The Navy is evolving IAMD from Air Defense and Ballistic Missile Defense Capabilities

- BMD 3.6 Initial Capability against SRBM/MRBM deployed with limited AAW capability
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- AEGIS Baseline 8 deployed Open Architecture with Technical Data Collection capabilities, but focused primarily on Air Defense
- AEGIS Baseline 9 deploys IAMD capability balancing radar resources to conduct both Air Defense and BMD with an IAMD Mode along with NIFC-CA
- Future Development will deploy advanced sensors and integrated Softkill and Hardkill

Combatant Commander Demand for Navy IAMD Capability / Capacity is Increasing
CNO Sailing Directions

- Warfighting First
- Operate Forward
- Be Ready

“We will deliver credible capability for deterrence, sea control, and power projection to deter or contain conflict and fight and win wars.”

“We will address economic change by being effective and efficient. We will innovate to:

- Use new technologies and operating concepts to sharpen our warfighting advantage against evolving threats
- Operate forward at strategic maritime crossroads
- Sustain our fleet capability through effective maintenance, timely modernization, and sustained production of proven ships and aircraft
- Provide our Sailors confidence in their equipment and in their own skills.”

IAMD Provides Significant Advantages To A Forward Deployed Surface Navy
Rapidly Evolving Missions Drive Navy Capability Advancements

Operational Environment

- Humanitarian Assistance
- Short and Medium Range Ballistic Missiles
- Simultaneous Raids Across Multiple Mission Areas
- Persistent ISR
- Intermediate Range Ballistic Missiles
- Anti-Piracy
- Small Boat Attacks
- Stealth Under-Sea
- Torpedoes
- Complex Threats
- Employing Advanced Technology in Challenging Environments
- Cyber Warfare
- Anti-Ship Ballistic Missiles
- Sub-Sonic Anti-Air & Anti-Surface Missiles
- Super-Sonic Anti-Air & Anti-Surface Missiles
- Advanced Super-Sonic Anti-Air & Anti-Ship Missiles
- Advanced Super-Sonic Anti-Air & Anti-Ship Missiles
- Space Based BMD Tracking
- Enhanced Shipboard Sensors (Radar + ES/EA)
- Cyber Defense
- Multi-Ship Resource Coordination
- Rail Guns
- Directed Energy

Capability Advancements

- Integrated AAW & Situational Awareness
- Area Air Defense In Clutter Environments
- High Data Rate Battle Group Networks
- Over Land Defense
- Improved Self-Defense
- Integrated Air and Missile Defense
- Space Based BMD Tracking
- Enhanced Shipboard Sensors (Radar + ES/EA)
- Cyber Defense
- Multi-Ship Resource Coordination
- Rail Guns
- Directed Energy

IAMD is a Core Navy Mission Driving Capability Enhancements

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Navy Technical and Operational Architecture

- Navy surface forces operate in a regional joint networked environment with joint and coalition forces
  - Link 16 – Joint operations, situational awareness, BMD
  - Cooperative Engagement Capability – Integrated surface force tracking and engagement network, Navy IFC

- Surface combatant force foundation is Multi-mission operations
  - Area Air Defense, Ballistic Missile Defense, Under Sea, Surface, Strike, Naval Gunfire Support
  - Driven by COCOM requirements to operate forward

- Strategy of Advanced Capability Builds provides incremental warfighting improvements for countering evolving threats with new capability
  - Network based COTS computing environments enable rapid insertion of new capabilities to meet threat drivers
  - COTS allows for faster upgrades and reduces combat system variants
Navy Architectures Enable Effective Use of BMDS Networked Sensor Capability

**Current Systems**

- Individual on-board mission systems (AAW, BMD, USW, etc.)
- Ships with AAW focus or BMD focus
- Rotating Radars on Carriers
- Improved SPY-1 variants on CGs and DDGs
- Independent hard kill and soft kill systems
- CM/decoys for soft kill
- Organic and Cued BMD Engagements
- Extended battlespace through EOR using SPY-equipped ships and AEGIS Ashore

**Future Capability**

- Increased integration of off-board mission systems
- Integrated AAW and BMD
- Phased arrays on carriers
- Advanced phased array technology
- Integrated hard kill & soft kill
- Addition of electronic attack for soft kill
- Persistent Space BMD IR Tracking
- More flexible EOR expanding to other Navy/BMDS sensors

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Pushing the IAMD Mission Forward

Improved Mission Capability

Integrated Air & Missile Defense

Force Integration

Improved Small Boat Defense

Advanced Technologies

Improved Large Deck Self-Defense

Improved Theater ASW Defense

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### Enabling Developments

#### AEGIS Baseline 9 Combat System Upgrade

**Improved Mission Capability**

**Enabling Developments**

**Force Integration**

**Advanced Technologies**

<table>
<thead>
<tr>
<th>AEGIS Baseline 9 (BL 9)</th>
<th>Air Defense Cruiser</th>
<th>IAMD DDG</th>
<th>New Construction IAMD DDG</th>
<th>AEGIS Ashore</th>
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<td><strong>In-Service Destroyers</strong></td>
<td><strong>New Construction Destroyers</strong></td>
<td><strong>AEGIS Ashore</strong></td>
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<tr>
<td>(CG 59-64)</td>
<td>(DDG 51-78)</td>
<td>(DDG 113-118)</td>
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</tbody>
</table>

**Capability:**
- NIFC-CA
- CEC
- SM-2, SM-6
- ESSM
- No BMD
- No MMSP

**Capability:**
- IAMD
- CEC
- BMD 5.0
- NIFC-CA
- SM-2, SM-6, ESSM
- SM-3 Blk IA,IB
- CEC Interoperability Mods
- Link 16 Model 5
- IFF Mode 4

**Capability:**
- BMD only
- BMD 5.0/5.0 CU
- SM-3 Blk IA,IB
- Remote Launcher Mods

**Conducting Integration & Test w/ Tactical Builds**

**Conducting Integration & Test with Tactical Builds**

**Detailed Design in-progress**

**Detailed Design in-progress**

**Network Based COTS Combat Systems**

- In-Service DDG/CG Upgrade
- New Construction DDG
- AEGIS Ashore

**Integrated Air Def & BMD**

- Enhanced BMD
- Improved Networking
- Integrated Fire Control
- PAA Phase 2

**Development on Track for Delivery of Near Term Capability**

**BL 9 Adds DDGs & Land Based AEGIS with BMDS Connectivity**

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Enabling Developments
Multi-Mission Signal Processor (MMSP)
Enables IAMD for SPY-1 Radars

- Improved Performance in Littoral Environments
- Improved Performance Against Sea Skimmers
- Dual-Beam Operation
- Improved BMD Search
- Enhanced BMD LRS&T Performance
- AEGIS BSP Enhanced Range Resolution, Discrimination & Characterization

Improved Mission Capability

Enabling Developments

Force Integration

Advanced Technologies

Increased Threat Set

Dynamic Resource Allocation to Maximize BMD While Not Yielding AAW Defense

Real-Time Capability Displays

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AEGIS Common Source Library

Percent Code Re-use

AEGIS Baseline 9 managed in one Common Source Library (CSL)

- ACB 08
  - Baseline 9
  - CG Modernization
  - ~6000K SLOC
  - ~97% Re-use
- BMD 4.0.1
  - Baseline 9
  - DDG Modernization
  - ~8000K SLOC
  - ~99% Re-use
- BMD 5.0
  - Baseline 9
  - DDG New Construction
  - ~8015K SLOC
  - ~99% Re-use
- BMD 5.0
  - Baseline 9
  - AEGIS Ashore
  - ~8080K SLOC
  - ~99% Re-use

- BMD 4.0.1
  - ~97% Re-use of non UYK-43 code

- SPY-1D(V) Integration
  - ~15K SLOC
- AEGIS Ashore Adaptation
  - ~66K SLOC

AEGIS CSL Process Reduces Time and Cost of Development, Maintenance and Future Upgrades
Force Integration

Force Level Sensor and Weapons Coordination

- Integrated Force Level Kill Chain
  - Coordination of Netted Force Operations to Counter Mid-Term Threats
  - AEGIS-to-AEGIS SM-3 Weapons Coordination
  - AEGIS-to-BMDS Weapon Coordination
Agenda – NIFC-CA

Joint

NIFC-CA

Combat System Efforts

Future Roadmaps

RAM

ESSM

Standard Missile

SPY-1

MMSP

AMDR
NIFC-CA Kill Chains

- Provide an Engage On Remote (EOR) and Over The Horizon (OTH) air defense capability, utilizing the full kinematic range of active missiles
- Three Kill Chains: Each consists of an active missile, elevated sensor(s), a sensor network, and a weapon control system

From-The-Sea (FTS)
- E-2D - Advanced Hawkeye
- Cooperative Engagement Capability (CEC)
- AEGIS Weapon System (ACB12)
- Standard Missile (SM-6)
- JLENS (Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System)

From-The-Air (FTA)
- E-2D - Advanced Hawkeye
- Link 16
- F/A-18E/F
- Advanced Medium Range Air-to-Air Missile (AMRAAM)

From-The-Land (FTL)
- E-2D - Advanced Hawkeye
- JLENS
- Common TACTICAL Network
- Surface Launched Missile (AoA in progress)
NIFC-CA From The Sea Pillars

NIFC-CA FTS

E-2D
- Upgrade Radar & IFF
- Update E-2D/CEC Interface
- Produce E-2D
- Develop E-2D Radar sensor model

JLENS
- Define JLENS/CEC Interface
- Develop demo program concepts and plan
- Provide and maintain JLENS model
- Develop CPG-Lite for HIL/SWIL testing
- Conduct JLENS Demo and develop follow-on test and eval plan

CEC
- Develop E-2D, JLENS, and AEGIS Adaptive Layers
- Develop CEC IFC algorithms and kernel for non-SPY
- Develop/integrate CEC I/F to WSMR FCS Upgrade
- Develop CEC model
- Build P3I Terminal

AEGIS
- Open AEGIS Architecture
- Develop/install WSMR FCS Upgrade for risk reduction
- Define AEGIS/SM-6 I/F
- Define Fire Control algorithms for non-SPY
- Upgrade AEGIS/CEC I/F
- Develop AEGIS model
- Field via AMOD

SM-6
- Integrate AMRAAM seeker with BLK-IV airframe
- Define and implement guidance laws
- Define AEGIS/SM-6 interfaces
- Build missiles
- Develop SM-6 6-DoF model

NIFC-CA SEI&T
- Capture pillar requirements and performance and demonstrate SoS capability
- Integrate Pillar Models into a SoS End-to-End Federation to support SoS Analysis
- Conduct SoS performance assessment and validate SoS model
- Plan and execute SoS testing, leveraging pillar test events
- Identify and mitigate SoS risks to support delivery of NIFC-CA capability in 2014

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Force Integration
NIFC-CA/SM-6 Extends Battlespace

SM-6 Has A Large Intercept Envelope + Over The Horizon Capability

Current Ship System Engagement Capability

Ship System Capability with SM-6

Ship Sys Capability With SM-6 and Remote Sensor

Improved Mission Capability

Enabling Developments

Force Integration

Advanced Technologies
Enabling From the Sea

◆ Pillar Program Design & Development for NIFC-CA
  – Missile - Active seeker, extended range engagements
  – Combat System – Use of non-SPY sensor data
  – Sensor Network (CEC) – Integration and transfer of non-SPY sensor data
  – Sensors - Track data from elevated sensor

◆ Integration & Testing
  – Desert Ship upgrade to AEGIS ACB12 configuration
  – Rigorous land-based test series leading to at-sea firing events
  – Pillar Program models federated into System of Systems level tool
  – Test data/SoS Federation verification of NIFC-CA performance

Accelerating Effort for First At-Sea Firing in FY13
NIFC-CA Summary

- SoS design in place
- Pillar Program development/testing on schedule
- SoS test planning in progress
- Joint IFC Demonstration with JLENS planned for FY12

First At-Sea Event in FY13
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QUESTIONS?