

**Cost Of Corrosion  
(CoC)  
Working Group**

**NSRP SP-3 Update  
18 Jun 2008**



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- <sup>1</sup>Bob Stump National Defense Authorization Act for Fiscal year 2003, Pub. L. 107-314, Sec. 1067 (Dec. 2, 2002).
- <sup>2</sup>U.S. General Accounting Office, *Defense Management: Opportunities to Reduce Corrosion Costs and Increase Readiness*, GAO-03-753 (Washington, D.C.: July 7, 2003).
- <sup>3</sup>Department of Defense, *Report to Congress, Department of Defense, Long-Term Strategy to Reduce Corrosion and the Effects of Corrosion on the Military Equipment and Infrastructure of the Department of Defense* (Washington, D.C.: Dec. 2003).
- <sup>4</sup>U.S. General Accounting Office, *Defense Management: Opportunities Exist to Improve Implementation of DOD's Long-Term Corrosion Strategy*, GAO-04-640 (Washington, D.C.: June, 2004).
- <sup>5</sup>Department of Defense, *Corrosion Prevention and Mitigation Strategic Plan*, (Washington, D.C.: Nov. 2004).
- <sup>6</sup>Department of Defense, *Status Update on Efforts to Reduce Corrosion and the Effects of Corrosion on the Military Equipment and Infrastructure of the Department of Defense* (Washington, D.C.: May 2005).
- <sup>7</sup> LMI Government Consulting, *The Annual Cost of Corrosion for Army Ground Vehicles and Navy Ships*, April 2006.



# Eating The Elephant



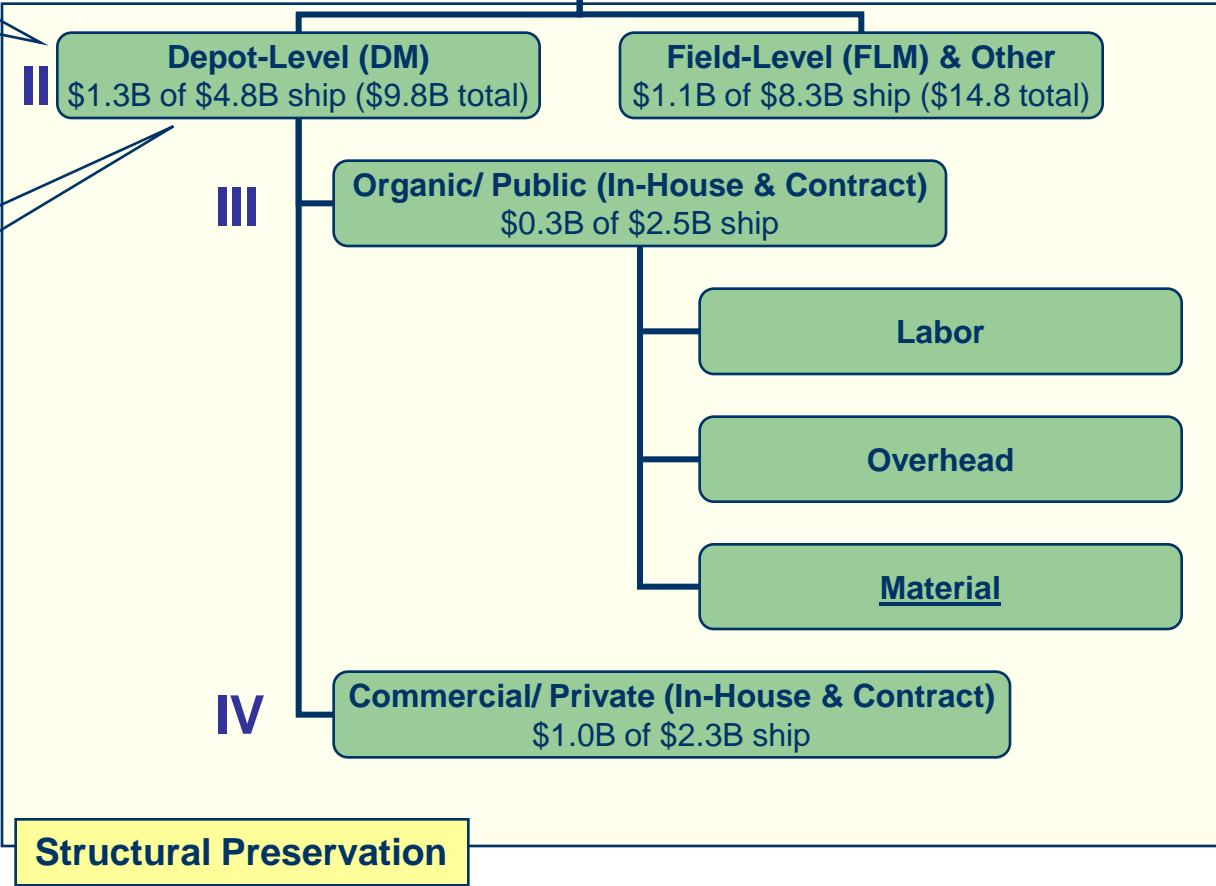
Navy Ship  
Cost of Corrosion  
(CoC)\*

Navy Fleet Maintenance  
\$24.6B total

Cost of Corrosion (CoC)  
\$2.4B

Non-Corrosion-Related  
\$22.2B

54%



27%

Team I.  
Comprehensive  
High-Level CoC  
Analysis (FY04)-  
•Depot-Level  
•Field-Level

Team II.  
High-Level DM  
Analysis (FY05)  
•Surface  
•Aircraft Carrier  
•Submarine

Team III & IV.  
Organic &  
Commercial DM  
Value Stream  
Analysis (FY06)  
•Tanks  
•U/W Hull  
•Non-Skid Deck

\* LMI, Annual CoC for Navy Ships, Apr 06 (FY 04)



# Continuous Process Improvement

## Cost Metrics – Depot Level Structural Maintenance

Area	Factors	Metric
Overall Measure	Cost "High-Cost Drivers"	\$ (actual)
Performance & Reliability	Cost/ Area/ Performance "Lifecycle Costs"	\$/ sq-ft/ lifetime
Maintenance Policy	Cost : Importance "Customer Alignment"	\$ : comp risk
Execution	Cost/ Area/ Time "Repair Cost Rates"	\$/ sq-ft/ avail
Overall Effectiveness	Failure "Corrective Costs"	\$ (corrective)





# High-Cost Drivers

## Conclusion

### Ship Structure & Coatings

#### •Tanks (123/ 176)

- Ballast
- CHT
- JP-5

#### •Decks (634/ 606)

- Non-Skid, Flight & Hangar Decks
- Deck Coverings

#### •Painting (631/ 605)

- Freeboard & Exterior Superstructure
- Underwater Hull
- Bilge
- Painting, Outside Machinery Spaces

### Surface Preparation

- Gas Freeing
- Chloride Mitigation
- Blasting Operations
- Power Tool Cleaning



# 2007 Recommendations

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- Improve and report Return Cost Measures and Metrics for ship structure and coatings maintenance. [Continued 2008 Global CoC effort.]

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- Study maintenance policy (\$:risk) with respect to—
  - Touch-Up [Addressed in CCAMM.]
  - Cosmetic Appearance [2008 Recommendation.]
  - Tank Inspection Periodicity [Addressed in CCAMM.]

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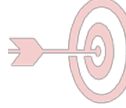
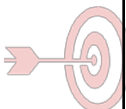
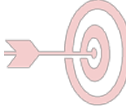
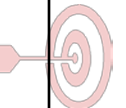
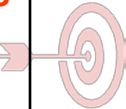
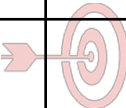
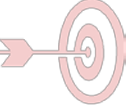
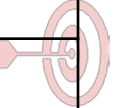
- Study performance and reliability (lifecycle costs) with respect to—
  - Component/ Coating Longevity [Addressed in ECAT-1. Recommend ECAT-2.]
  - Relative Humidity [Closed.] [Partially addressed in CCAMM.]
  - Cost of Deferred (Preventive) Maintenance [Partially addressed in CCAMM.]

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- Seek improvements to reduce Surface Preparation related costs (repair cost rates) for high-cost drivers.
  - Gas Free [Closed.]
  - Chloride Mitigation [Closed.]
  - Blast & Power Tool Cleaning [Addressed in SEA04 Paint Improvement Program.]



# 2008 Recommendations

AREA \ GROUP	All	Hull	Interior	Tank/ Void	Topside
All					
Technical Design		<b>Method - Flash Rust, Painting Over (CWP351)</b>		<b>Method - DFT Coverage, Cost-Benefit of 100%</b>	
Maintenance Planning	<b>Method - Structural Degradation CbM</b> 				<b>Machine - Cosmetic Appearance, Digital Inspection Of</b>  <b>Material - CRES Exterior Topside Materials, Use Of</b> 
Work Execution	<b>Measures - SI 009-99 Enforcement</b> 				
Continuous Improvement				<b>Machine-Enhance E-CAT</b> 	<b>Measures - Combat Systems, High-Cost Driver (992)</b> 



# Technical Design

## Painting Over Flash Rust

- The Navy is incurring excessive maintenance costs to achieve required WJ-2L (light flash rust) surface preparation standards, given the high performance/ reliability, and low risk experienced with freeboard and underwater hull coating systems.

• Change SI 009-32 to permit use of WJ-2M surface preparation standard for freeboard and underwater hull areas where WJ-2L is impracticable. This is CWP-TF-351.



# Technical Design

## Cost-Benefit of 100% DFT Coverage

- The Navy is incurring excessive maintenance costs and schedule losses to achieve required 100% holiday free tank coatings given the performance/ reliability and risk experienced with most tank & void coating systems.

- Change SI 009-32 to waive/ reduce cure-to-recoat times where touch-up is limited to less than 10% of the area being re-coated in new coating installations
- When using OAP coatings allow 95% coverage for primer coats provided final coating system is fully inspected for 100% coverage.



# Maintenance Planning

## Structural Degradation CbM Policy

- The Navy lacks graduated condition assessment criteria for evaluating structural degradation of steel strength and integrity.

- Establish technical basis/ assessment criteria for structural strength and integrity
- Model/possibly incorporate with the CCAMM coating condition scale in order to monitor the structural degradation/ material condition/ readiness of ship structure.



# Maintenance Planning

## Inspection of Cosmetic Appearance

- A significant proportion of coating applications are made for visual appearance. The general mandate to present a favorable appearance and maintain morale must be balanced with the need to minimize unnecessary maintenance.
- The Navy lacks clear/ consistent criteria for material readiness/ assessment of freeboard cosmetic appearance and cleanliness.

• Develop a reliable/ repeatable automated system based on ISIS visual algorithm to digitally assess freeboard material readiness, and incorporate its use in graduated condition assessment criteria/ score.



# Maintenance Planning

## Use Of CRES Topside Materials

- The Navy has approved many cost effective corrosion resistant alternative materials for use in exterior / topside applications. The problem is that these materials are not consistently deployed, and therefore, the potential maintenance cost savings are not being fully realized.

- Codify maintenance policy with respect to the use of corrosion resistant (composite, CRES, etc) materials. Includes deck grating/ catwalks, vent screens, electrical boxes, deck drains, CHT piping, rope guards, louvers, etc.
- Change GSO and TWH issue letter requiring use of corrosion resistant materials for depot-level maintenance/ repair.



# Work Execution

## SI 009-99 Enforcement

- Cost metrics provide an excellent measure of efficiency, customer value, and effectiveness, and are vital to decision making. Return cost data is rarely complete, standardized, accurate, or of sufficient level of detail or clarity.
- The Navy/ preservation community does not fully realize potential cost savings/ process improvements because it does not enforce consistent data collection and assessment of vital maintenance cost measures and metrics.

- Standardize reporting between ship programs and NSA's to support accurate depot level cost metrics.
- Improve enforcement of NAVSEA SI 009-99 and NAVSEAINST 4790.14 (Ship Departure Reports) for high-cost drivers.



# Continuous Improvement

## Enhance E-CAT

- The Navy does not fully realize the cost benefits of condition monitoring/ Condition-Based Maintenance (CbM) because it lacks the analysis tools to facilitate the assessment of system performance and reliability data.

• Enhance Expert Coating Analysis Tool (E-CAT) analysis software to render user-defined data sets using CCIMS data to support statistical analysis.



# Continuous Improvement

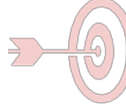
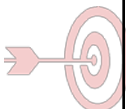
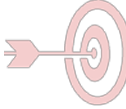
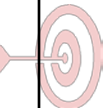
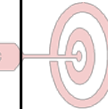
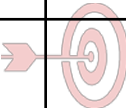
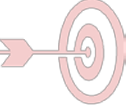
## Study Combat Systems High-Cost Drivers

- The Navy is not sufficiently addressing corrosion control maintenance issues related to critical combat systems.

- Conduct a detailed study of the effects/ impacts of corrosion to ship Combat Systems
- Identify maintenance improvement opportunities.



# Questions?

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