

# *Modeling & Simulation for Enterprise Test and Evaluation*



*Shala Malone*

Combat Systems Performance Manager  
PEO IWS 7D  
202-781-2133  
Shala.Malone@navy.mil

*13 March 2008*

Distribution Statement A: approved for public release.

# Report Documentation Page

*Form Approved*  
*OMB No. 0704-0188*

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE <b>13 MAR 2008</b>	2. REPORT TYPE <b>N/A</b>	3. DATES COVERED <b>-</b>	
4. TITLE AND SUBTITLE <b>Modeling &amp; Simulation for Enterprise Test and Evaluation</b>		5a. CONTRACT NUMBER	
		5b. GRANT NUMBER	
		5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)		5d. PROJECT NUMBER	
		5e. TASK NUMBER	
		5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Program Executive Office for Integrated Warfare Systems, US Naval Sea Systems Command</b>		8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)	
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release, distribution unlimited</b>			
13. SUPPLEMENTARY NOTES <b>2008 DoD M&amp;S (Modeling and Simulation) Conference, presentations held in Orlando, Florida on March 10 - 14, 2008, The original document contains color images.</b>			
14. ABSTRACT			
15. SUBJECT TERMS			
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>	<b>UU</b>
			18. NUMBER OF PAGES <b>14</b>
			19a. NAME OF RESPONSIBLE PERSON



# Operational Context: Ship Self Defense



**Radars: SPS-49, SPS-48, SPQ-9B, MFR...**

*Ship Defense MOE  
Probability of Raid Annihilation ( $P_{RA}$ )  
is the ability of a particular stand-alone ship **as a system** to detect, control, engage, and defeat a specified raid of threats within a specified level of probability in an operational environment*



**CIWS/SEARAM sensor**



**ES, IRST**



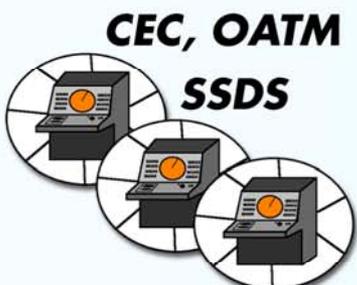
**SLQ-32, advanced ES**

**DEW**



**NATO Seasparrow, ESSM**

**Onboard EA**



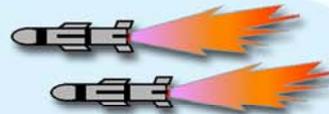
**CEC, OATM**

**SSDS**

**Open Architecture**

**TSCE**

**MK 214 Chaff**



**Multi-threat raid**

- Subsonic, supersonic, high diver
- Hi-G maneuvers
- Multi-mode seekers



**NULKA**

**MK 216 Chaff**



**CIWS gun**



**RAM**

*Battle Timeline  $\approx$  30 seconds*

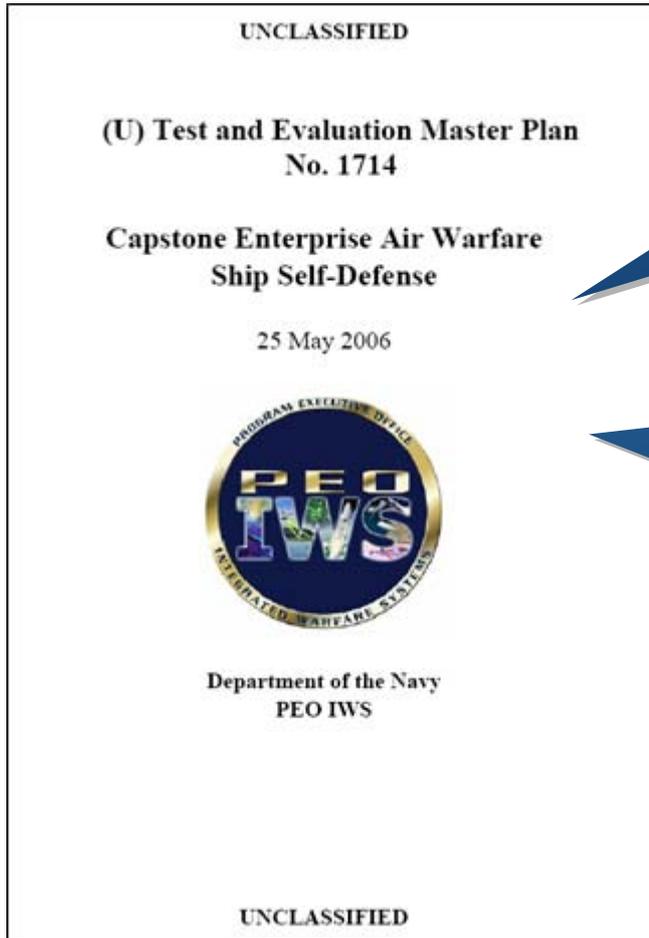
*Battle Space  $\approx$  0-12 nmi*



**Signature control**



# Enterprise Test & Evaluation Master Plan



The purpose of the Capstone Enterprise Air Warfare Ship Self Defense (AW SSD) Enterprise Test and Evaluation Master Plan (TEMP) is to consolidate all AW SSD at-sea testing and P<sub>RA</sub> Testbed testing

The AW SSD T&E Enterprise Strategy is founded on a two-tiered process to assess AW SSD warfare systems performance:

- 1) Validate models with live testing
  - Operational Ship testing
  - Self Defense Test Ship (SDTS) testing
- 2) Assess performance with models

*Test Events DT/OT-ET15 thru ET19 are formal P<sub>RA</sub> Testbed events*

*Includes DDG 1000, LHA 6, LCS and CVN 21 ship classes*



## *Enterprise P<sub>RA</sub> Testbed System Engineering – Drivers for Centralized IWS Leadership*

- **Systems performance for P<sub>RA</sub> assessment spans different technical communities and multiple managing program offices**
- **P<sub>RA</sub> will be assessed using a federation of interoperable simulations; it will not (cannot) be tested empirically**
  - Complex, multi-spectral, integrated HK/EW problem space
- **Many specific parameters, assumptions, and limitations are negotiated between the testing and acquisition communities**
- **The testing community is intent on consistent P<sub>RA</sub> assessment across ship classes and warfare system configurations**
  - Different hulls, different configurations...same threat models, same virtual range conditions

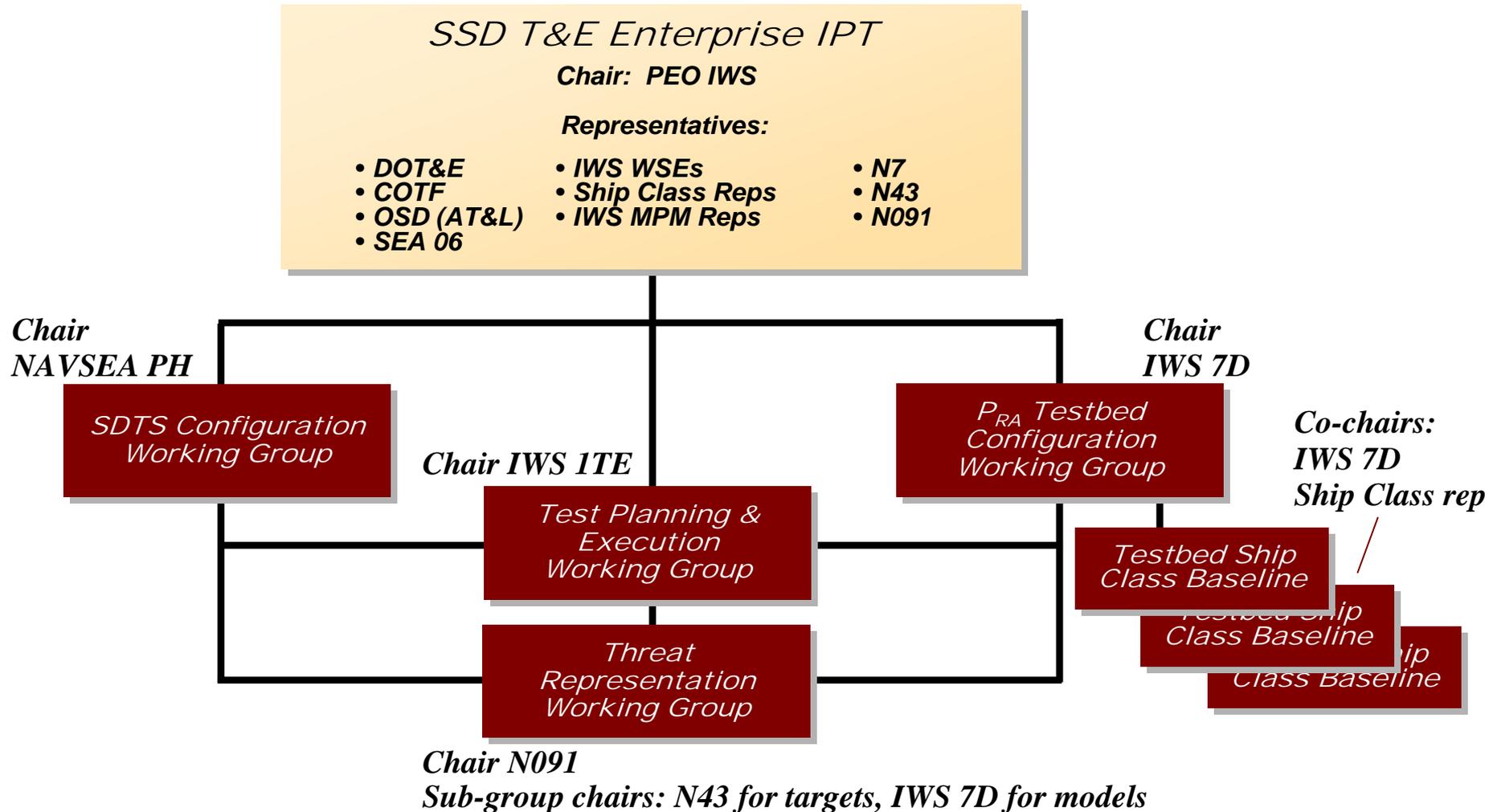


# *Enterprise Test Planning & Execution*

- **Non-traditional factors**
  - M&S events as formal test events
    - “Virtual Range” requirement
  - Expectation for formal, planned data flow from empirical testing to model validation
- **Organization and planning are combat-system-centric vice platform-centric**
  - Single Enterprise Test Team
  - Centralized management and resourcing of P<sub>RA</sub> Testbed
  - Multiple ship classes provide testing data supporting P<sub>RA</sub> Testbed component development and validation



# Navy Ship Self Defense T&E Enterprise IPT Structure



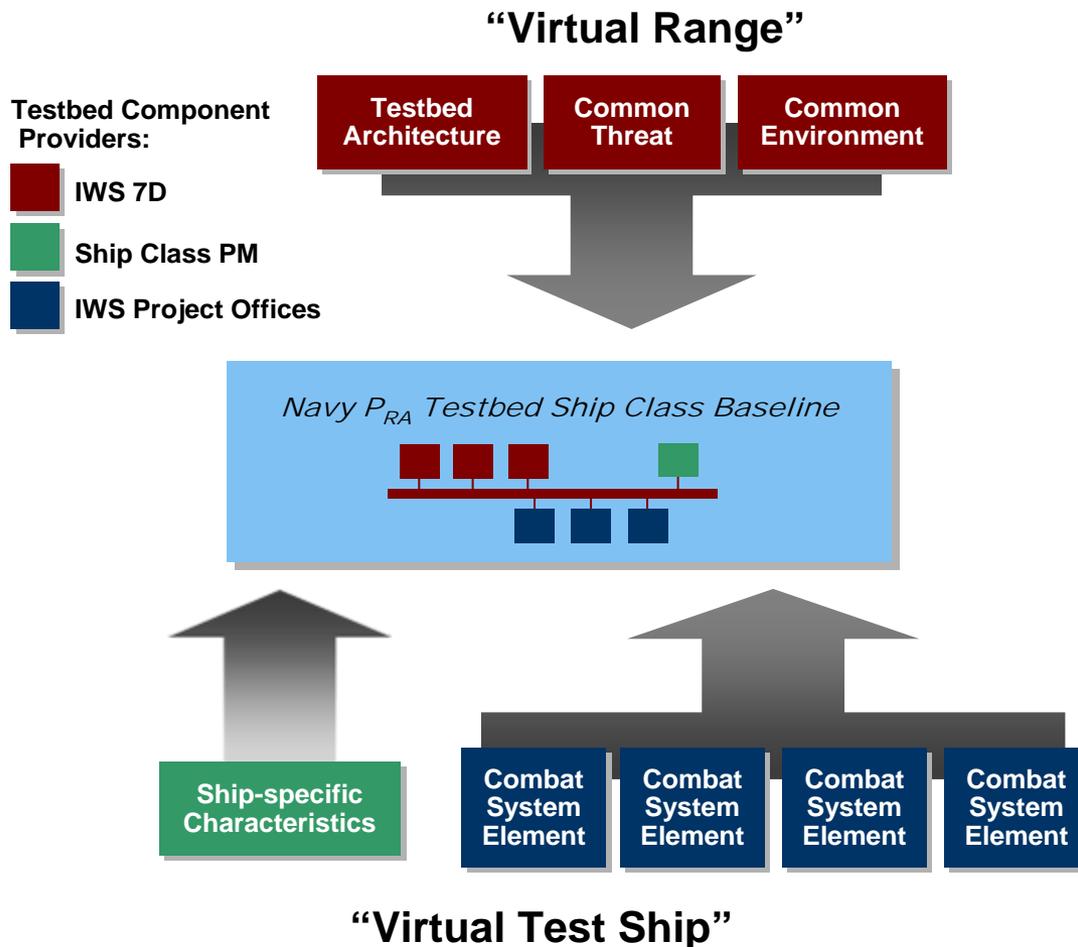


# *Enterprise P<sub>RA</sub> Testbed System Engineering*

- **Engineering one Enterprise Testbed, which is instantiated in several unique configuration baselines**
  - Formally accredited Baselines are correlated to Enterprise test events and ship class OPEVALs
  - Element Project Offices are vendors to Enterprise not individual ship classes
- **One master set of requirements for the Testbed**
  - Fed by both Enterprise SE and Baseline IPTs
  - Allocated and adjudicated according to Enterprise deliveries
- **A single Enterprise delivery may provide capability to more than one Testbed Baseline**
  - A single set of SE artifacts is maintained at the Enterprise level
- **Testbed-based Enterprise test events will be treated as empirical events**
  - E.g., test readiness reviews, test objectives



# Enterprise $P_{RA}$ Testbed Components



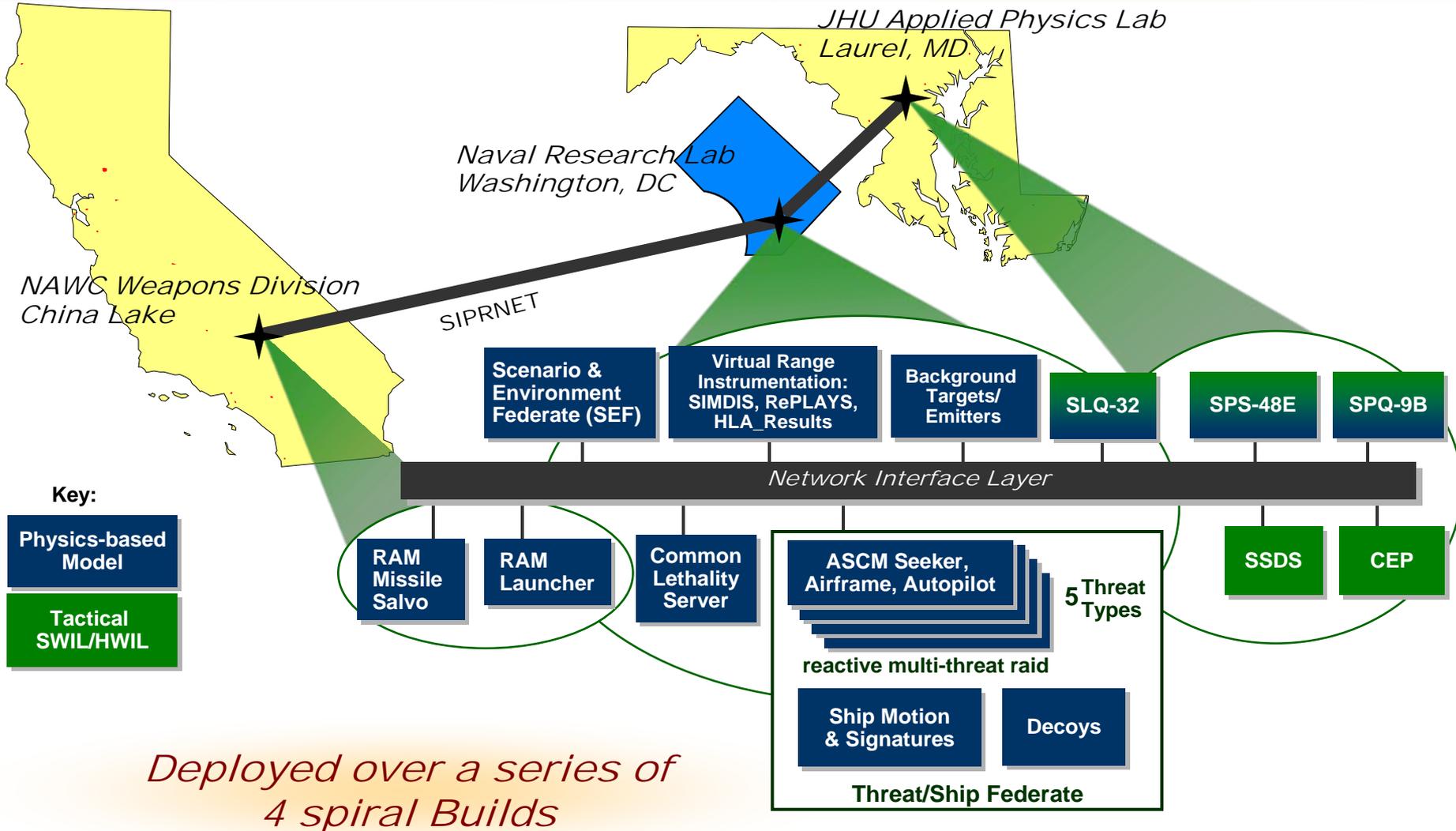


# *Current Simulation Framework Characteristics*

- **HLA federation implementation**
  - All system representations execute simultaneously for each ship defense engagement
- **Geographically distributed**
- **Constructive simulation, conservative time management**
- **System representations are a mix of digital models and tactical software**
  - Most representations are a hybrid of tactical SWIL and digital model
  - Most tactical SW re-hosted to general purpose computers



# $P_{RA}$ Testbed Deployment LPD 17 Baseline





# *Enterprise P<sub>RA</sub> Testbed Status*

- **P<sub>RA</sub> Testbed Configuration Working Group established under Ship Self Defense T&E Enterprise**
  - Testbed baseline IPTs established for current Enterprise ship classes: LHA 6, DDG 1000, CVN 21, and LCS
  - Enterprise Testbed Master Requirements initiated
- **LPD 17 Testbed Baseline nearing completion support of Ship Class OT&E**
  - CSSQT validation runs completed Dec 07; further V&V ongoing, leading to COTF accreditation
  - LPD 17 assessment planned for completion Dec 08



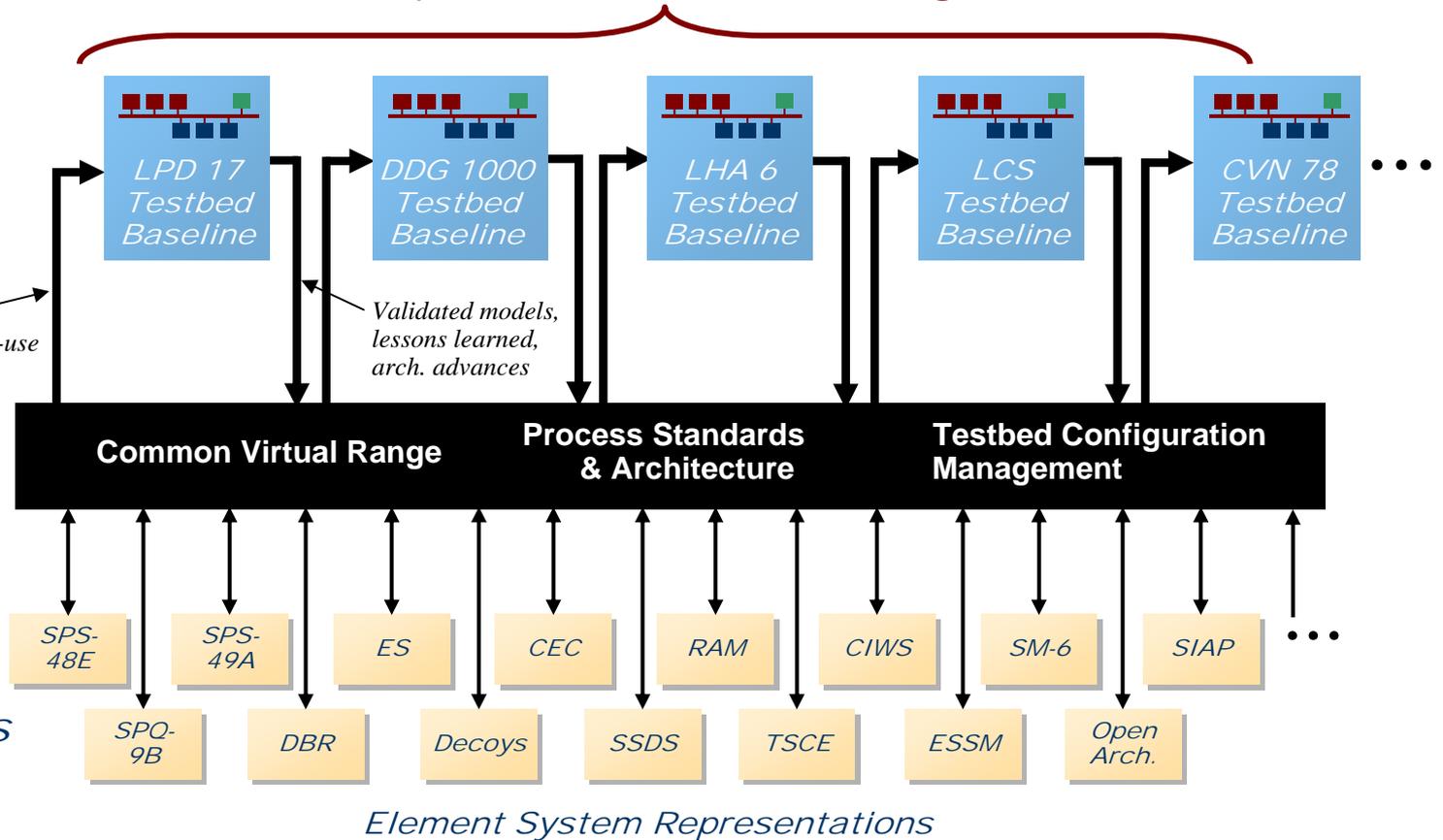
# Enterprise $P_{RA}$ Testbed Evolution

*Consistent Testbed development across ship classes and CS configurations*

Enterprise  $P_{RA}$  Testbed Baselines

PEO IWS 7D Leadership

PEO IWS Project Offices



*Significant cost avoidance through re-use of models, virtual range, & architecture*



## *Challenges Ahead*

- **Feedback of knowledge and capabilities to early phase acquisition systems engineering**
- **Improved mechanisms for injecting data needs into planning of empirical tests**
- **Relationship of  $P_{RA}$  Testbed simulations to other M&S supporting system development and T&E**
- **M&S capabilities development to support Family-of-Systems development**



*Questions?*

