Rust Converter Investigation for Space and Missile Command Phase II

Progress Report

23 Sep 04

AF COATINGS TECHNOLOGY INTEGRATION OFFICE

Bill Hoogsteden

Program Manager

Coatings Technology Integration Office

Air Force Research Laboratory

Background
Space and Missiles Need

Background

Testing

Test Schedule

Progress Report

- **30th Space Wing not allowed to sandblast in open air**
  - **Santa Barbara County in non-attainment for state fine air particulate standard, federal and state one-hour ozone standards**
- **Enclosed sandblasting is not cost effective**
  - **Increased man-hours, waste stream removal**
- **Sandblasting alternative needed**

Adhesion problems with Carbozinc Primer

Background (Cont)
Rust Converting Primers

- Polymer matrix containing tannic and phosphoric acid
- Applied directly to corroded surface
  - Passivates surface and prevents further decay of substrate
- Minimal cost and waste stream
- Interferes with action of zinc rich primers
- Appropriate components and system not known

Background (Cont)
Rust Converter Investigation Phase I

Background

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- **Tested five commercial rust converting primers and one tannic acid solution**
- **One topcoat (Amercoat 450 HS), one zinc rich primer (Carbozinc 11 WB) and one epoxy primer (Rustbond)**
  - **MLSA performing EIS test on these panels**
- **Identified three top performing rust converters**
  - **<u>Rust Trapper</u>, <u>Extend</u>, <u>Rust Reformer</u>**
- **Identified adhesion problems between topcoat and intermediate primer**

Test Primers and Topcoats

Primers

- MIL-P-53022 Type I,Lead and Chromate Free Epoxy Primer (Sherwin Williams E90W201/V93V202)(white)
- Kem Aqua 70P Water Reducible Primer (Sherwin Williams E61R572)(red oxide)
- Recoatable Epoxy Primer (Sherwin Williams B67R5, B67H5) (red oxide)
- Recoatable Epoxy Primer (Sherwin Williams B67R5, B67H5) (red oxide)
- Spectra-Tone Red Oxide Metal Primer #097(red oxide)
- MIL-PRF-85582 Type I, Class N (PRC DeSoto EWDY048)

Topcoats

- VOC-Complying Industrial Enamel (Sherwin Williams B54WZ101) (color, white)
- VOC-Complying Industrial Enamel (Sherwin Williams B54WZ101) (color, white)
- VOC-Complying Industrial Enamel (Sherwin Williams B54WZ101) (color, white)
- VOC-Complying Industrial Enamel (Sherwin Williams B54WZ101) (color, white)
- Direct-to-Metal Enamel (Sherwin Williams B55W101) (white)
- Spectra-Tone Interior/Exterior Latex Semi-Gloss Enamel #598 (white)
- MIL-PRF-85285 Type III (Deft 55-W-002) (color, 17925)

Phase II Testing

- Screening Tests
  - ✓ Adhesion (Wet Tape)
  - ✓ Substrate strength
- Performance Tests
  - ✓ Weathering (B117/GM9540)
  - ✓ Corrosion Resistance
  - ✓ Reparability
  - ✓ Removability
  - ✓ Repeat Adhesion (Dry Tape)
  - – Field testing
  - ✓ EIS (MLSA)

Test Schedule

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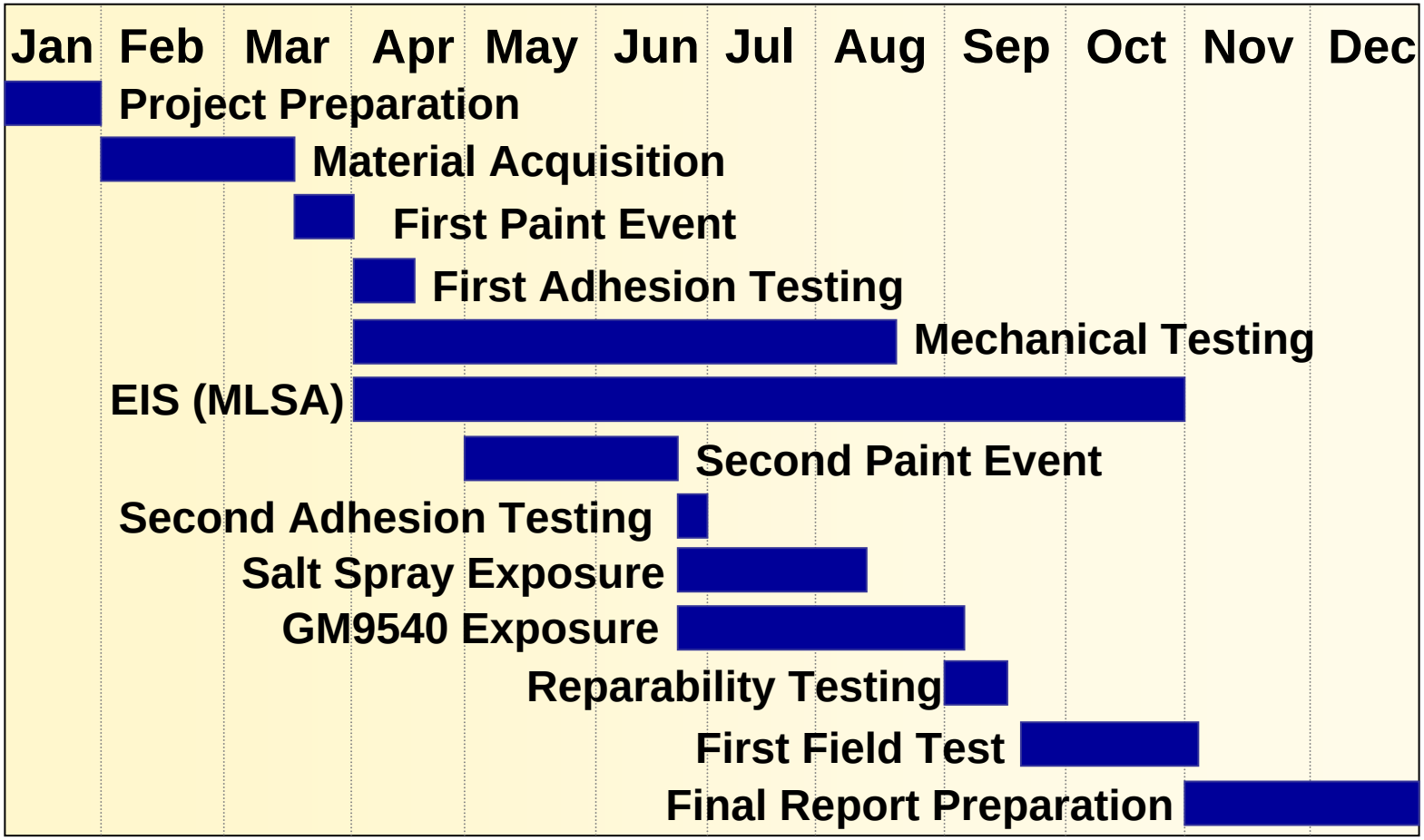
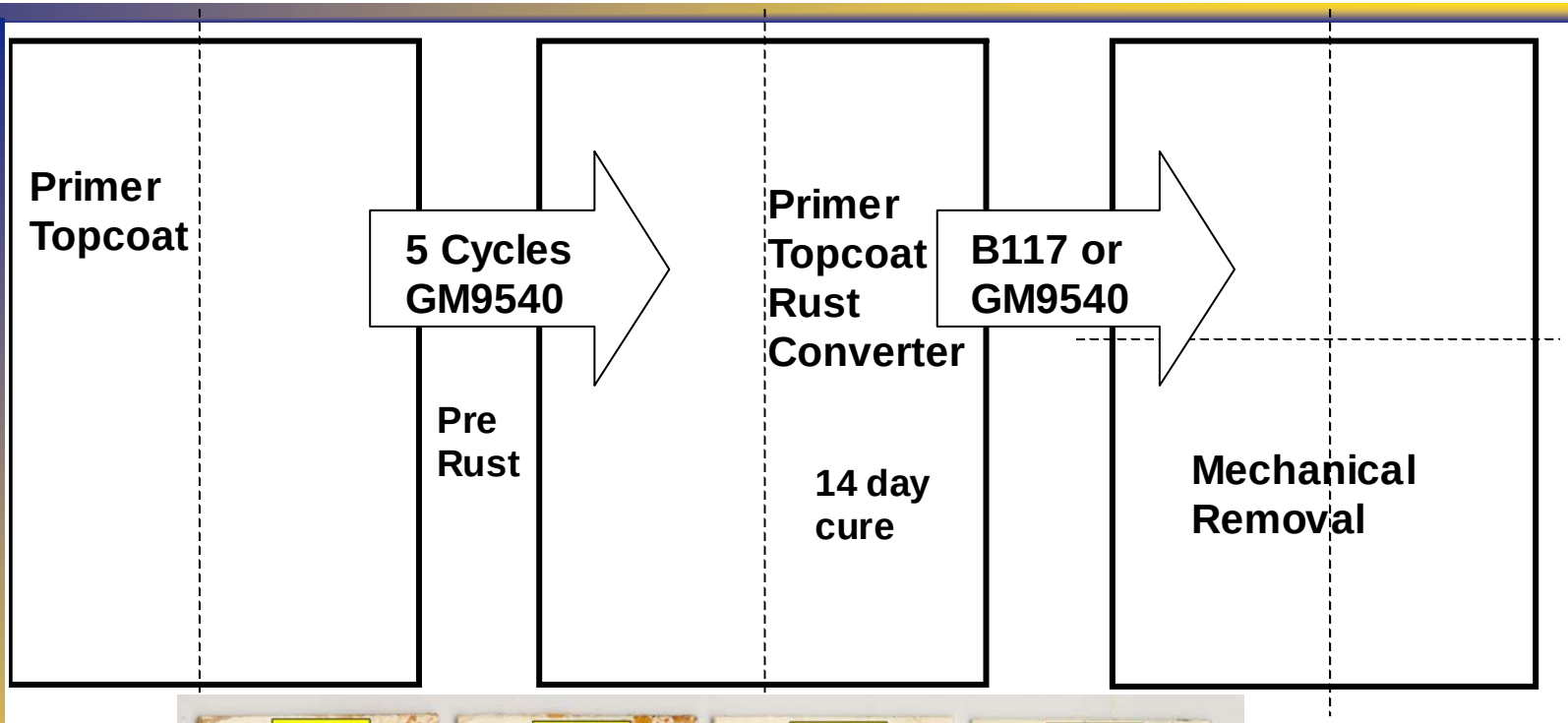
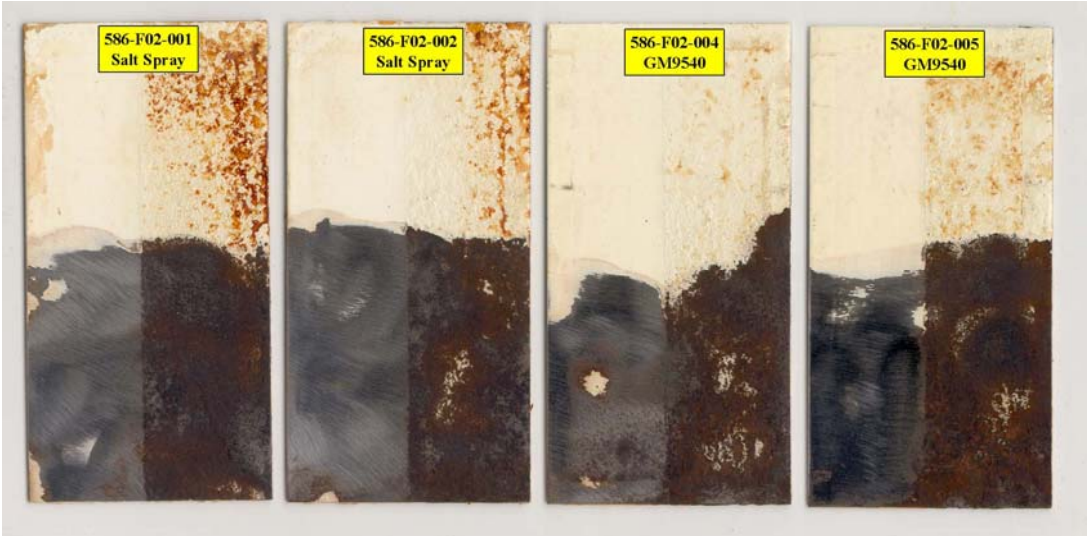


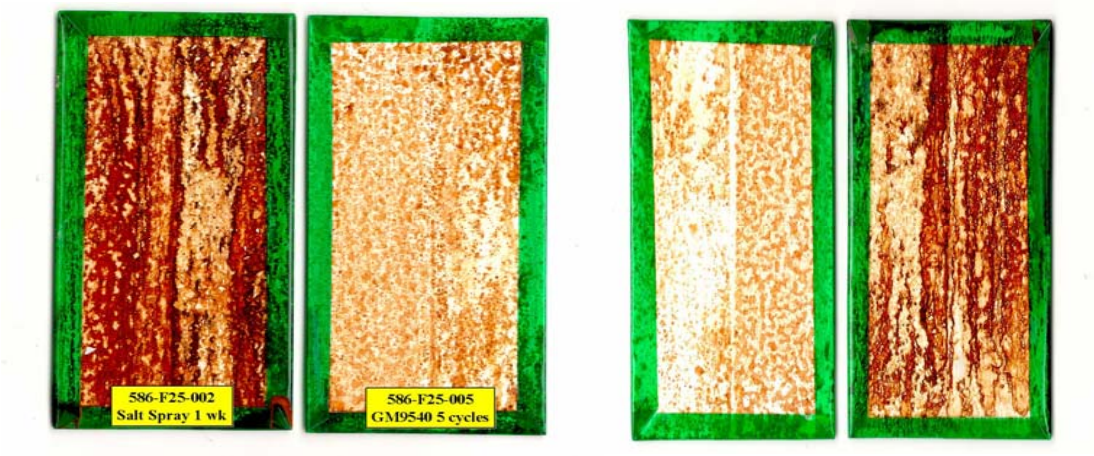
“Weathering” Test Methodology





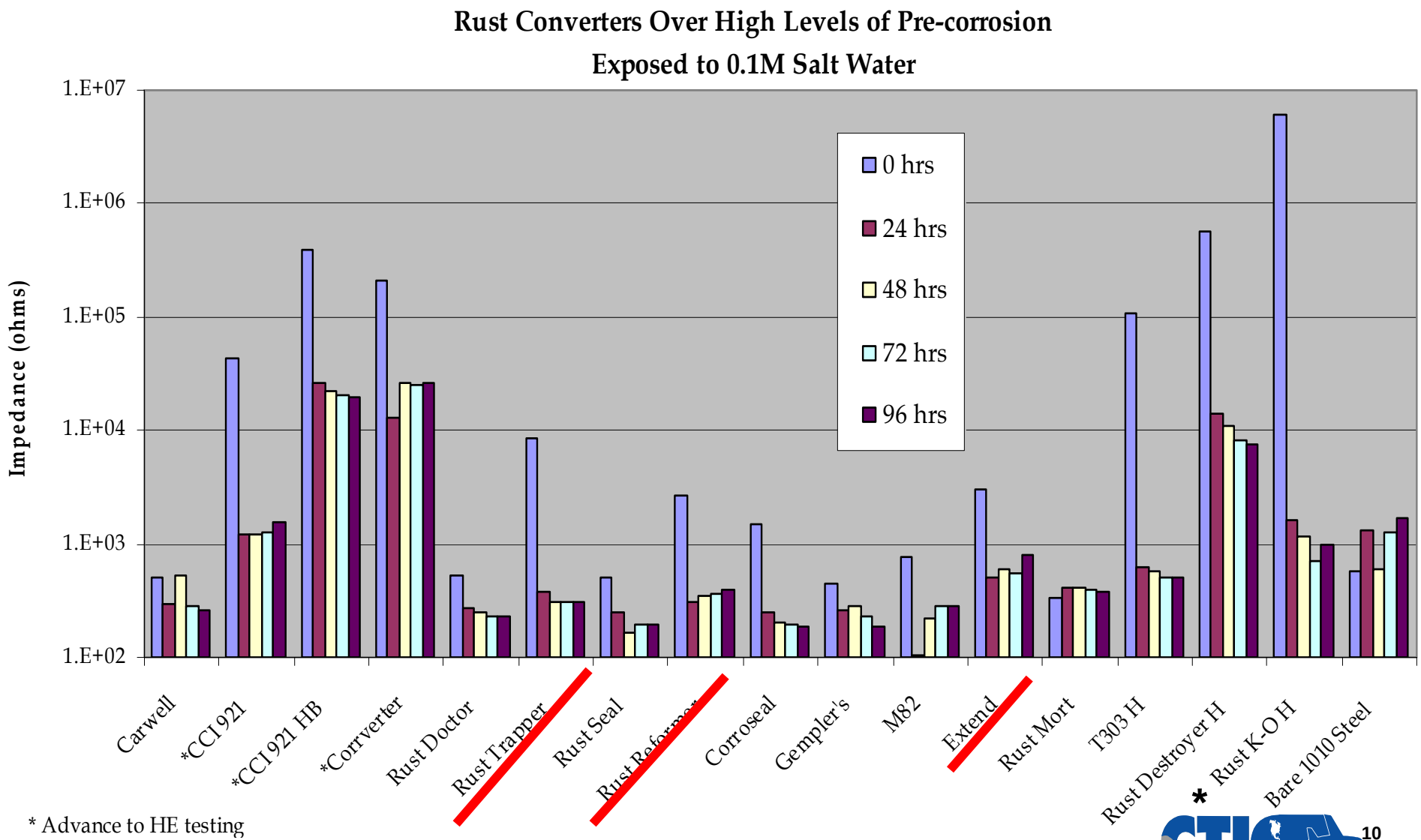
Weathering Specimen Examples

- **Some failed after 1 week**



- **Some went to 6 weeks**

EIS Data on Rust Converters Only
Low Frequency Impedance (0.05 Hz)



* Advance to HE testing

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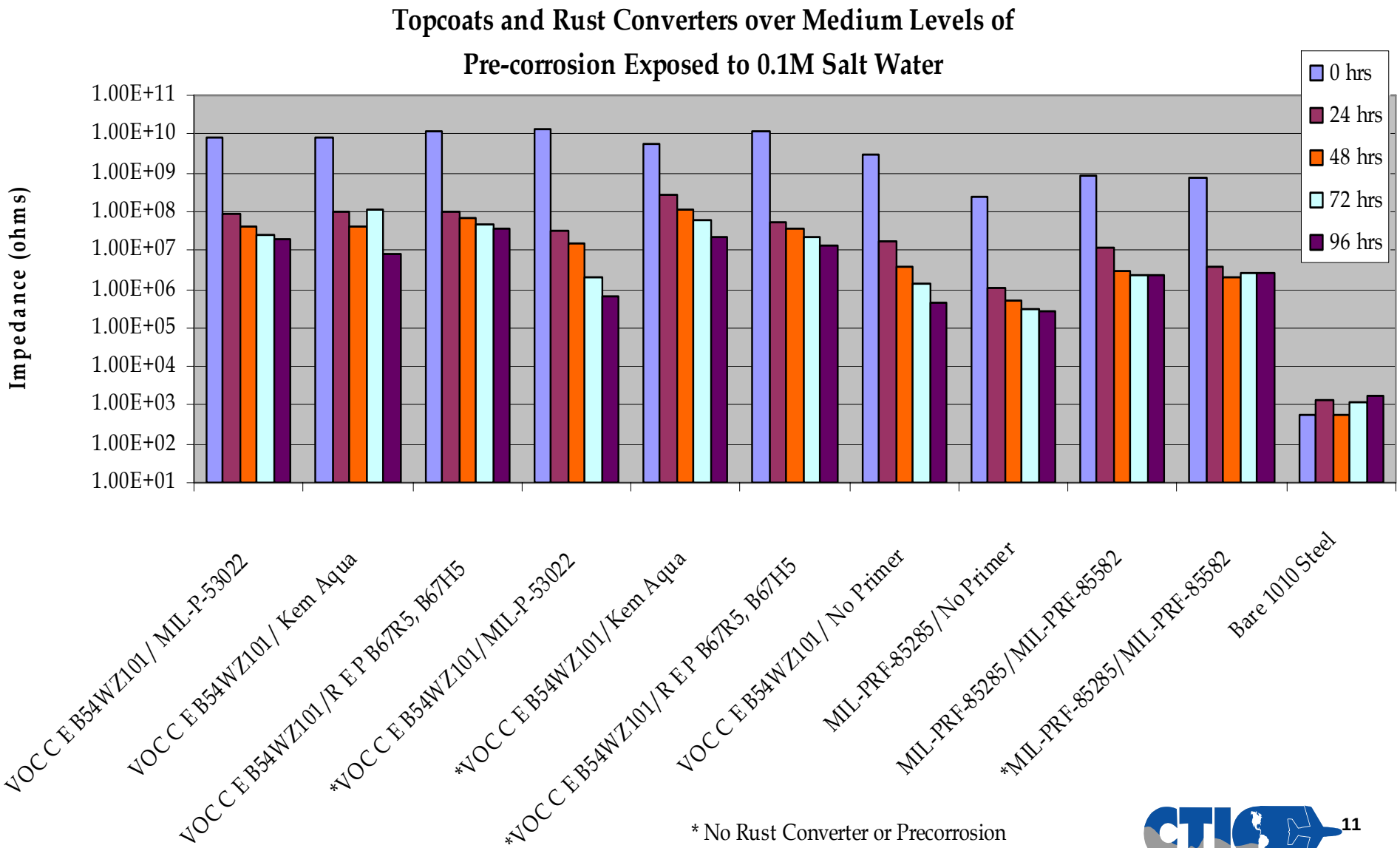
Test Coating Systems EIS Data
Low Frequency Impedance (0.05 Hz)



* No Rust Converter or Precorrosion

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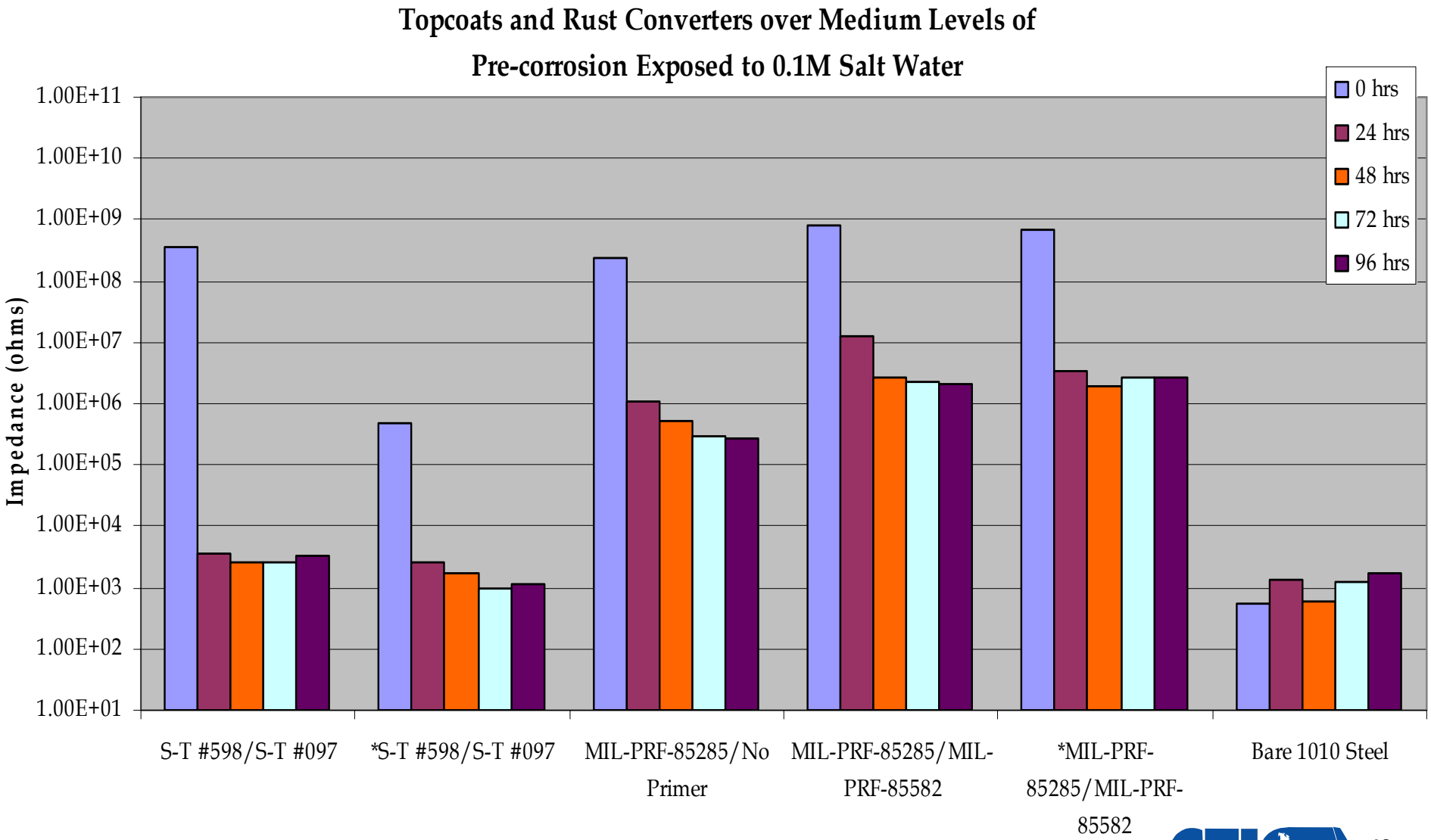
Test Coating Systems EIS Data (con't)

Low Frequency Impedance (0.05 Hz)



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Test Coating Systems EIS Data (con't)
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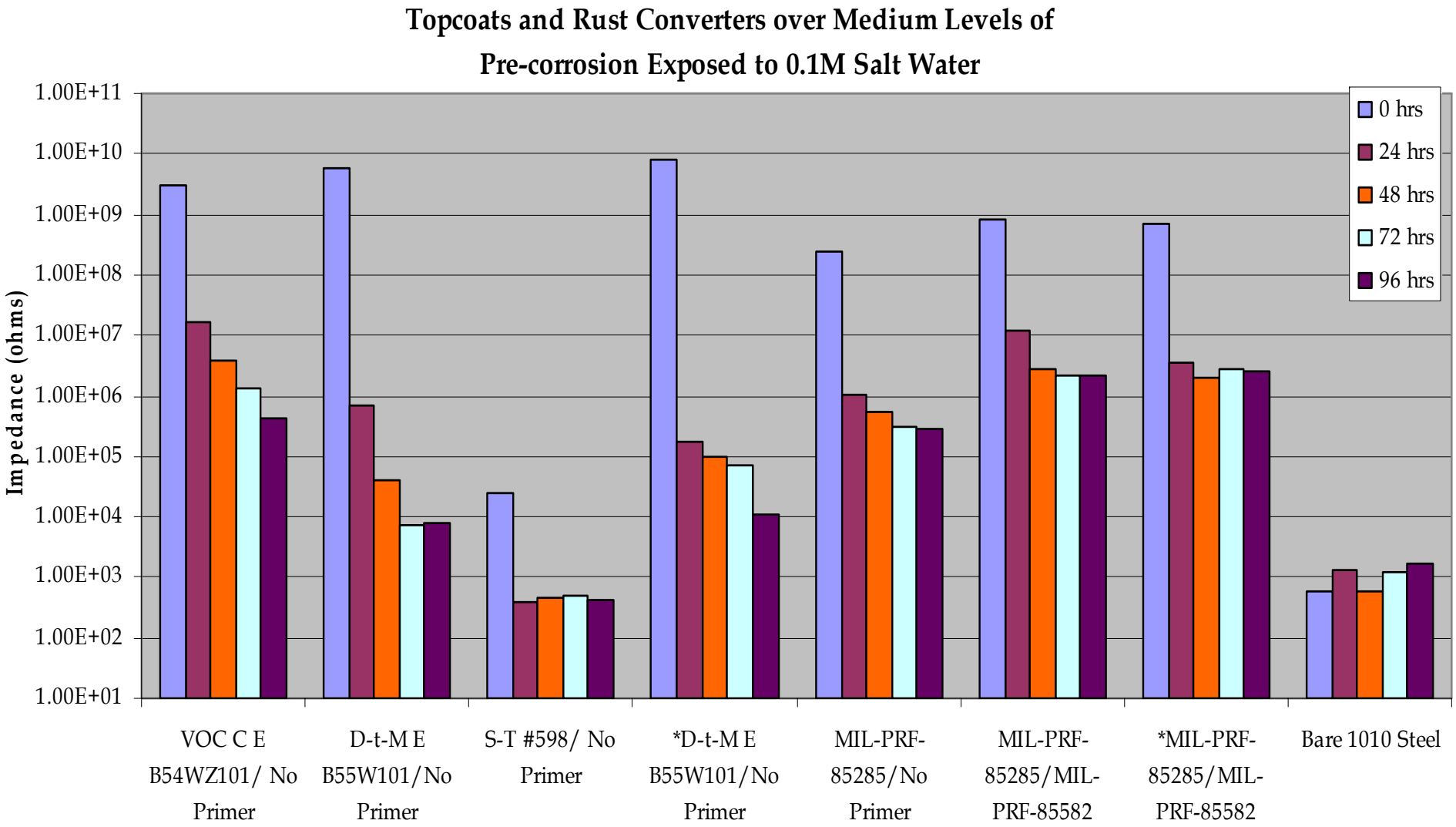

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Progress Report

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Progress Report

- ✓ Materials Received
- ✓ Paint events completed
- ✓ Adhesion testing completed
  - – Wet tape testing results were poor.
  - – Conducted dry tape testing to verify. Results were also poor.
- ✓ Mechanical testing (substrate strength) completed
  - – All coatings performed well on pristine and pre-rusted samples, excepting Extend.

CTIO Points of Contact

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Chemical Stripper Evaluation for Space and Missile Command

23 September 2004

AF COATINGS TECHNOLOGY INTEGRATION OFFICE

Bill Hoogsteden

Project Manager

Coatings Technology Integration Office

Air Force Research Laboratory

Background
Space and Missiles Need

Background
Test Plan
Test Schedule
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- Environmental regulations in Santa Barbara County, CA have significantly reduced the allowable VOC content for coatings systems
  - Predicted to be 100 g/L in 2006
- Strippers currently in use have high VOC content
- Some units have used commercial product Hydrostrip 500 and have found it to perform to their satisfaction
- Project initiated to study effects of Hydrostrip 500 in substrates

Background
Project Extension

Background
Test Plan
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Progress Report

- Additional funds have been procured to extend testing of this product
- Project evaluated the effects of Hydrostrip 500 and compared with Hydrostrip 502 and with Surface Preparation Compound (SPC) -202, -203, -901,and -909
- Project now also includes field testing
  - Locations will be determined at second kickoff meeting

Test Plan

Background

Test Plan

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- Includes
  - ✓ pH Verification
  - ✓ Hydrogen Embrittlement
  - ✓ Immersion Corrosion
  - ✓ Dissimilar Metal Corrosion
  - ✓ Residue Corrosion
  - ✓ Evaporation
  - ✓ Hypergolic Compatibility
  - – Removal Power
  - – Field Testing
- Second Kickoff Meeting will determine further details

Data Summary

Stripper						Immersion Corrosion		Dissimilar Metal Corrosion			Residue Corrosion		
	pH	MMH	UDMH	Embritt.	Evap.	Al	Mild Steel	AL-SS	Al-St.	SS-St.	Al	SS	Mild Steel
H-500	4.0	F	F	P	F	P	P	P	P	F	P	P	P
H-502	3.0	P	P	F	F	P	F	P	F	F	P	P	F
SPC-202	2.5	P	P	P	P	P	F	P	F	F	P	P	F
SPC-203	2.0	F	F	F	P	P	P	F	F	F	F	P	F
SPC-901	4.6	P	P	P	P	F	P	P	F	F	P	P	F
SPC-909	5.9	F	F	F	P	P	P	F	F	F	P	P	F
H_2O	7.2	P	P	N/A	N/A	N/A	N/A	P	P	F	P	P	F

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Chemical Stripper Evaporation Loss

Hydrostrip products fail at 77°F and above

Background

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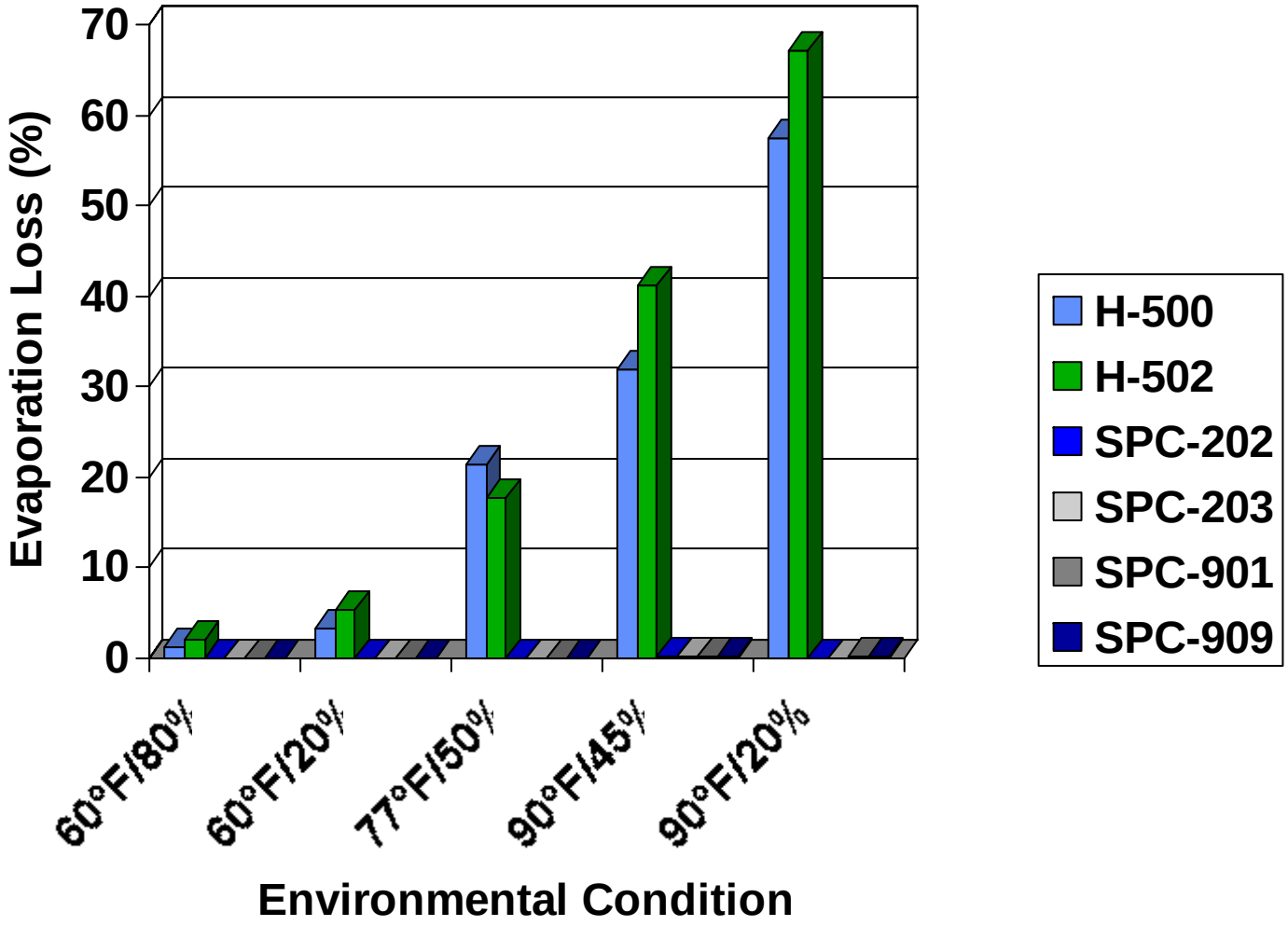

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Chemical Stripper Evaporation Loss

Hotter conditions cause greater evaporation

Background

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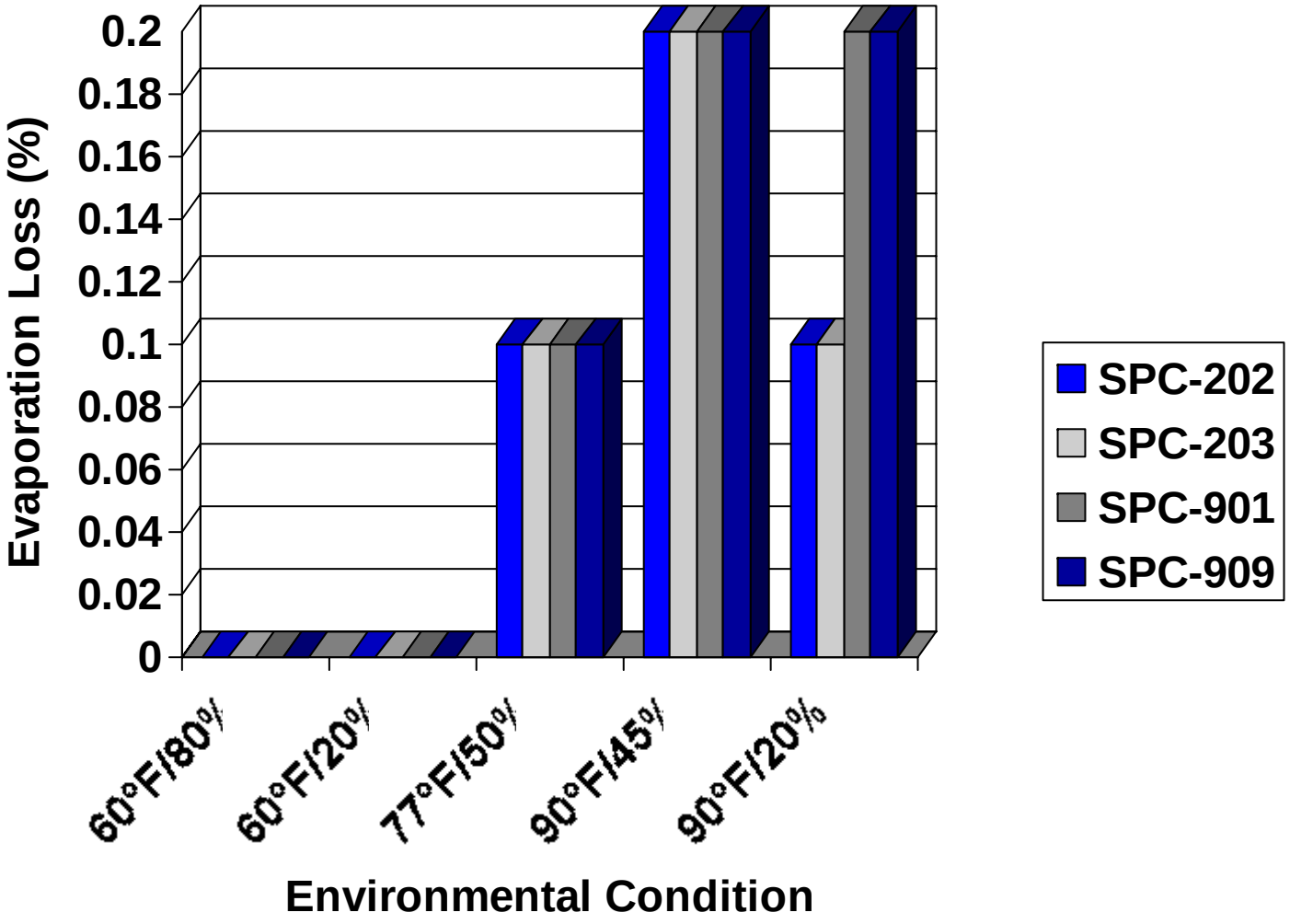

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Test Schedule

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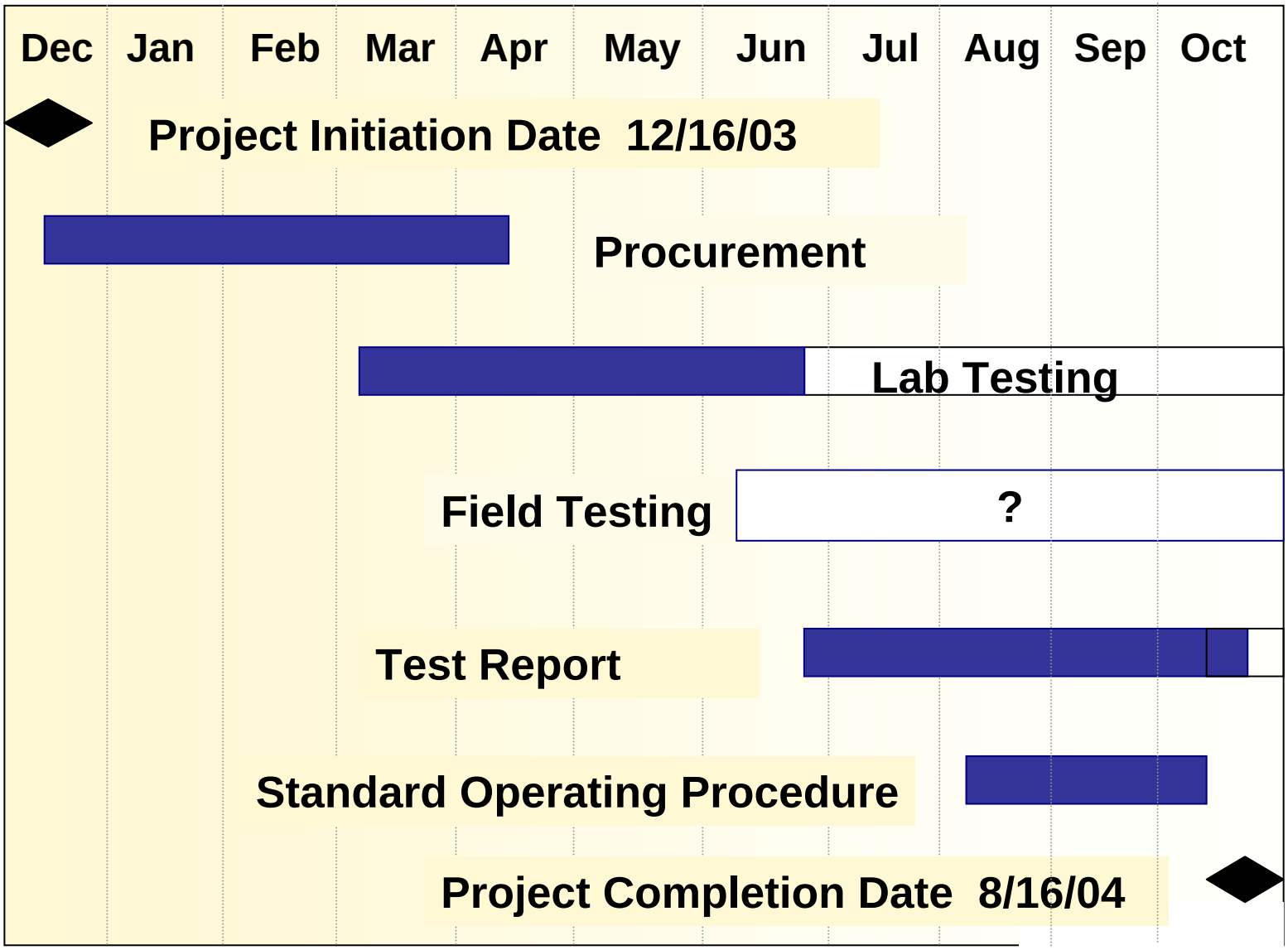

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- Revised coatings for testing
  - Better reflect ICBM coatings
  - All substrates metallized
    - Awaiting substrate specimens to complete removal testing
- Hypergolic compatibility testing complete
  - Hydrostrip 500, SPC-203 & SPC-909 show incompatibility

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