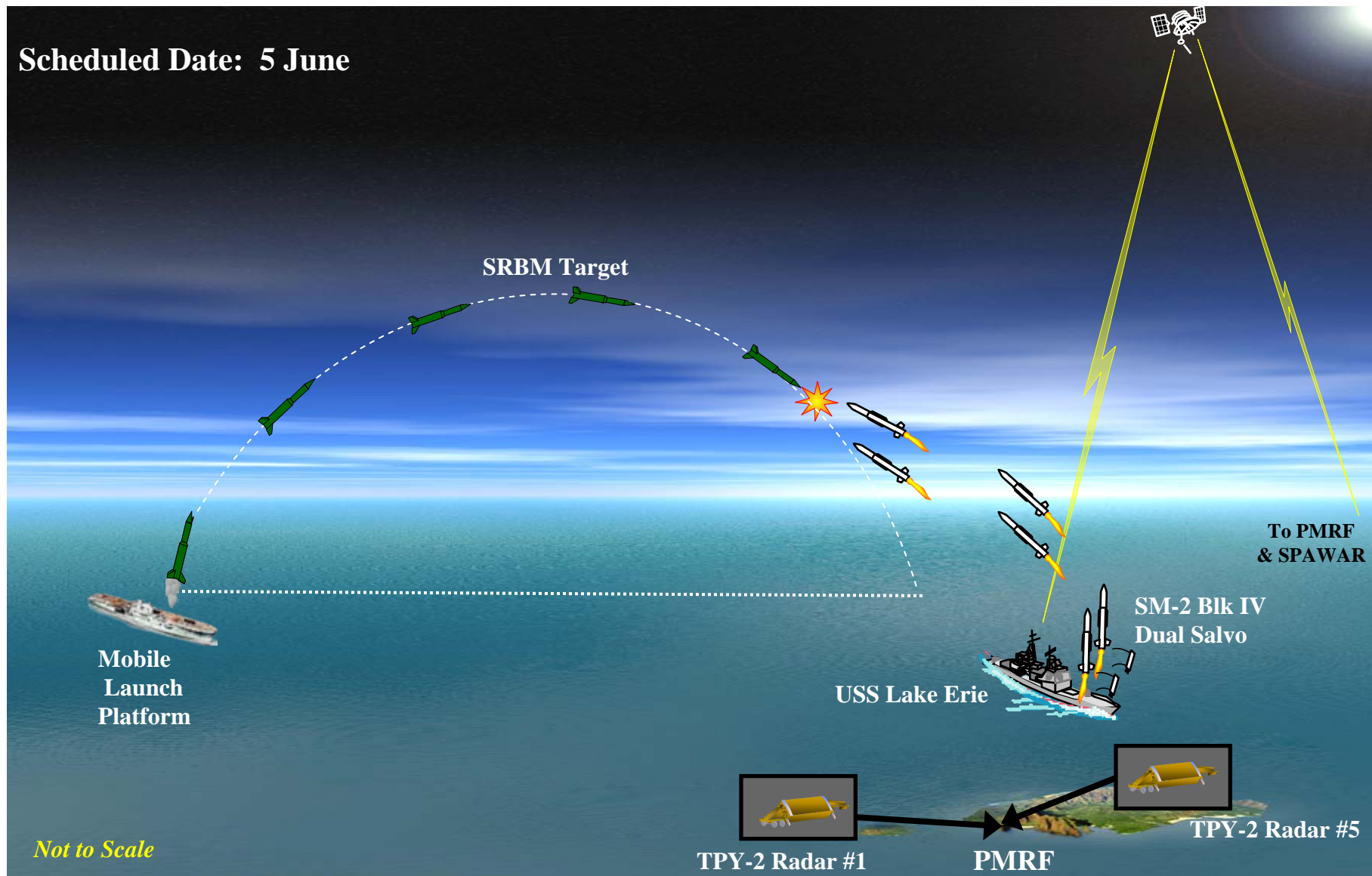
- **FTM-14 Is a Near-Term Sea Based Terminal (SBT) engagement of a FMA Group “A” SRBM incorporating:**
  - An Aegis BMD 3.6.1e configured CG with a SM-2 Block IV fuse modified missile.
  - Significant operational realism through the use of a combat ready Aegis BMD ship and crew, a no-notice target launch, and operational patrol areas.
  - BETD Mission Window for the Event is 1800 – 2100 Z, 5 Jun 08 (0800 – 1100 W, 5 Jun 08).
- **Participants**
  - Aegis BMD 3.6.1e Cruiser
  - THAAD/TPY-2 (Soldiers Only, No Link)



# FTM-14: Live Near-Term SBT Engagement

*Aegis BMD*

Scheduled Date: 5 June





# FTM-14 Firsts

*Aegis BMD*

- **First 3.6.1 Live Fire Event (3.6.1e)**
- **First FMA firing for ABMD (Event 1)**
  - Target launched from a barge “Out to In”
  - Same target system used for THAAD firing in FTT-07
    - 4 target launches to date from MLP
- **First Modified SM-2 BLK IV fired with BMD 3.6.1 (Event 1)**
  - Previous firing was with Linebacker derivative





# Modifications To Aegis Ballistic Missile Defense System To Accomplish Mission

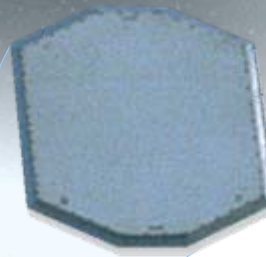


**Aegis BMD**

- Report Satellite as an Engageable Track
- Identify Satellite as Valid Target
- Compute Valid Intercept Points



- Revise Aimpoint to Increase Likelihood of Rupturing Hydrazine Tank



**Radar System  
AN/SPY-1**






**SM-3 Blk IA**



**Vertical  
Launching  
System Mark 41**

**Program of Record  
Quantities Thru 2013  
(MDA \$)**

	<b>3</b>
	<b>15</b>
	<b>147</b>



# Sensors and Missile Improvements With Increased Integration With BMDS

**Aegis BMD**

## Near-Term

### Tactical Capability



**Aegis BMD 4.0E/4.0/4.0.1**

- Enhanced Use & Support of BMDS ESGs
- Enhanced SRBM, MRBM & Limited IRBM Defense

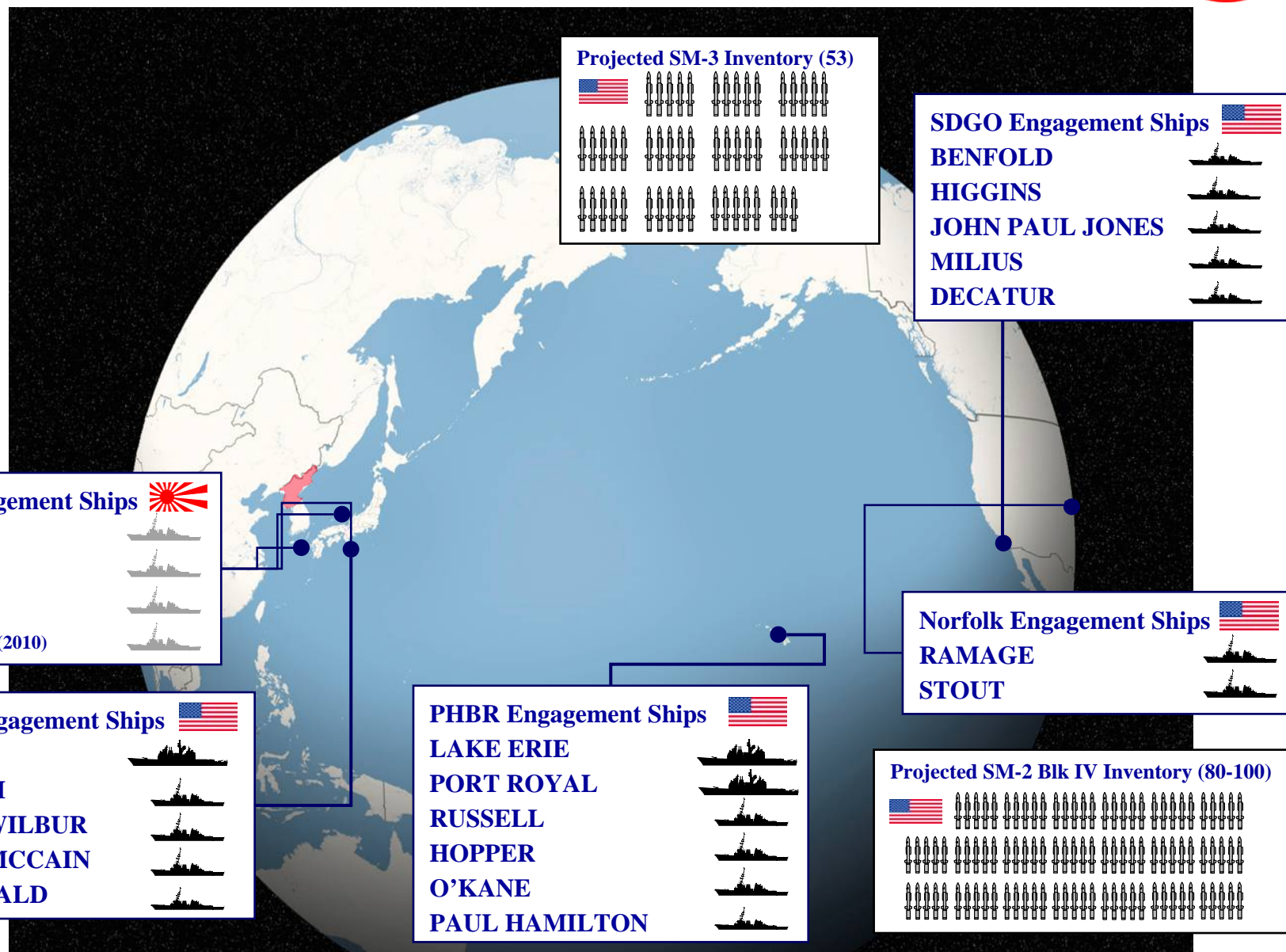
- AN / SPY-1 Radar with Aegis BMD Signal Processor (BSP)
- SM-3 Block IB Missile with Improved IR Sensitivity & Discrimination
- Launch on Remote with BMDS Sensor Cueing
- Tactically Certified Weapons System Capability (2010 / Aegis BMD 4.0.1)

**AEGIS BMD UNDERLAY SUPPORTS “3<sup>rd</sup> SITE”**



# The Aegis BMD Fleet – End of CY 2009

*Aegis BMD*













# Aegis BMD SM-3 Evolution

## Spiral Development with Incremental Capability Improvements

**Aegis BMD**

SM-3 Blk IA	SM-3 Blk IB	SM-3 Blk II	SM-3 Blk IIA
<ul style="list-style-type: none"> <li>• Blk IA Kinetic Warhead (KW) <ul style="list-style-type: none"> <li>– 1-Color Seeker</li> <li>– Pulsed Divert/Attitude Control System (DACS)</li> </ul> </li> <li>• 13.5" Propulsion <ul style="list-style-type: none"> <li>– 2nd &amp; 3rd Stage</li> </ul> </li> <li>• MK 72 Booster</li> <li>• MK 41 Vertical Launch System (VLS) Compatible</li> </ul> 	<ul style="list-style-type: none"> <li>• Blk IB KW <ul style="list-style-type: none"> <li>– 2-Color Seeker</li> <li>– All-Reflective Optics</li> <li>– Advanced Signal Processor</li> <li>– Throttleable Divert/Attitude Control System (TDACS)</li> </ul> </li> <li>• 13.5" Propulsion <ul style="list-style-type: none"> <li>– 2nd &amp; 3rd Stage</li> </ul> </li> <li>• MK 72 Booster</li> <li>• MK 41 VLS</li> </ul> 	<ul style="list-style-type: none"> <li>• 21" Nosecone Japan Cooperative Research (JCR)</li> <li>• Blk IB KW</li> <li>• 21" Propulsion <ul style="list-style-type: none"> <li>– 2nd &amp; 3rd Stage</li> </ul>  </li> <li>• MK 72 Booster</li> <li>• MK 41 VLS Compatible Light Weight (LW) Canister</li> </ul> 	<ul style="list-style-type: none"> <li>• 21" Nosecone JCR</li> <li>• Large Diameter KW <ul style="list-style-type: none"> <li>– Adv Discrim Seeker</li> <li>– High Divert DACS</li> </ul> </li> <li>• 21" Propulsion <ul style="list-style-type: none"> <li>– 2nd &amp; 3rd Stage</li> </ul>  </li> <li>• MK 72 Booster</li> <li>• MK 41 VLS LW Canister</li> </ul> 

(Part of IIA Development;  
Not Planned to be a Fielded Capability)



# Supporting An Increasingly Capable BMDS

## (Aegis BMD Spiral Evolution)

Rev: 2/16/06



Aegis BMD

- System Flexibility and Robustness
- BMDS Advanced Battle Management and Weapons Control

Enhanced Engage on Remote



SM-3 Block II / IIA



Advanced KW

- Feature Aided Track Correlation (FATC)
- Open Architecture

- Missile Kinematic Capability
- BMDS Coordinated Battle Management

Engage on Remote



21" Propulsion

- Feature Data Exchange
- Sensor Registration
- Open Architecture

- Missile IR Engagement Capability
- BMDS Planning Capability



TDACS 2-Color Seeker

- Theater Engagement Coordination

- Ship RF Discrimination Capability
- BMDS Fire Control Connectivity

Launch on THAAD

Enhanced Launch on TADIL



Aegis Ballistic Missile Defense Signal Processor (BSP)

- Greater Network Architecture Flexibility

Launch on FBX-T

Launch on TADIL



Aegis BMD Block 2004





# Aegis BMD Block IIA

## “SM-3 Cooperative Development Program”

*Aegis BMD*

- MDA/D Provided Direction to Incorporate IIA Development Into Aegis BMD in 22 Dec 05 Program Guidance Letter
- The 21" SM-3 Blk IIA Combined with BMDS Remote Sensor Data Provides:
  - Increased Defended Area
  - Increased Probability of Kill Against a Broader Threat Set
  - Reduces Force Structure Requirements
  - Improves Operational Flexibility
- PB07 Program Assumes Japan Work Share at ~50%
  - Cost Estimate \$2.1B  
(\$1B – Japan Estimated Contribution)
- SM-3 Block IIA Delivery End of 2015







# Greater Missile Reach Increases Defended Area

**Aegis BMD**

**SM-3 Block IB**

**SM-3 Block IIA**



**Aegis BMD 5.0/5.1/5.2**

- Enhanced Use & Support of BMDS ESGs
- SRBM, MRBM & Enhanced IRBM Defense & Limited ICBM Defense

- **Supports 3<sup>rd</sup> Site**

- Forward Layer of Defense Ascent Phase
- Underlay
- Additional Depth of Fire
- Interoperable Component of BMDS Including GMD and THAAD

**WORLDWIDE MOBILE CAPABILITY**



# Aegis BMD Congressional Adjustments FY05-08



**Aegis BMD**

## Weapon System Updates

- +\$108M
  - Aegis Ballistic Missile Defense Signal Processor (BSP)
  - S-Band Advanced Radar
  - Open Architecture

## Pacific Missile Range Facility

- +\$16.6M

## Standard Missile-3 Development, Manufacturing & Expanded Manufacturing Capacity

- +\$110M

## Asymmetric Threat Initiative

- +\$14M

## Sea Based Terminal

- +\$15M (Plus \$20M)

## Major Reports

- Assessment of Missile Defense Programs With Boost / Ascent Phase Capability (2006)
- Analysis of the Need for & Deployment of Asymmetric Missile Defense Capability (2006 & 2007)

PMRF



# Sea-Based Ballistic Missile Defense State of Play

**Aegis BMD**



## United Kingdom (UK):

- MDA Framework MOU
  - RDT&E Annex
- US / UK Type 45 BMD Capability Study completed

## Netherlands:

- LCF Frigates (3) SMART-L (L-Band) APAR, MK 41 VLS
- Completed successful tracking of TTV during FTM-11 (Dec 06)
- Looking at potential for SM-3 integration

## Japan:

- Upgrading 4 KONGO DDGs to BMD 3.6
- First Engagement Capable Ally in Dec 07
- Largest BMD Co-Development - SM-3 Blk IIA Co-Development – Flight Test in 2014/15
- Discussions on SM-3 Joint Maintenance Facility in Japan
- Radar (JUSRR) and Open Architecture (BMDOAR) Co-Research Annexes

## Spain:

- 4 Aegis (F-100) Ships: SPY-1D (S-Band), MK 41 VLS (B/L 3.4.8)
- 2 Aegis Ships (B/L 7.1)
- F-104 participated in FTM-12 to detect and track ballistic missile

## Germany:

- F 124 Frigates (3)
  - SMART-L (L-Band) & APAR
  - MK 41 VLS
- Plan to implement LRS&T capability
- MOU for LNO in Aegis BMD

## South Korea:

- 3 Aegis Ships Under Construction
- KDX-III Destroyers
  - B/L 7.1 COTS (C/R-2)
- Expressed Interest in Sea Based Terminal

## NATO ALTBMD Requirements:



- Integration Test Bed
- Aegis BMD providing sensor support to initial lower tier efforts

## Australia:

- 3 Aegis Ship Procurement (DDG 101-103)
  - B/L 7.1 OA
- MDA Framework MOU
  - 07 July 2004

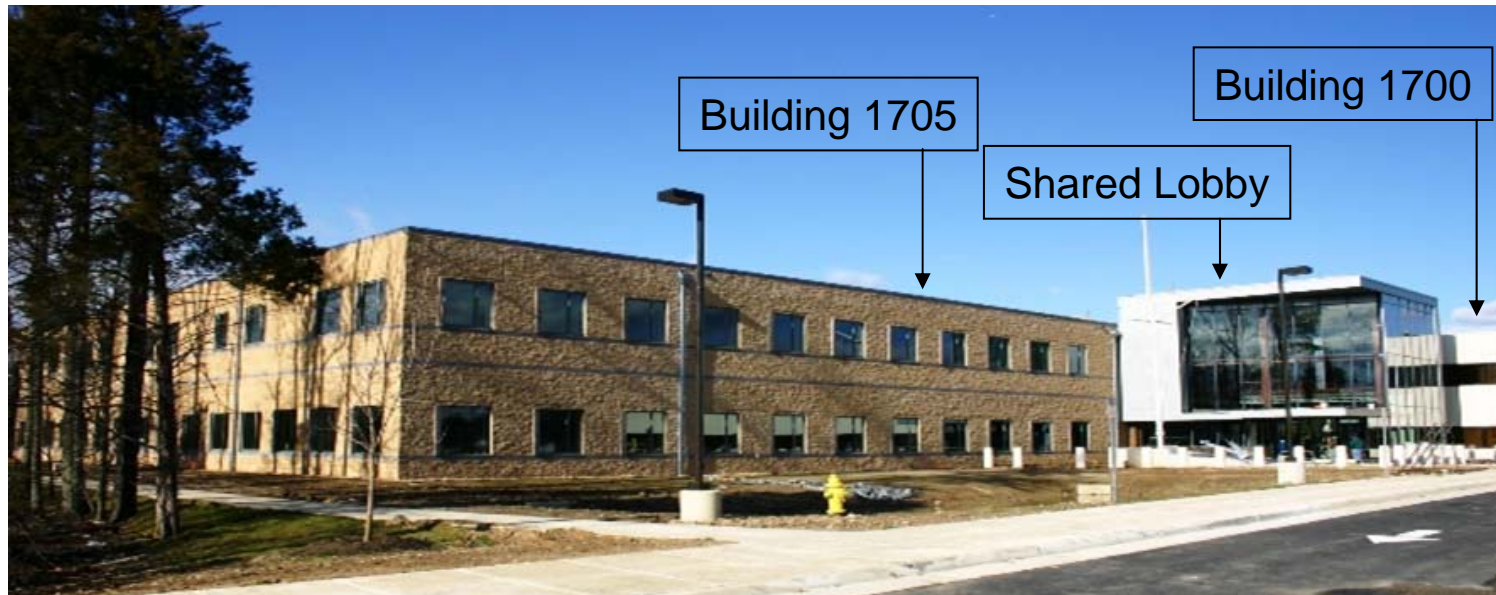




# Aegis BMD HQ Building #1705, Dahlgren

## – Aegis BMD Moved on 24 Aug 07 –

**Aegis BMD**



- **Aegis BMD Occupies Building 1705**
  - Part of a \$22M NAVFAC MILCON Project
  - Approximately 350 MDA/AB and Infrastructure Support Staff
- **Some Aegis Functions Still Housed in Temporary Facilities at Dahlgren**
- **Over 88% of Aegis BMD Government Staff Committed to the Move**
  - Received All Transfer of Function Letters.
- **FY08 Manpower**
  - Program Office: 339
  - Total Field Activities: 556
  - NSA-SP Field Activity: 128
- **Aegis BMD Huntsville Footprint Increasing**





# Where Is the...

*Aegis BMD*

# ...Missile Defense Fleet?

**Forward...At Sea...On Patrol**



**Enabling Capabilities, Providing Options for U.S. and Allies**