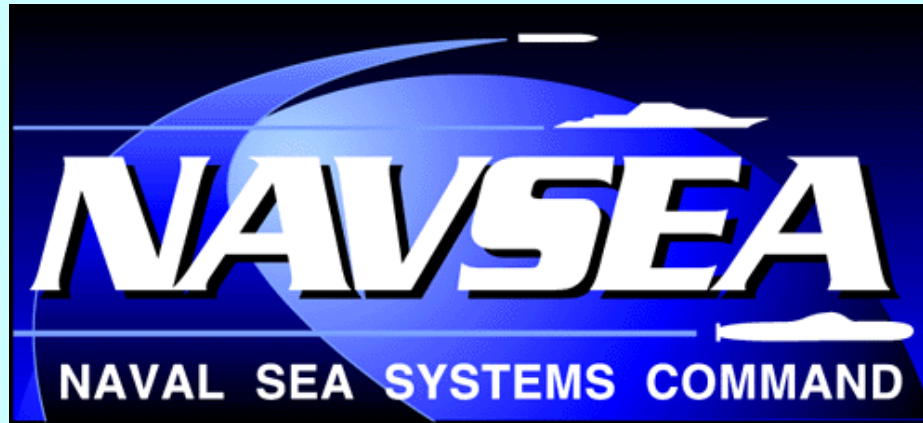


NAVAL SEA SYSTEMS COMMAND RECENT DEVELOPMENTS IN COATINGS



National Shipbuilding Research Program – SP-3 Panel

Aug. 2010

Mr. Mark Ingle, P.E.

SEA 05P23

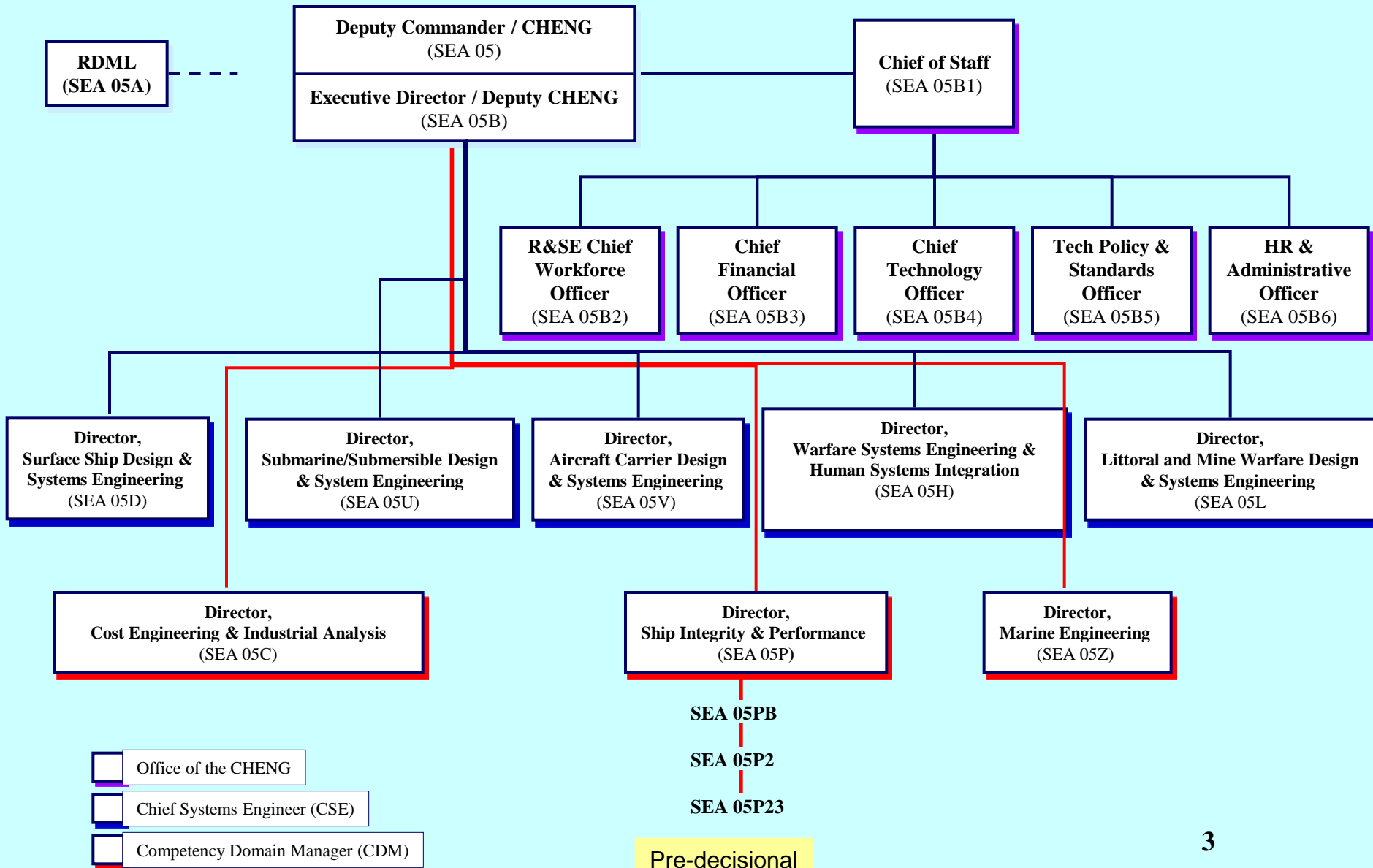
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OBJECTIVES

- Summarize evolving Naval Sea Systems Command (NAVSEA) organization and coating requirements:
 - Headquarters NAVSEA organization & Objectives.
- Summarize recent **accomplishments** in NAVSEA coatings and maintenance cost reduction strategies:
 - Updates to Standard Item 009-32.
 - Elimination of paint requirements for ship's fuel tanks.
 - Continue to expand applications for single-coat paint.
- Summarize FY-10 **initiatives** in NAVSEA coatings and maintenance cost reduction strategies:
 - Development of a high-solids, MIL-DTL-24441
 - Implementation of Enhanced Performance Topside Coatings.
 - Paperless quality assurance (QA) – PACE, Pat Rupert.
- Discuss Cooperative NAVSEA/NSRP Projects.
 - Study to Determine the Level of Salt Mitigation as related to the Accuracy of the Measurement.

Naval Systems Engineering Directorate (SEA 05)



Coatings & Corrosion Control Technical Pyramid

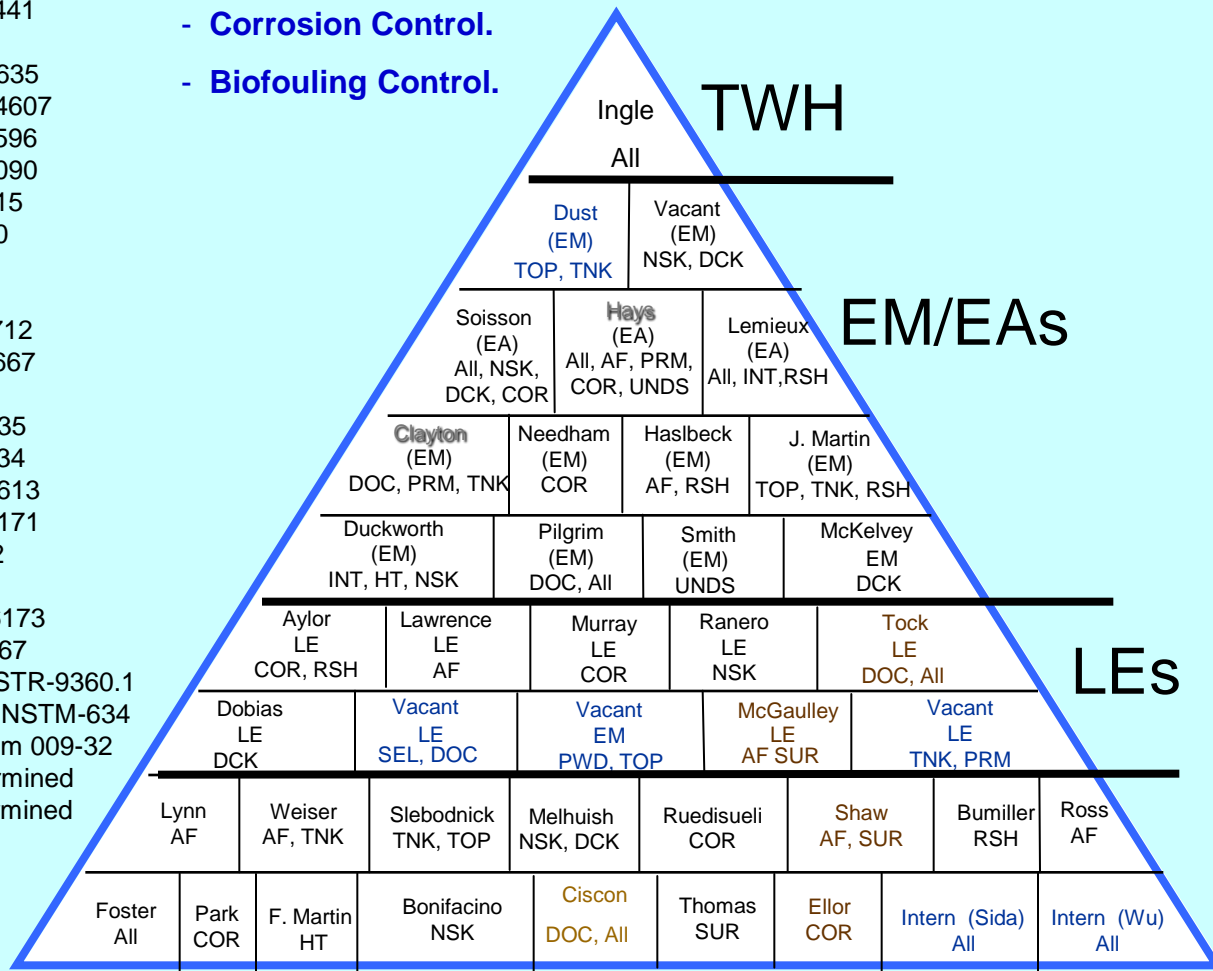
DRAFT Aug. 2010

Code - Product - Related Specifications

All - All Technical Products, Managerial	- All
AF - Antifouling Coating System	- MIL-PRF-24647
TNK - Tank Coatings, Epoxy Primers	- MIL-PRF-23236 MIL-DTL-24441
PRM - Primers, Single Component	- TT-P-645
TOP - Topside Coatings, Alkyd Colors	- MIL-PRF-24635
INT - Interior Coatings (SEA 08)	- DOD-DTL-24607 - MIL-PRF-24596 - MIL-DTL-15090 - MIL-DTL-1115 - MIL-DTL-700 - TT-P-28
HT - High Temp. Coatings, Metallic Corrosion Control Coatings	
PWD - Powder, Interior, Cosmetic	- MIL-PRF-24712
NSK - Non-Skid, High Temperature, Non-traditional	- MIL-PRF-24667
DCK - Deck Coverings	- MIL-PRF-3135 - MIL-PRF-3134 - MIL-PRF-24613 - MIL-PRF-32171 - MIL-A-22262
SUR - Abrasive blasting, surface preparation, pretreatments	
SEL - Sealants and Preservatives	- MIL-PRF-16173
COR - Corrosion Policy and Design	- DODI-5000.67 - NAVSEAINSTR-9360.1 - NSTM-631, NSTM-634 Standard Item 009-32
DOC - Policy Documents	
RSH - Research, Corrosion, Coatings	- To Be Determined
UNDS - Regulations, Underwater-hull, Flight-deck Cleaners, Cooling Water Fouling Control	- To Be Determined

Technical Warrant Holder (TWH) for Coatings & Corrosion Control responsible for:

- Coating Environmental Compliance.
- Corrosion Control.
- Biofouling Control.



Pre-decisional

Key: Navy employee, Navy Developmental Employee, Contractor Employee

OBJECTIVE

REDUCE TOTAL OWNERSHIP COST

- NAVSEA focused on reducing Total Ownership Cost (TOC):
 - Significant factor in performance evaluation.
 - Funding to support projects to reduce TOC.
- TOC proposals require use of a spreadsheet that includes:
 - Specific cost and service life data fields.
 - Discount rate of 4.2% per annum for future savings.
 - Five and ten year Return On Investment (ROI) review.
- Service life cannot be traded away for up-front cost savings.
- Performance risk needs to be managed by technical warrant holder.

Aug. 2010, HQ-NAVSEA SEA 05D & SEA 05P23, DDG-1000 Team Received NAVSEA Total Ownership Cost Award for Adjusting Edge Radius Requirements When Using High-solids Edge Retentive Paints.

New Requirement – Program Office must concur with reported savings.

Universal Paints Requirement Document

- Navy historically applied coatings to ships in accordance with:
 - NSTM 631 – Ship, submarine & carrier maintenance painting & ship's force painting.
 - Standard Item 009-32 – Maintenance work on ships.
 - Submarine Maintenance Standard (SMS), 631-081-015 – Maintenance work on subs.
 - New construction contract, RCOH contract, other contracts.
- Each document has its own, similar, but not identical requirements.

PROBLEM: Multiple requirements documents create training cost drivers & confusion.

SOLUTION: Reduce training, planning, & implementation costs by having one document.

Accomplishments:

1. SEA 00 letter directed use of Standard Item 009-32 as universal paints requirements document on 3 July 2008.
2. NSTM 631 updated to reference to Standard Item 009-32 on 1 Nov. 2008.
3. SMS updated to reflect use of Standard Item 009-32 on 1 June 2009.
4. FY-11 Standard Item 009-32 fully coordinated with SEA 08 and approved, via route sheet on 8 Dec. 2009. Issued by SSRAC in Dec. 2009 – in use today.
 - Requires single-coat paint in ballast tanks, voids, chain lockers.
 - Allows single coat as option in fuel tanks and well-deck overheads.
 - Allows retention of moderate level of flash rust on exterior, hull coatings.
 - Allows polysiloxane paints topside with option of single-coat polysiloxane on aluminum.
 - Eliminates requirement to paint CHT tanks at 50% relative humidity.

Universal Paints Requirement Document

July 2010 SSRAC Summary

Acknowledge the “Definition” of Touch-up and Expand Allowable Areas.

Changed surface ship "touchup" that **was** less than 1% and no area more than 10 sq.ft., to **now be** less than 10% and no area more than 10 sq.ft.

Rationale:

1. Consistent with current submarine practice.
2. Consistent with CCAMMS policy for a “fair” coating (i.e., previous requirement for a “good” coating).
3. Avoids leaving exposed bare metal because budgets will not support full re-preservation.

Allowed Steel Added to Ship’s Uncompensated Fuel Tanks to Remain Unpainted.

Changed Note 65 to allow “new” steel to be uncoated; but **required** “new” steel with pre-construction primer (PCP) to be over-coated with one coat of MIL-PRF-23236, Type VI, Class 5, at 4-6 mils.

Rationale:

1. Consistent requirement for new and existing steel in the tank.
2. Fuel & Engine Technical Warrant Holders (TWH) will not accept large areas of uncoated PCP due to potential for zinc release into fuel.
3. Costs still low, do not have to blast in tank.

Clarified that Only Uptake Spaces on Steel Ships (e.g., DDG-51) are Critical Coated Areas.

Modified which Uptake spaces are on critical list: only critical uptakes **are** "Gas turbine exhaust uptake spaces and trunks (steel surfaces only)."

Rationale:

1. Aluminum uptakes not subject to severe corrosion.
2. Fleet does not want to pay for added documentation for FFG, CG, LCS.
3. Aluminum uptakes still preserved.

Universal Paints Requirement Document

July 2010 SSRAC Summary

Reduce Environmental Requirements for Touch-up.

For individual areas 2 sq.ft. or less totaling less than 0.03 percent of the total surface area, **relax** 50% RH requirement for PW/FW tanks to be 85% RH to match what we allow for all other locations.

Rationale:

1. Small area equates to small risk.
2. High cost to dehumidify tank for such small repairs.

Allow Exposed Ends of Non-ferrous Piping.

Allow up to 6" of non-ferrous piping to remain bare when masking removed.

Rationale:

1. Non-ferrous piping does not corrode.
2. Small area will not drive galvanic corrosion.
3. Pure water reduces risk of galvanic corrosion.

Required Consistent Experience for Coating Inspectors.

Require uniform two years coating related work experience for NBPI, SSPC, and NACE certifications.

Rationale:

1. Uniform requirement to satisfy NAVSEA need for experienced personnel.
2. NAVSEA action to explore uniform (i.e., government and contractor) approach to compressing experience requirement.

Expanded Allowable Profile Range for Non-skid.

Allow profile readings of 3 - 6 mils, as compared with current requirement of 3 - 4.5 mil, with no individual reading over 7 mils (was 5 mils).

Rationale:

1. Non-skid can cover high profile.
2. Many decks have high profile already.
3. Still need to control pressure and grit size associated with unlimited upper profile.

Universal Paints Requirement Document

July 2010 SSRAC Summary

Prohibit Painting in High Winds.

Added requirement from NSTM 631 that was missing from 009-32, that painting shall not be performed when sustained winds exceed 15 mph, without an enclosure.

Rationale:

1. Painting in high winds wastes paint.
2. Overspray is greater problem in high winds.
3. Substrate contamination is greater in high winds.

Eliminated Requirement to Apply Antifouling Inside of Stern Tubes.

Eliminated requirement that interior surfaces of stern tubes and coupling covers get antifouling topcoat.

Rationale:

1. Low flow and low light areas do not foul.
2. Touch tacky requirement for antifouling primer leads to problems with workers in tight spaces.

Allowed Use of Salt Strip Technology to Measure Surface Conductivity.

Allowed use of salt strips: Conductivity samples shall be collected using a product that meets the requirements of NACE SP0508-2008, "Methods of Validating Equivalence to ISO 8502-9 on Measurement of the Levels of Soluble Salts"

Rationale:

1. Salt strips could reduce time and cost associated with conductivity measurement.
2. Strips passed NACE test at three salt levels, not just the one level normally required.
3. Favorable comments from field trial in Puget Sound, need final report by early Sept. 2010.

Universal Paints Requirement Document

July 2010 SSRAC Summary

Other Administrative Changes:

Added High Durability Deck Paint (MIL-PRF-32171) as option to some areas.

Replaced call outs for "Spongejet" media with new, SSPC AB-4 for "Recyclable Encapsulated Abrasive Media."

Added crushed glass as option for surface preparation similar to garnet, aluminum oxide, and black walnut shell.

Inaccessible areas will be as agreed upon with the supervisor.

Added option for sprayable dielectric shields using Sherwin Williams, Novaplate. Looking to qualify other products from other vendors.

Added polysiloxanes as option for wet space topcoat.

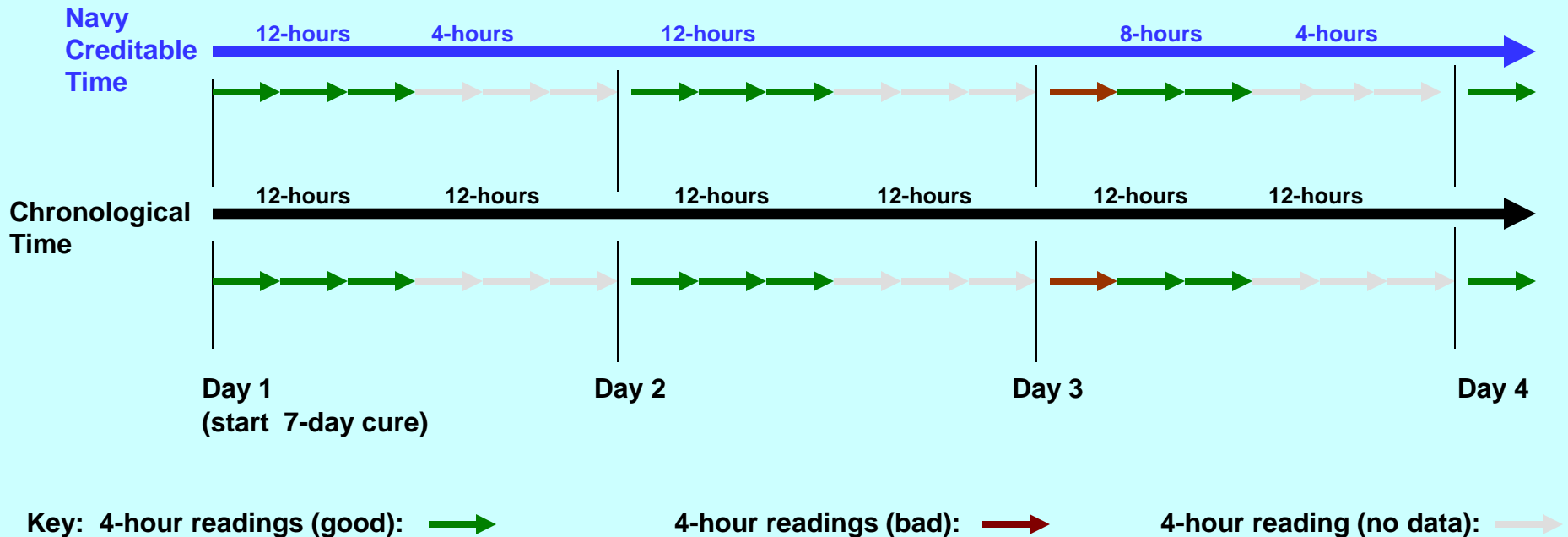
Added single-coat paint as option for CHT tanks.

Added powder coating as only option for DDG louvers, and as alternative option for all other removable louvers.

Waived paint storage requirement when MIL-PRF-23236 Type VII coatings are applied using a plural component spray pump with recirculation and preheating.

Universal Paints Requirement Document

- Navy shipyards requested “Creditable” hours concept be included to address limited ability to fund overtime.
 - Assume manual readings are being used for tank work and requirement is every 4-hours.
 - Time only applies to final cure, does not apply to overcoat window.
 - Must add up 168-hours of creditable cure time for a seven-day cure. May be more chronological time.



Example Above Shows 72-hrs of Actual Time Yields 40-hrs of Navy “Creditable” Cure Time

Single Coat Paint

- Application of rapid-cure, edge-retentive, high-solids paints in a single-coat more cost effective than applying multiple coats.

PROBLEM: Ultra-high-solids coatings require three coats (i.e., primer, stripe, and top coat) = Excessive Labor.

SOLUTION: Single-coat system based on application of a single color of paint, during a single coating evolution in the tank, with multiple passes of the paint gun. Cure time only four hours at 77F and one day to service.

Accomplishments:

1. FY-11, Standard Item 009-32 ONLY ALLOWS use of single-coat system in ballast tanks, voids, and chain lockers.
2. Completed single-coat installation on well-deck overheads with shipyard savings of \$246K.
3. SSN 688 Class SHAPEC incorporated notionals (≈30% paint application savings) into availability planning.
4. Completed demonstration installation of single-coat paints in submarine CHT tanks.
5. Completed one-year (April 2008 – Oct. 2009) inspection of single-coat on USS GREENEVILLE (SSN-772) – CCIMS Condition 1.
6. USS WASP (LHD-1) June, 2003 install, 20,000 sq.ft. tank still CCIMS Condition 1.

Single-coat Performing “As Advertised” Saving Time/Money.



When Fully Implemented

“Top down” cost estimate suggests annual savings of \$7.1M.

“Bottom Up” cost estimate suggests annual savings of \$6.5M.

High Solids MIL-DTL-24441

- Currently, 340 gram/liter MIL-DTL-24441 still widely used on carrier and submarines for potable water service.

PROBLEM: MIL-DTL-24441 requires three full coats, two stripe coats, one day between coats and seven days of ventilation in the tank for system to cure.

SOLUTION: Develop new, Type VI, high-solids, MIL-DTL-24441 that contains no reactive diluents.

Accomplishments:

1. March 2010, CWP group, lead by Norfolk Naval Shipyard that includes NAVSEA 04, 05, and 08 initiates funded project
2. Industry partners identified and initiating development of MIL-DTL-24441, Type VI based on:

Most Important:

- Similar formula to MIL-DTL-24441
- No added solvents
- Pass NSF, 500-gallon, potable-water test
- Rapid cure
- Edge retention
- Single coat

Least Important:

3. During Aug. 2010 status update, one industry partner has a 4:1 mix ratio product under test; while second vendor developing 1:1 product.



Potential order of magnitude reduction in time to paint freshwater tanks

Implementation of New Topside Paints

Office of Naval Research estimates Navy could save over \$5M/year by avoiding sailor/contractor labor to overcoat ships with fading Low Solar Absorbance (LSA) paint.

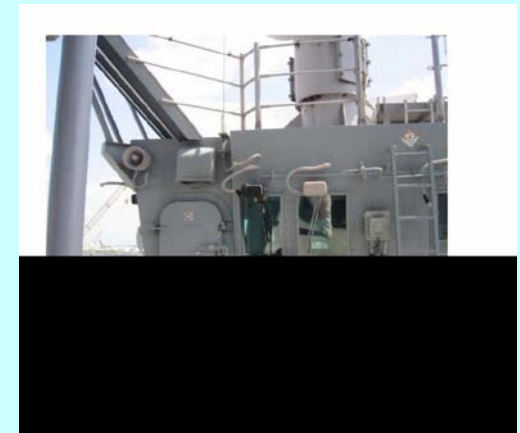
Problem: First generation LSA paints lose gloss and fade toward a “pink” color over time.
Color shift can occur in as little as one year.

Solution: Accelerate implementation of improved, MIL-PRF-24635, Type V, polysiloxane LSA paints with minimal color shift over time.

Accomplishments:

1. FY-11 & 12 Standard Item 009-32 Allows use allow epoxy/polysiloxane system on steel or one coat of polysiloxane direct to aluminum.
2. Qualified Sherwin Williams PXLE-80 and International Interfine 979 polysiloxanes in Feb. 2010 as MIL-PRF-24635, Type V paints. Qualified PPG/Ameron PSX-700 in May 2010.
3. Turn-key process to use polysiloxanes on ships. May 2010, USS BOXER (LHD-3) coated with polysiloxane.

Qualified siloxane on USS KEARSAGE (LHD-3)
No measurable color change after 17 months.



Why Use LSA Paints?


- **Low solar absorbance (LSA) topcoats developed by Naval Research Laboratory (NRL) in late 1990s to reduce heat load on DD-963s operating in Persian Gulf. June, 2000 first LSA paint installed on ex-USS FLETCHER.**
- **LSA topcoat applied to entire topside and superstructure. NRL measured 6F reduced temperature on structure. DD-963 class operated in Persian Gulf without expensive air conditioning plant upgrade.**
- **LSA coatings on lower portion of LCS-1 superstructure compared with uncoated aluminum – 12F reduced temperature.**
- **LSA coatings that color fade still reduce heat load on ship, reducing air conditioning plant energy consumption.**



LSA paint required since 2002, can reduce ship energy consumption when air conditioning operational

Implementation of New Topside Paints in Fleet

FY-12 Standard Item 009-32 provide option to use, polysiloxane paint.
Installations started with NRL demonstration under CIL-1 Program in Jan. 2006.

<u>Year</u>	<u>Ship</u>	<u>Location</u>
2006	USS PONCE (LPD-15)	Stack
2007	USS KEARSARGE (LHD-3)	Patch
2008	USS NIMITZ (CVN-68) USS KEARSARGE (LHD-3)	Mast Signal Shack
2009	ex-USS MISSOURI (BB-63) USS GERMANTOWN (LSD-42)	Entire ship Mast (single coat)
2010	 PLXE-80 & Interfine 979 on MIL-PRF-24635 QPL USS BOXER (LHD-4) USS ANTIETAM (CG-54)	Entire ship Planning for entire topside
2011	USS NIMITZ (CVN-68)	Planning for entire ship

Use of polysiloxanes reduces labor costs, two coats for steel topside instead of three, and one-coat direct to metal on aluminum.

Labor savings offset polysiloxane price of \$100/gallon vs. \$55 for silicone alkyd.

Key issue with polysiloxanes is touch-up and repair.

- 4:1 mix ratio.
- Low surface energy inhibits adhesion.
- Application over silicone alkyd inhibits performance.

Implementation of New Topside Paints in Fleet

- Polysiloxanes are two-part paints, not yet authorized for ship's force to use. Need Fleet input on how sailors support these new paints.

Options for Implementation Include:

1. Only allow sailors to use older style, silicone alkyd to touch-up polysiloxane.

PROS: Simple for sailors, no new materials or processes.

CONS: Must abrade substrate or adhesion problems can develop.

Excessive use of silicone alkyd would defeat the purpose of the polysiloxane.

Colors will mis-match over time as the silicone alkyd fades more rapidly than the polysiloxane.

2. Only allow sailors to use polysiloxane in cartridges.

PROS: Cartridges ensure proper mixing and due to limited volumes and relatively higher costs, cartridges may inherently limit the amount of touch-up painting likely to be conducted.

CONS: Must abrade substrate or adhesion problems can develop.

Cartridges are expensive, cartridge guns are expensive, and the costs may preclude the ship's from using the technology. Cartridges/guns require more training and are not "sailor proof."

3. Allow sailors to use polysiloxane in "small" kits (i.e., 1-gallon cans).

PROS: Low cost approach still allows paint to be brushed and rolled.

CONS: Must abrade substrate or adhesion problems can develop.

Kits are a 4:1 mix that could confuse sailors. Sailors might just apply the gray and forget about the smaller can leading to 100s of square feet of uncured paint on ships.

Pot life will lead to lots of solid paint waste (e.g., sailor goes to lunch and his pot of mixed paint is now solid).

CNSL & CNAL Expressed Interest in Moving Forward with Small Repair Kits.

SURFACE CONDITION MEASUREMENT TOOLS

(Pat Rupert, SEA 04XP)

The Digital Tools (Surface Profilometer, Dry Film Thickness (DFT) and Soluble Salt

Meters (SSM)) are authorized for use in collecting preservation data at all shipyards.

- **Surface Inspection Tool software certification complete and deployed to Naval Shipyard NMCI seats.**

All NSYs following a similar path for tool implementation.

- **Electronic Dry Film Thickness gage used in all yards.**
- **Electronic Profile gage used in 2 of 4 yards for data collection (PHNSY & PNS).**

Anticipate remaining yards acceptance NLT end of calendar year 2010.

- **Electronic Surface Salt meter – not yet in use at Naval shipyards**

Paperless QA Status Update:

- **A single process map is in development for Naval shipyard data collection incorporates Standard Item 009-32 requirements, procedures for using CQATK and procedures for using the instruments.**

- **Initial CQATK Working Group (CQATKWG) stood up to establish infrastructure**

Conclusions

- NAVSEA goal is to reduce coating total ownership costs from new ship acquisition through to ship disposal.
- NAVSEA completed:
 - Making single-coat paint mandatory in ballast tanks, voids, and chain lockers.
 - Allowing moderate levels flash rust on underwater hulls.
 - Qualified more durable, fade resistant topside paints.
- NAVSEA to continue with ongoing start tasks.
 - Transition to higher performance topside paints.
 - Development of a high-solids, MIL-DTL-24441
 - Support paperless QA tasks.
- NAVSEA to continue supporting NSRP with new materials & processes.

