Review of Acceptable Flash Rusting for Ship Coatings

Status Report – September 30, 2008

Steve Cogswell, Pete Ault

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Elzly Technology Corporation

Atlantic

The Problem:
“Hand Lance Areas” Develop Moderate Flash Rust which must be Remediated

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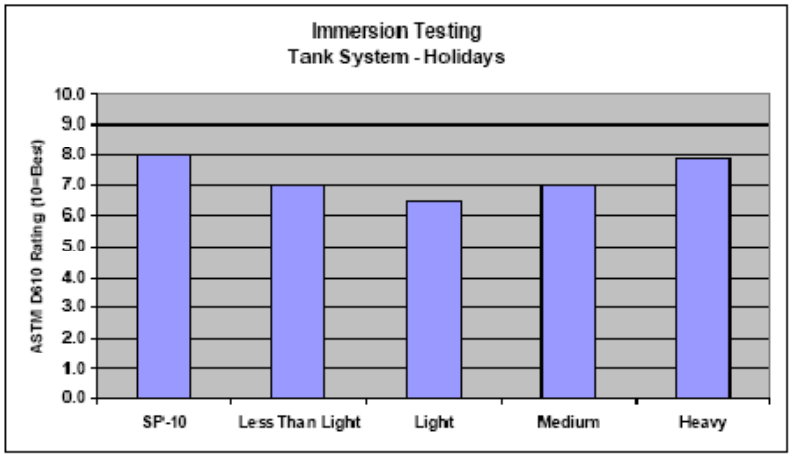
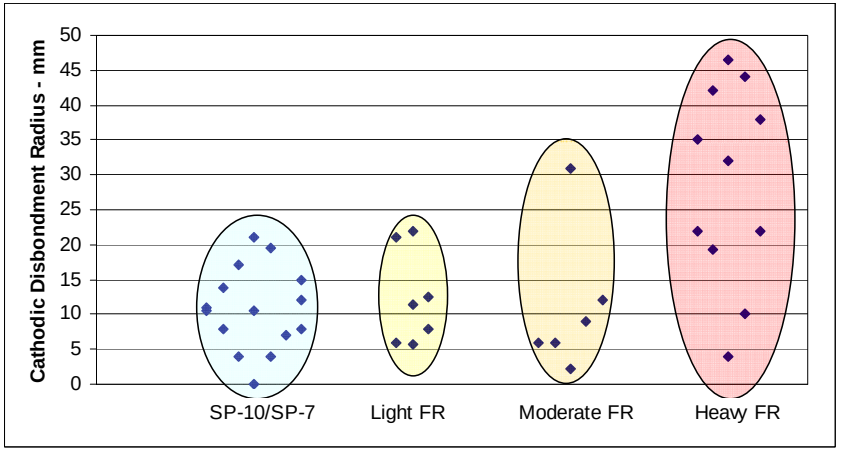
Background

- Navy-sponsored lab testing suggests Moderate Flash Rust does not significantly impact coating performance





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Background

- FY07 NSRP project
  - Ship inspection data suggest no significant performance difference between MFR and LFR
  - Round robin suggested that inspectors should be able to differentiate between MFR and HFR
- NSRP FY08 follow-on study
  - Based on feedback from Fleet Forces Command
    - Confirm that results are not unique to the shipyard/primer which was observed
    - Continue to collect data defining the risk of painting over MFR
  - Work with NAVSEA 05P23 to develop basis for CWP-351

Project Status

- Collected Data from Ships in Service
  - Continuing to analyze information
  - Anticipate evaluating commercial or USCG ships
- FY09 SSRAC proposal
  - Not adopted pending more study
- Evaluation of coating performance over Heavy Flash Rust
  - What is risk?

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Navy Ships with Coating over MFR

- No evidence of performance concerns
- Work performed at multiple yards by various contractors
- Time in service up to 9 years

- USS STENNIS (CVN-74)
- USS ENTERPRISE (CVN-65)
- USS HALYBURTON (FFG-40)
- USS THE SULIVANS (DDG-68)
- USS BELLEAU WOOD (LHA-3)
- USS LAMOURE COUNTY (LST-1194)
- USS ASHLAND (LSD-48)
- USS ESSEX (LHD-2)
- USS NASSAU (LHA-4)
- USS DULUTH (LPD-6)

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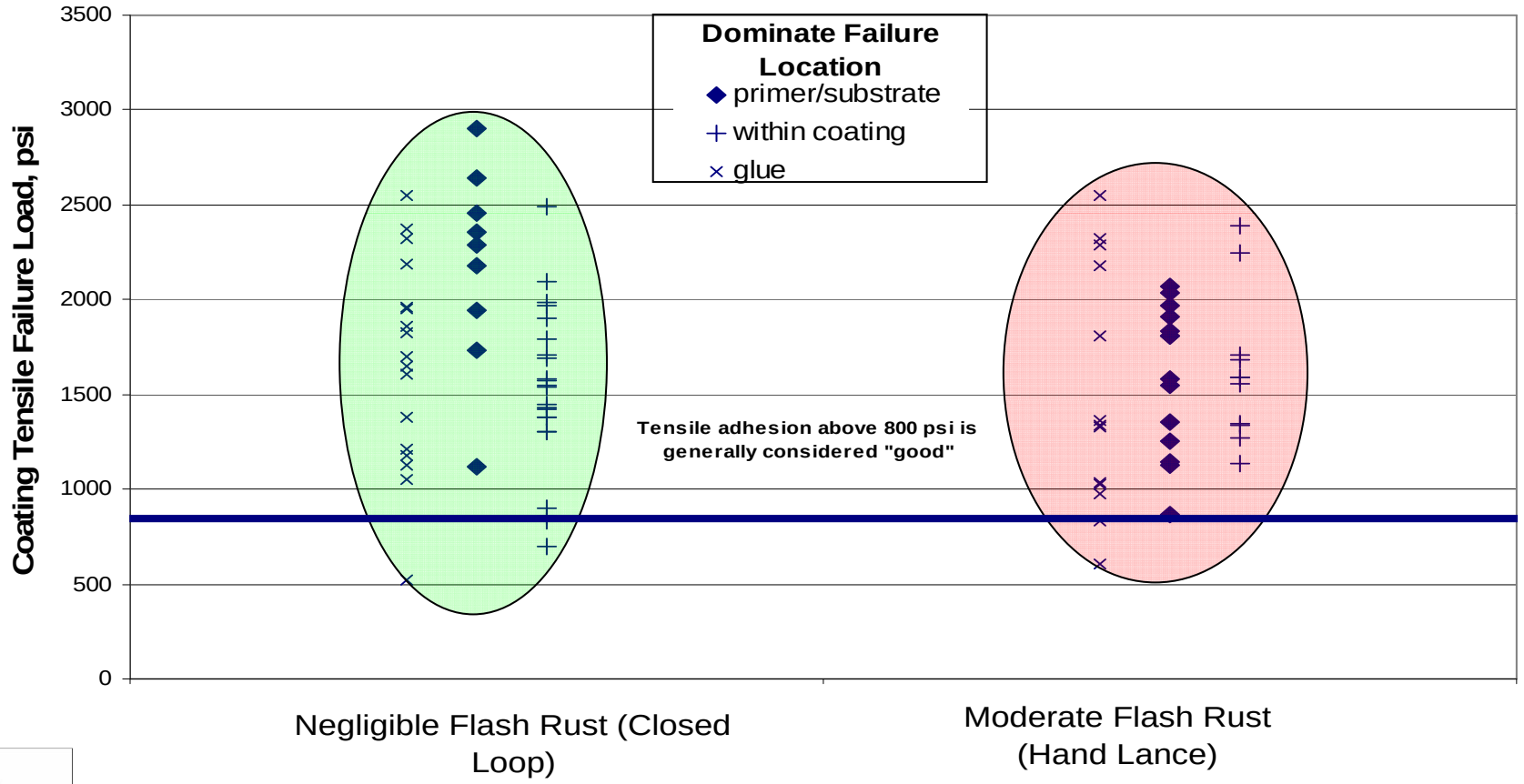
Adhesion Data from Navy Ships In Service



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Testing per 05P23 Recommendation

- Prepare flash-rusted panels that will “fail”
  - Failed panels will have some form of medium or heavy flash rust would allow Navy to define when costly, catastrophic failures would occur
- Perform preliminary evaluation of quantifiable tests for excessive flash rust
  - Rapid cure adhesive on ASTM-D-4541 pull-off test buttons
  - Colorimetric scratch test to determine rust adhesion
- CWP-351 to investigate issue further

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Panel Preparation

- Panels cut from heavily rusted steel plate
- Hand lance UHPWJ
- Flash rust developed over 8 days exterior exposure at Atlantic Marine in late July

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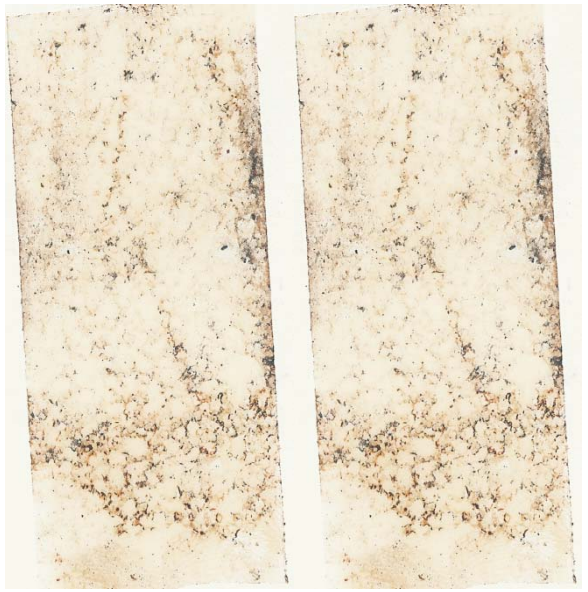
“Heavy” Flash Rust Characterization – Current Methods

- SP-12 Evaluation
  - Red-brown
  - Hides the initial surface condition completely
  - Exhibits a layer of heavy…rust
  - Evenly distributed
- Wipe Test
  - Exhibited significant marking when lightly wiped with a white cloth wrapped around a 4-inch paint brush.
- Tape Test
  - All panels transferred some flash rust to the 10th tape applied in the same location
- Surface Conductivity
  - Panel 1 – 72 uS
  - Panel 2 – < 30 uS
  - Panel 3 – 30 uS



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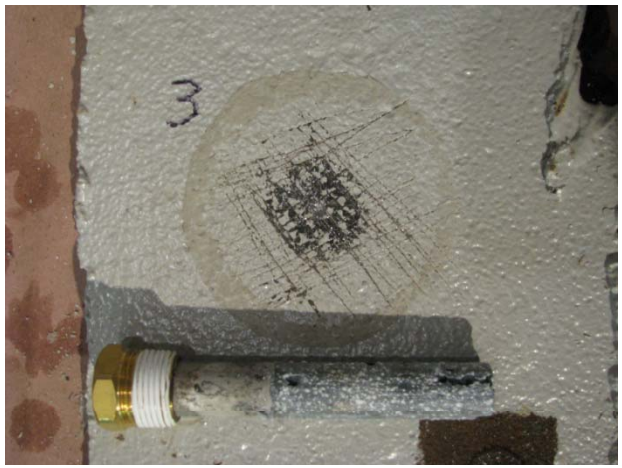
Coating Performance over Heavy Flash Rust

- Pull off Adhesion
  - Glue failures between 1300 and 2600 psi (Good result)
- Cathodic Disbondment Test
  - Failure radius similar to that previously observed



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Concluding Comments

- Continue to build body of evidence that painting over moderate flash rust will provide the desired performance
- Preliminary data suggests that the risk of incidental painting over Heavy Flash Rust as a result of process change is low
  - Heavy FR condition remains detectable
  - Performance over Heavy FR is not drastically worse
- More ship checks may be performed
- Anticipate delivering report in January, 2009

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