

Extended Recoat Windows for Non-Critical Zones

MegaRust
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Background



Source: <https://news.usni.org>

- The build sequence of Navy ships is long, and complex given all the compartments and fixtures that must be attached at various stages in the process.
- During the build sequence, primer application occurs in various non-critical areas. Topcoats are applied much later in the build sequence closer to final assembly and closeout. By the time this stage is reached, published primer recoat windows are often exceeded. These areas then require various levels of surface preparation to reactivate the surfaces for topcoat application.
- This part of the process is time and labor intensive. This project seeks to review multiple levels of surface preparation to determine which is the best course when recoat windows have been exceeded.

Anticipated Benefits

- More effective surface preparation for topcoat application in non-critical areas where primers have exceeded their recoat windows
- Reduced cost of surface preparation by extending the recoating window on interior non-critical areas (bulkhead and overhead)
- Optimize the most efficient surface preparation methods to ensure proper coating performance after passing recoating windows

Scope of Work

- Compare the various levels of surface preparation available for overcoating work.
- Determine adhesion and performance effects of the differing methods to find optimal performance.
- Identify and share best practices among shipyard coating experts.

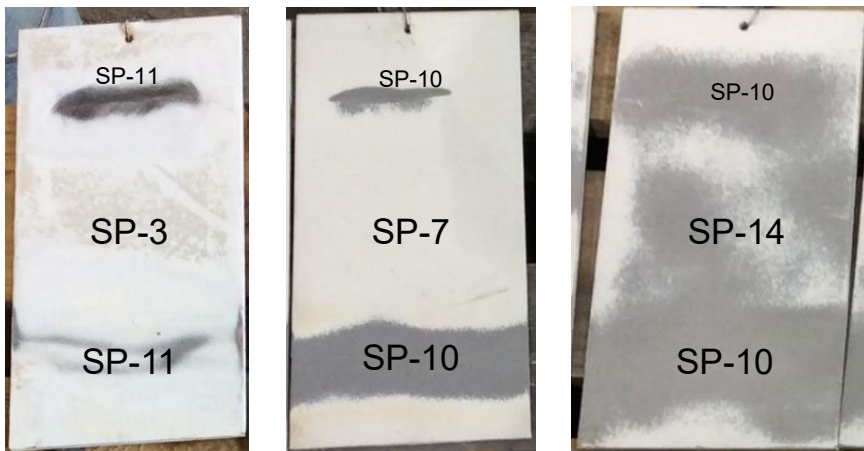


Previous Work

- Numerous studies have been performed across industries about proper surface preparation once recoat windows are missed.
 - Multiple SPC Panel Projects
- Recent studies have shown minimal differences in long term performance from surface preparation of non-critical areas that surpassed primer recoat windows.
- Multiple Shipyards performed preliminary recoat testing on candidate coating systems
- Initial results showed a blow down with no other preparation had provided the best adhesion results.
 - Other tested processes: dry cloth wipe, cleaning with water, cleaning with solvent, hand abrasion

Previous Work - Retention of Type VI Epoxy under UHS Epoxy

This project assisting in developing the data needed to request Navy approval to apply a Type VII UHS epoxy over a Type VI epoxy in critical coated areas



Surface Preparation Methods

SP-3/SP-11

SP-7/SP-10

SP-14/SP-10

Characterizing Secondary Surface Preparation

- Visual Inspection
- Film Thickness
- Surface Profile
- Prepared Coating Surface Tension
- Dyne Pens (experimental)

Performance Evaluation

- Pull Off Adhesion (D4541)
- Knife Adhesion (D6677)
- Condensing Humidity (D4585)
- Impact Testing

Conclusion: No clear differences between new coated systems and overcoated systems

Previous Work – Other Industries

- During bridge projects (specifically in the NE) recommended recoat windows are often missed due to weather, construction delays, etc.
- Coating vendors have worked with owners on various surface preparation methods when overcoating.
 - Pressure washing, sand injected pressure washing, power tooling, solvent wiping, hand sanding, and no preparation have been explored
 - Intercoat cleanliness (grease, oils, dirt) found to be greatest effect on adhesion and performance



Tasks

- Task 1 – Identify surface preparation methods currently used to reactivate primers in non-critical areas
 - Hold a Kick-off Meeting with the project team to discuss the current methods used to prepare primers for topcoat in non-critical areas. Best practices of all the yards will be discussed. The project team will identify testing strategies for production and long-term use.
- Task 2 – Evaluate coatings after application to prepared, primed surfaces
 - Based on the preparation methods identified in Task 1, laboratory testing of adhesion and performance will be performed on coatings applied over primers whose recoat windows have been exceeded.
- Task 3 – Final Report
 - The project team will assemble a comprehensive final report, including the results of the information review, details of sample preparation, and laboratory evaluations. The final report (or a version thereof) will be suitable for unlimited distribution.

Task 1 (Completed) - Identify surface preparation methods currently used to reactivate primers in non-critical areas

- Held kick-off meeting
- Yard visit (HII-NNS)
 - Visited production and module storage
 - Discussed processes and constraints
 - Reviewed coating performance/characterization
- Test plan circulated with partner yard
 - 3 candidate coating systems
 - MIL-PRF-23236 Ty VI + MIL-PRF-24596/MIL-PRF-24607
 - 3 surface preparation methods
 - Scuff sand (80gr) (control) vs. SP 1 solvent wipe; compressed air blow-down



Example of MIL-PRF-23236 Type VI primed module from ship construction, Ingalls Shipbuilding, NSRP Retention of MIL-PRF-23236 Type VI Epoxy, 2019

Task 1 (Completed) - Identify surface preparation methods currently used to reactivate primers in non-critical areas

- Background research and literature review findings
 - UV degradation leads to embrittlement and micro-cracking
 - Commonly evaluated via adhesion testing (ASTM D4541 and D6677)
 - Other methods that may be useful in characterizing UV degradation:
 - Surface metrology/surface roughness
 - Visual or microscopic analysis
 - Hardness
 - Surface cleanliness
 - Influence of soluble salts or contamination on primer-topcoat intercoat adhesion

Task 2 (On-going) – Evaluate coatings after application to prepared, primed surfaces

- Laboratory Study
 - Accelerated aging of primers (UV/Condensation – 1,000–3,000 hours)
 - Primer characterization
 - Topcoating → Coating system performance testing
- Field Study
 - Utilize successful characterization methods from lab study to assess primer conditions on in-process production modules
 - Correlate lab aging and characterization data to actual yard/process storage
 - What modifications must be made to adopt testing for field use (e.g., vertical surfaces, materials/equipment available to production staff)

Task 2 (On-going) – Evaluate coatings after application to prepared, primed surfaces

Lab Study:

- Coatings (primer) sprayed out in February 2026
- ASTM D4587 Fluorescent UV + Condensation exposure for 1,000, 2,000, and 3,000 hours
- Status:
 - 1,000-hr samples completed QUV exposure/data analysis in-process
 - 2,000-hr samples will complete QUV on 11JUN26
- Characterize primer conditions
- Topcoat applications, coating system testing/evaluation

Task 2 (On-going) – Evaluate coatings after application to prepared, primed surfaces

- Characterization of primer – How does performance of aged primer change over time (1,000-3,000 hours)
 - ASTM D523 – Gloss
 - ASTM D2244 – Color
 - ASTM D4214 – Chalking
 - Fourier Transform Infrared Analysis (FTIR)
 - ASTM D4752 – Solvent Resistance
 - ASTM D7334 – Contact Angle/Wettability
 - ASTM D4417 – Surface Roughness
- Analytical data from aged (primed) panels combined with surface preparation methods to be correlated with overall coating system performance
- Determine which characterization test method(s) may be suitable for field use

Task 2 (On-going) – Evaluate coatings after application to prepared, primed surfaces

- After 1,000 hours exposure (ASTM D4587)

Primer 1
Control



Primer 2
Control



Primer 1
1,000 hrs
QUV



Primer 2
1,000 hrs
QUV



Task 2 (On-going) – Evaluate coatings after application to prepared, primed surfaces

- Performance of MIL-PRF-23236 Ty VI primers after 1,000 hrs QUV exposure (preliminary data):
 - Gloss ~ 70-95% gloss retention
 - Color ~ 4-9% total color change (ΔE)
 - Chalking – Ratings of 10 → 6 (controls → 1,000 hrs)
 - Solvent Resistance - Ratings of 5 → 4 (controls → 1,000 hrs)
 - Contact Angle/Wettability – *in-process*
 - Surface Roughness – *in-process*
 - Fourier Transform Infrared Analysis (FTIR) – *in-process*

Task 3 (Future) – Final Report

- Comprehensive final report will include lab/field test results, conclusions, and recommendations to be shared with NSRP community

Path Forward

- No-cost extension approved by ATI
- Complete lab-based testing
- Shipyard visit for field testing
- Complete/distribute final report (EDD 3SEP2026)

Questions?

