

# **NAVAL SEA SYSTEMS COMMAND**

## **COATINGS & CORROSION CONTROL STATUS UPDATE**



**NATIONAL SHIPBUILDING RESEARCH PROGRAM**

**Sept. 2009**

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# OBJECTIVES

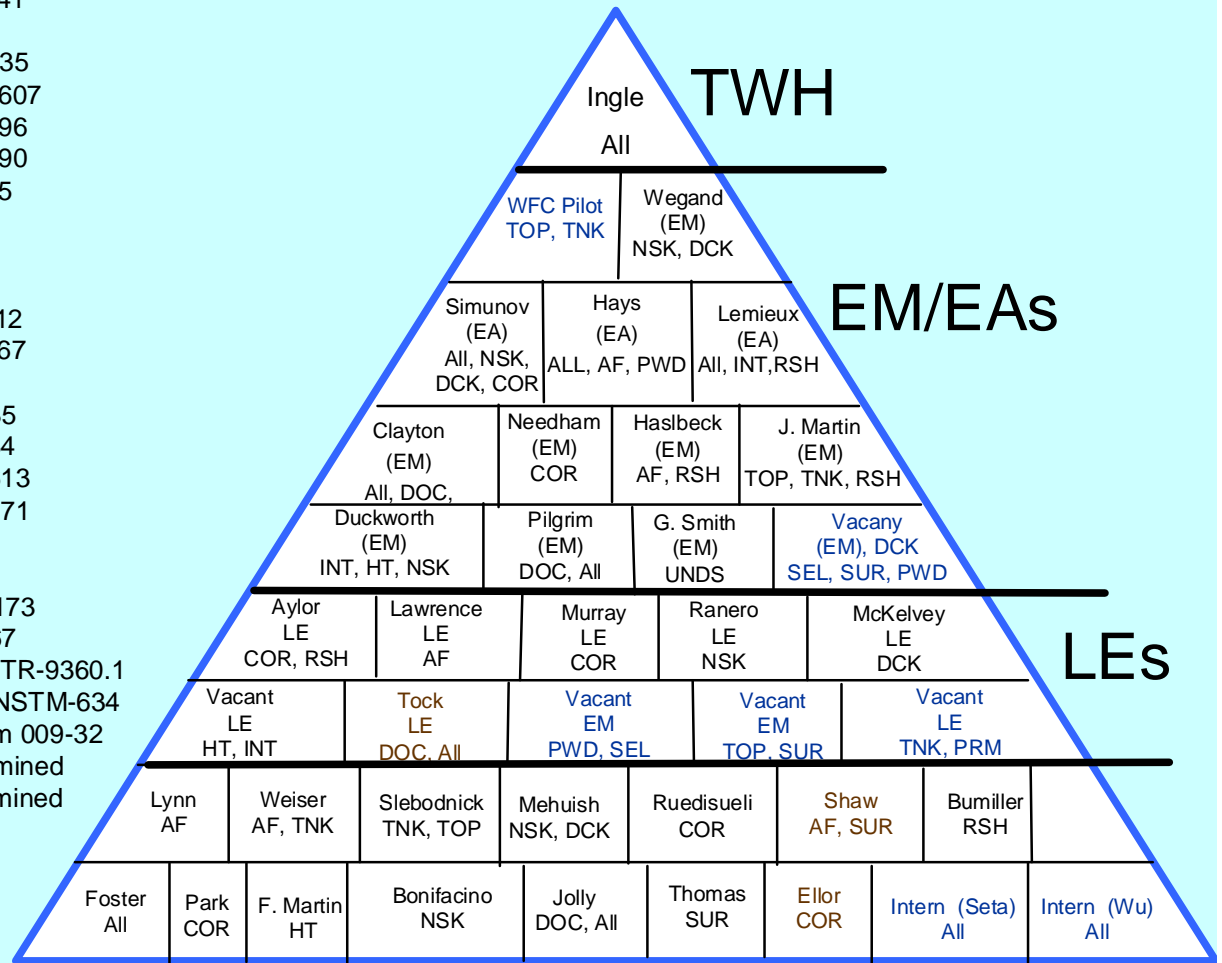
- **Update NAVSEA structure and organization.**
- **Summarize NAVSEA progress toward reducing coating application costs:**
  - **Standard Item 009-32 as a Universal Paints Requirements Document.**
  - **Reduce coating specification conformance test requirements.**
- **Summarize NAVSEA Progress toward reducing coating application costs Cumbersome Work Practices tasks:**
  - **Delete Stripe Coat.**
  - **Rapid Cure, Single Coat.**
  - **Moderate flash rust on underwater hull & freeboard.**
  - **Induction Heating Coating Removal.**
  - **Paperless QA & QA Tools.**
- **Discuss potential future interface with NRSP Research Projects and “new start” projects:**
  - **Retention of high-solids paint in tanks being repaired.**
  - **FY-10 Proposed CWP New Start Projects.**

# Coating & Corrosion Control Technical Pyramid

## DRAFT 17 Sept. 2009

### 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
DOC - Policy Documents	- NSTM-631, NSTM-634 Standard Item 009-32
RSH - Research, Corrosion, Coatings	- To Be Determined
UNDS - Regulations, Underwater-hull, Flight-deck Cleaners, Cooling Water Fouling Control	- To Be Determined



**Key:** Navy employee, Navy Developmental Employee, Contractor Employee

# Universal Paints Requirement Document

- Navy currently applies 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 Manual (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 and can lead to waterfront confusion.**

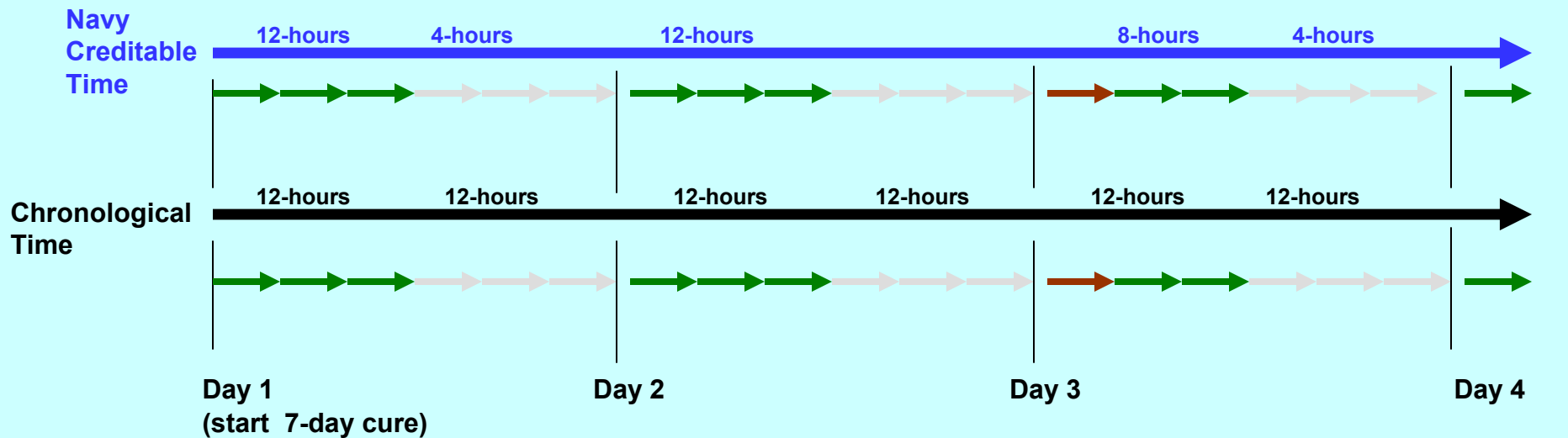
**SOLUTION: Reduce training, planning, & implementation costs by having one paint document.**

## Accomplishments:

1. ADM McCoy signed letter authorizing use of Standard Item 009-32 as universal paints requirements document on 3 July 2008.
2. NSTM 631 Update, to include reference to Standard Item 009-32 as paint requirement document, signed on 1 Nov. 2008.
3. SMS updated to reflect use of Standard Item 009-32 on 1 June 2009.
4. Comments on FY-11 Standard Item 009-32 due to SERMC by 19 Sept. 2009
  - Risk associated with not recoating ship's fuel tanks.
  - Data to support allowance of expanded storage temperature range.
  - Explaining the "Creditable" hours concept.
  - Risk associated with allowing higher relative humidity during MIL-DTL-24441 final cure.
  - Risk associated with allowing coating of CHT tanks at 85% RH.

# Universal Paints Requirement Document

- Navy shipyards requested “Creditable” hours concept be included in Standard Item 009-32 to address limited ability to fund overtime.
  - Assume manual readings are being used for tank work and requirement is to take readings every 4-hours.
  - This issue only applies to final cure, does not apply to overcoat window.
  - Creditable hours must add up 168-hours for a seven-day cure. Chronological time the tank is curing will be longer.



Key: 4-hour readings (good): 4-hour readings (bad): 4-hour period, no data:

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

# Coating Specification Conformance Testing

SEA 05P23 / NAVSEA / Shipbuilders / Shipyards

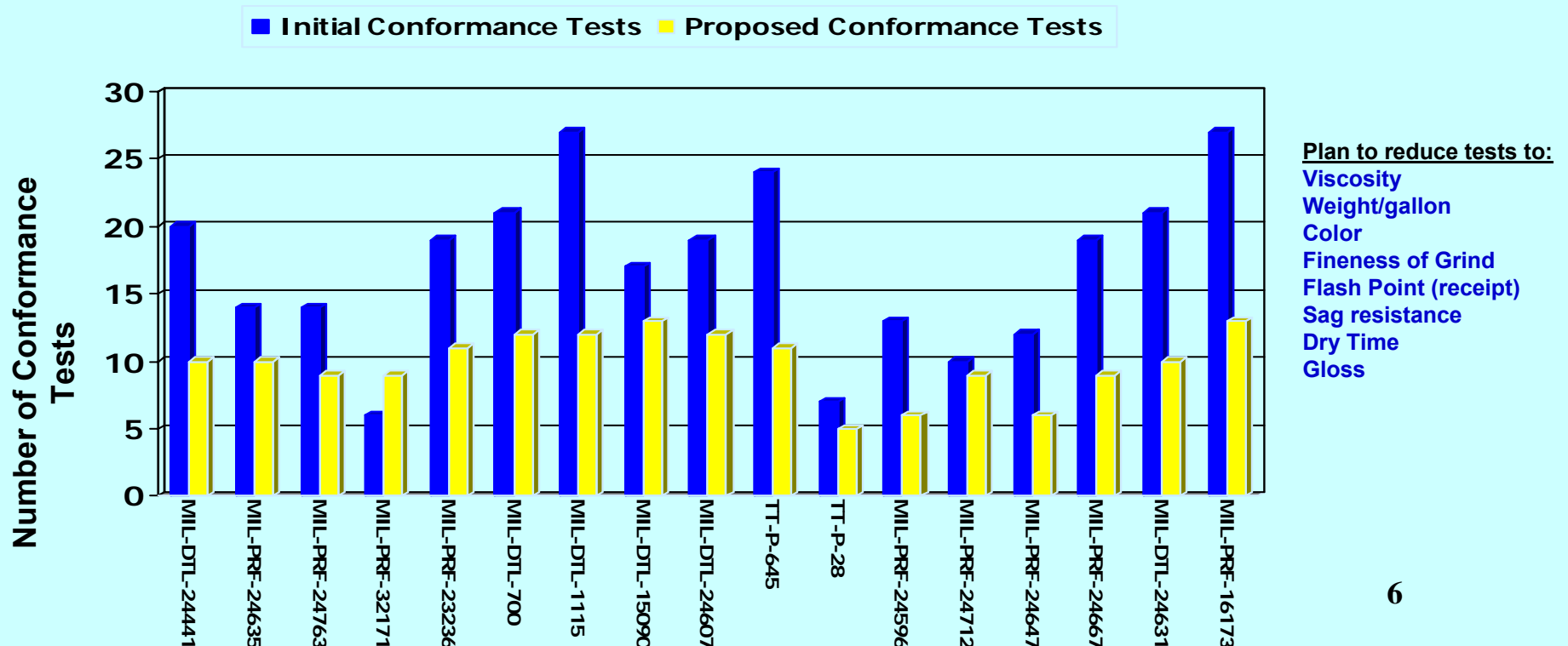
- SEA 05P23 alerted to paint specification conformance testing not being conducted by paint vendor or shipbuilder or shipyard –

**PROBLEM:** Too many tests, duplicative approaches, too time consuming.

**SOLUTION:** Reduce number of tests in a LEAN mode to the “right” number for shipyard OQE and paint manufacturer’s process.

## Accomplishments:

- Shipyard-lead LEAN event completed.
- All batches of paint specifications out for comment on 30 July 2009.



# Delete Stripe Coat

Puget Sound Naval Shipyard / SEA 05P23

## Issue:

- Legacy coatings retain 30% thickness on edges, stripe-coat required to establish minimum required coating thickness.
- Ultra-high solids, edge-retentive, coatings retain about 70% of thickness on edges, so an additional stripe coat protects edges more than required.

**Problem:** Requiring stripe coat increases time and costs to apply coatings and may not be needed.

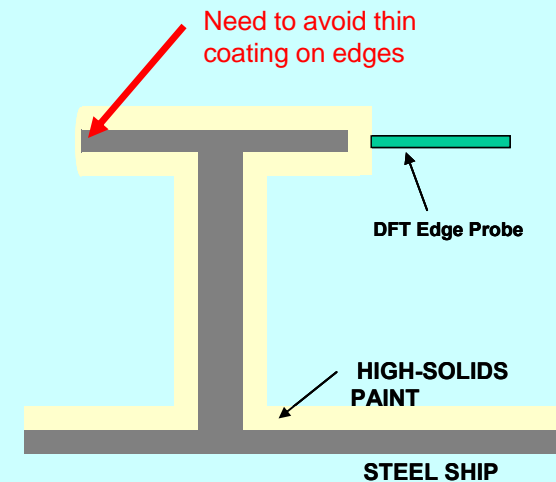
**Solution:** Eliminate the stripe-coat requirement for edge-retentive paints and add additional OQE checks on areas in close proximity to edges to ensure minimum, specified coating thickness obtained.



## Accomplishments:

- Delete stripe coat system applied to two submarine tanks. QA process developed and demonstrated.
- Savings 10-20% of overall job time & cost. Estimated savings of \$154K on CVN docking.
- PPIs for delete stripe coat included in CVN-71 RCOH.
- FY-11 Standard Item 009-32 includes.

Item is Essentially in the “Done Pile”



# Single Coat Preservation System

## Portsmouth Naval Shipyard / SEA 05P23

- Application of rapid-cure, high-solids paints in a single-coat is more cost effective than applying paints in two or three discrete steps.



**PROBLEM:** Ultra-high-solids coatings require three coats (i.e., primer, stripe coat, and top coat) = Excessive Labor. Legacy coatings require 24-hours between coats and seven days before service, for total process time of >14 days.

**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. Change 1 to FY-10, Standard Item 009-32, allowing only use of single-coat paints in ballast tanks, voids, and chain lockers issued on 9 March 2009.
2. Completed single-coat ballast tank/void installations on carriers, submarines, amphibious ships and combatant tanks/spaces.
3. Completed demonstration installation of single-coat paints in three fuel and two CHT tanks.
4. Completed one-year inspection of USS CHOSIN (CG-65).

CWP reports savings of up to 20% possible for CVN (\$433K) availability.

Contractors report job cost savings of 26% possible.

[Single-coat Performing “As Advertised” & Preventing Tank Corrosion.](#)

# BUSINESS CASE FOR SINGLE COAT PAINTS

## Cost Estimate Summary

- Cost estimates based data from shipyards, contractors, and paint vendors. Costs estimates are for painting a “representative” 5,000 ft<sup>2</sup> tank and do not include consistent costs like cleaning, staging set-up, blasting, and clean-up. NAVSEA business case consistent with:

Cumbersome work practices, single-coat project

20% paint application cost reduction  
after CWP demonstration  
\$433K possible savings DPIA.  
15% to 30%

Contractor reports savings:

### MODEL RESULTS:

- Single-coat paint total application costs lower than other coating systems.
 

Solvent-based paints (MIL-PRF-23236, V or MIL-DTL-24441) 15 mils DFT	\$31,128 to \$30,888	
100% Solids paints at 17 mils DFT	\$24,833	} 22% reduction
100% Solids, single-coat paints at 25 mils DFT	\$19,250	
- Single-coat paint material costs higher for 5,000 square foot tank.
 

Solvent-based paints	\$1,296 to \$1,056
100% Solids paints	\$2,898
100% Solids, single-coat paints	\$6,292
- Facilities & utilities costs lower for single-coat paints.
 

Solvent-based paints	\$13,100
100% Solids paints	\$8,300
100% Solids, single-coat paints	\$7,300
- Labor for single-coat paint lower than other paints.
 

Solvent-based paints	\$16,732
100% Solids paints	\$13,635
100% Solids, single-coat paints	\$5,658

# BUSINESS CASE FOR SINGLE COAT PAINTS

## Progress Summary

- No negative feedback on business case to date. SEA 05D has business case and is sharing with Navy new-construction shipbuilders.
- SSN 688 Class SHAPEC incorporated notionals ( $\approx 30\%$  paint application savings) into availability tanks where single-coat system is being planned to be installed.
- Single-coat demonstration saved money on USS CHOSIN (CG-65) compensated fuel tank and is performing well after one-year inspection.



Custom GRACO 68 to 1 Extreme Mix Heated Plural Component Application Spray Pump Rig used to install June 2008



Blue, extended release masking tape indicating areas requiring paint touch-up. Final job accepted by QA



July 2009, areas touched-up using paint cartridges showing color difference. Minor corrosion at rat-holes



# Surface Condition Measurement Tools

Puget Sound Naval Shipyard / SEA 05P23

## Issue:

Paper used to track records is archaic and can lead to transcription errors, use new technology to improve rate/accuracy data collection.

**Problem:** Existing surface measurement technology is expensive, labor intensive, and has poor repeatability.

**Solution:** Identify and qualify improved surface inspection tools. Verify tools are compatible with the Paperless QA Initiative.

- Dry Film Thickness (DFT) meter.
- Surface Profile meter.
- Soluble Salt/Conductivity meter.

## Accomplishments:

- Need targeted .mil site (owned by NAVSEALOGCEN located at NNSY) certified by June 2009 to support POA&M – Delayed – Reschedule date no yet determined (N43).
- Pursue NMCI certification for software & hardware – most likely point of potential delay.
- POA&M defines initiative completion as development of the procedures and the training package; and demonstration of tool usage, data collection, and data transfer to CQATK by a single shipyard.
- Recent demonstrations suggest software integration is a key issue.



# Cumbersome Work Practices

## Surface Condition Measurement Tools

<b>QA Tools Distro List</b>	<b>PSNS</b>	<b>PNS</b>	<b>NNS</b>	<b>PHNS</b>	<b>Totals</b>
<b>QA Inspection Tool</b>	<b>Qty</b>	<b>Qty</b>	<b>Qty</b>	<b>Qty</b>	<b>Qty</b>
<b>Elcometer 224 Model T</b>	4	8	4	4	20
<b>RPCT Soluble Salt Meter RPCT-07-001</b>	3	3	3	3	12
<b>Elcometer 456 (DFT)</b>	4	0	4	4	12
<b>Totals</b>	11	11	11	11	44



### SURFACE PROFILE

Elcometer 224 Model T or  
ElectroPhysicTR200

Both have resolution to 0.1 mil

Elcometer has memory and  
USB, while ElectroPhysic just  
has USB.



### SALT METER

Rich Parks, soluble salt meter  
RPCT-07-001 or

Elcometer 130 SCM400 Salt  
Contamination Meter

Both have 0.1 uS/cm resolution

RPCT has memory, USB and  
data transfer



### DRY FILM THICKNESS

Elcometer 456, QNIX 8500  
Premium, PosiTector 6000  
MemoryF90S3, or Oxford  
Instruments CMI233-RSMP1

All have 0.1 mil resolution

All have memory, USB and data  
transfer

All Tools Types Authorized for Use in Naval Shipyards. Shipyards Using Tools to Some Degree, Full Roll-out in FY-10

# Reduce Costs by Allowing Retention of Moderate Flash Rust

## Norfolk Naval Shipyard / SEA 05P23

### Issue:

- Surfaces cleaned with hand lance waterjet equipment tend to develop *Moderate* flash rust which must be removed using a secondary surface preparation. Allowing paint application over moderate flash rust will result in cost savings provided risk of premature coating failure is mitigated.



**Problem: Rework to achieve Light level of flash rust leads to failed check points and rework.**

**Solution: Allow painting over moderate flash rust on hand-lanced areas by developing a tool to determine when surface has high flash rust instead of acceptable moderate level.**

### Accomplishments:

- NSRP completed 2007 project showing Moderate is acceptable with little added risk of coating failure.
- NAVSEA, NSRP, and NSWC-CD/Elzly working to develop tool to determine when flash rust is excessive.
- FFC N43 expressed support for project and belief savings will flow to Navy.
- 3x3-inch microscope slides no longer manufactured, no standard for such slides.



[Need Contractors - Who Do Work - to Validate Cost Savings](#)

# Reduce Costs by Allowing Retention of Flash Rust

## NAVSEA Flash Rust Adjudication Procedure:

The following procedure shall be used to determine if a disputed zone, surface, or area has a "moderate" or a "high" level of flash rust as per SSPC-SP-12/VIS-4. Note that this procedure is not a substitute for the definitions contained in the SSPC standard, but rather is intended to provide objective quality evidence (OQE) that a disputed zone, surface, or area has a moderate or high level of flash rust.

1. **Ensure Surface Condition:** The zone, surface, or area shall be cleaned to the required level of cleanliness in accordance with SSPC SP-12 (e.g., WJ-2) and possess a level of flash rust that can not be readily gauged/appraised with certitude using the guidelines of SSPC-SP12/VIS-4 alone.
2. **Obtain OQE of Flash Rust Level:** The following procedure provides objective quality evidence for determining the level of flash rust on the steel surface in question.
  - 2.1 **Determine Minimum Sample Number:** One flash-rust reading (consisting of a test measurement and control measurement) shall be taken for every 200 square feet for the first 1,000 square feet of a zone, surface, or area. For each additional 500 square feet or increment thereof, one additional flash rust reading shall be taken.
  - 2.2 **Prepare Test Sample:** Each test sample is prepared by applying a 4-5 inch length of ISO 8502-3 dust tape to the flash rusted surface. The inspector shall rub the tape onto the steel with his/her thumb or other finger, pressing as hard as possible over the central 3-inches of the tape without damaging it. Remove the tape from the steel in a manner that retains as much of the adherent rust as possible (i.e., do not shake the tape or try to dislodge the rust). Apply the tape, adhesive-side down, centering its length over the 75mm dimension of a 1.2mm thick clean, clear microscope slide which is 50mm by 75mm or larger. *CAUTION: excessive pressure applied to the tape can crack the slide and create a dangerous, sharp surface.* To help secure the tape to the slide, not more than ¼-inch of the tape end may be wrapped under each end of the slide. Additional tape may interfere with the measuring devices. Any test sample with air bubbles larger than 1/4-inch in diameter shall be rejected and another test sample prepared. Using a permanent marker to write on a non-test portion of the slide, date and uniquely identify each sample.

# Reduce Costs by Allowing Retention of Flash Rust

**2.3 Prepare Control Sample:** While avoiding transferring fingerprints to the central 3 inches of tape, prepare a control sample in the following manner. Apply a 4-5 inch piece of the ISO 8502-3 dust tape directly from the same roll as used in Section 2.2 to a 1.2mm thick clean, clear microscope slide which is 50mm by 75mm or larger. Fully adhere the adhesive side of the tape to the slide, centering the tape's length over the 75mm dimension of the glass. *CAUTION: excessive pressure applied to the tape can crack the slide and create a dangerous, sharp surface.* To help secure the tape to the slide, not more than 1/4-inch of the tape end may be wrapped under the slide. Additional tape may interfere with the measuring devices. Any control sample with air bubbles larger than 1/4-inch in diameter shall be rejected and another control sample prepared. Using a permanent marker to write on a non-test portion of the slide, date and uniquely identify each sample.

**2.4 Measure Transmittance:** For each test and engineering control tape/microscope-slide assembly, measure the transmittance using a Laser Labs Model LM100, Monroe PMP Model PD2.1, Monroe PMP Model PD3.0, or NAVSEA-approved equivalent transmittance measurement meter. Transmittance measurements shall not be made in direct sunlight or in an area where the ambient light level exceeds 100 foot candles. Insert the slide into the instrument with the tape facing the meter's light source. Record two measurements from different locations on the test sample. Record two measurements from the control tape, taking one measurement from each end. Calculate the average of the two control readings and subtract the average of the two test readings. The difference in average transmittance of the test sample (i.e., sample with flash rust) and the average transmittance of the control sample shall constitute one transmittance reading.

**3. Adjudicate Flash Rust Level:** A difference in transmittance reading (i.e., control minus test sample) shall be applied to the entire zone, surface, or area which the measurement is intended to represent. The following values shall apply:

- Readings in excess of 20% shall be considered to represent an SSPC-SP-12/VIS-4 "high" level of flash rust
- Readings between 10% and 20% indicate the surface is at least an SSPC-SP-12/VIS-4 "moderate" level of flash rust
- Readings below 10% indicate the surface may have an SSPC-SP-12/VIS-4 "low" level of flash rust.

**4. Retain Samples:** Both test transmittance samples and control transmittance samples shall be retained as objective quality evidence that the required level of surface cleanliness was obtained.

# Retention of High Solids Paints During Repair FY-10, New Start CWP Task

**Issue:** New start, CWP task initiated by PSNS. Goal would be to reduce the time & money required to blast off intact, adherent high-solids coatings during repair while ensuring long service life from tank coatings.

**PROBLEM:** Currently, tanks are required to be completely blasted and repainted if damaged area exceeds 10% of tank area. Such a requirement represented the most cost-effective means of repairing tanks with solvent-based coatings, but may increase costs for tanks with high-solids, single-coat paints.

**SOLUTION:** Develop process for blasting areas of tanks coated with high-solids paints that have been damaged or failed, but retain intact, adherent high-solids paint. Overcoat entire tank at 50% RH to produce final coating with 10-12 year service life.



## Accomplishments:

- Defined scope (UHS paint systems only; Condition “D” or better)
- PHNSY accomplished partial blast of Fwd Trim Tank on USS BUFFALO in mid April, utilizing the draft Puget procedure. Savings estimates were:
  - 58% cost savings (Planned = 638 hrs; Actual = 266 hrs)
  - 69% schedule reduction (Planned = 8 days; Actual = 2.5 days)
  - Retained paint was sweep blasted and resulted in a surface profile of > 2 mils
- Edit partial blast procedure to incorporate comments/concerns (i.e., no DFT allowance on painted surface, surface cleanliness, etc.).
- Perform another partial blast job using revised procedure, *if applicable*, on USS HELENA (SSN 725) or USS CHICAGO (SSN 725) in Nov. 2009

# FY-10, New Start CWP Tasks

<u>Issue</u>	<u>Problem</u>	<u>Proposed Solution</u>
Fuel tank coating is difficult to accomplish on in-service tanks.	<b>Tanks corrode, fuel oil contaminates tank surface, surface preparation difficult and expensive.</b>	For un-compensated, ship's fuel only, allow paint to degrade, clean away paint flakes, "oil" steel and do not repaint. Three TWH & SEA 08 involved. Expand to compensated?
Receipt inspection of paints leads to returns and slows just-in-time (JIT) delivery.	<b>Receipt inspection is slow process with radically different results that adversely affects JIT process.</b>	Eliminate receipt inspection. Allow conformance test by paint vendor in JIT mode.
Reserve feed-water tanks require MIL-DTL-24441.	<b>Solvent in multi-coat system is slow to evaporate away, seven-day final cure makes process expensive.</b>	Work with paint vendor to develop a "formula" Single-coat, rapid-cure paint with defined composition. Need to prove performance is similar to standard legacy system.

# Conclusions

- NAVSEA goal is to reduce coating application costs from new ship acquisition through to ship disposal.
- NAVSEA making progress toward:
  - Making Standard Item 009-32 the Universal Paints Requirements Document.
  - Specification Update (Paint Conformance Testing).
  - Implementing findings of Cumbersome Work Practices tasks:
    - Delete Stripe Coat.
    - Rapid Cure, Single Coat.
    - Induction Heating Coating Removal.
    - Paperless QA & QA Tools.
    - Retention of Moderate Level of Flash Rust.
- NAVSEA would encourage NRSP SP-3 participation in projects evaluating:
  - Retention of High Solids Paint.
  - Proposed FY-10 New Start Task



# Backup slides