NAVAIR Progress in Assessing, Validating and Implementing Non-Chromate Primers

February 9, 2011

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NAVAL AIR WARFARE CENTER

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
09 FEB 2011		**00-00-2011 to 00-00-2011**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
NAVAIR Progress in Assessing, Validating and Implementing Non-Chromate Primers	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval Air Warfare Center,Materials Engineering Division,22347 Cedar Point Road,Patuxent River,MD,20670**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
ASETSDefense 2011: Sustainable Surface Engineering for Aerospace and Defense Workshop, February 7 - 10, 2011, New Orleans, LA. Sponsored by SERDP/ESTCP.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**19**	

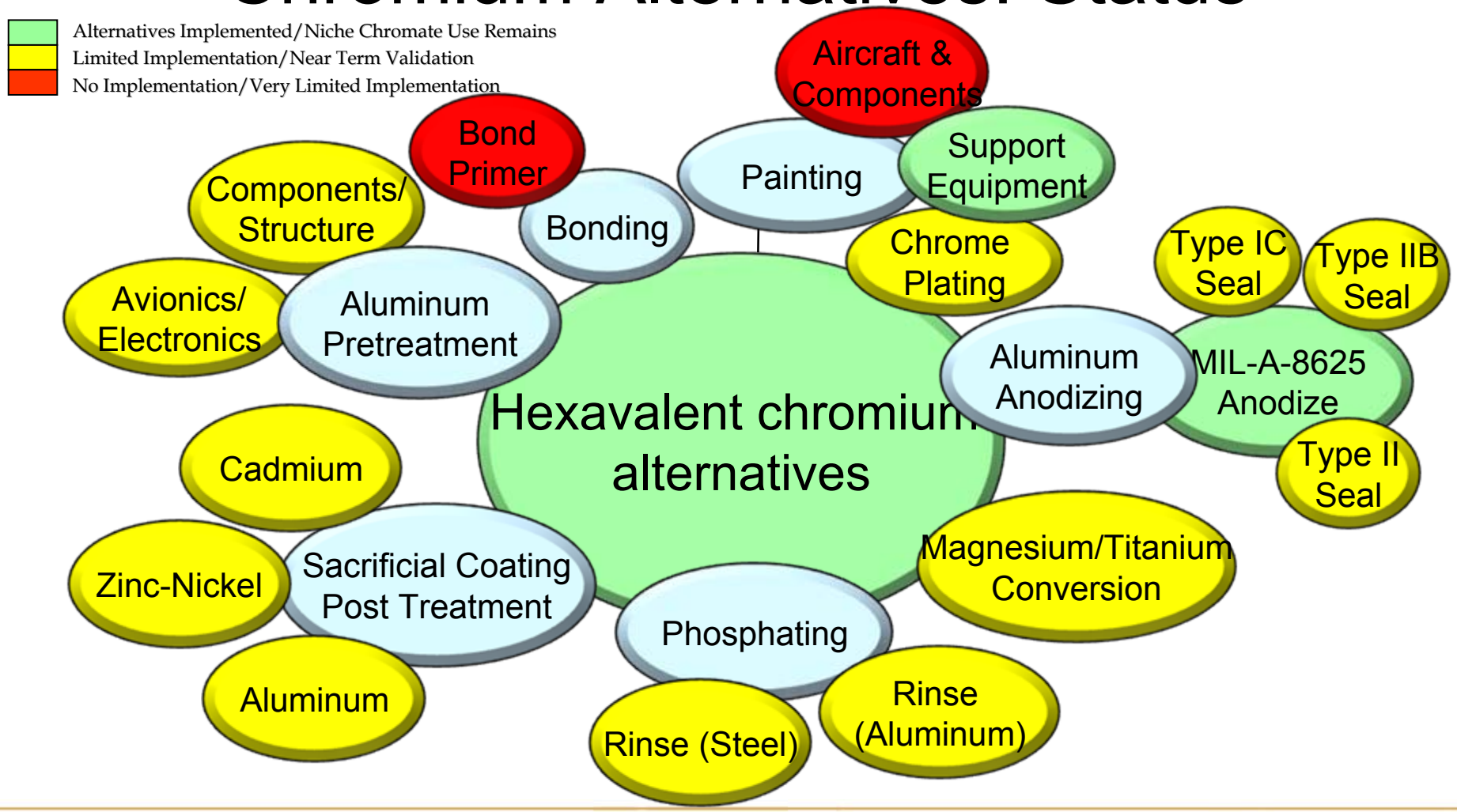
Overview

- Why?
- Application Areas: Status
- On-going efforts
- Implementation Strategy
- Comprehensive NC Primer Projects
- Where are we going?

Why?

To understand the balance between corrosion protection, environmental benefits, regulatory compliance and logistics for any new coating or coating system

NAVAIR Application Areas for Hexavalent Chromium Alternatives: Status



On-going Efforts

Project/Primer	Goal
Mg-Rich Primer	Optimize primer for general use
Electrocoat Primer	Optimize, demonstrate and validate primer/process for aluminum component rework/repair
Non-Chromate, Zero VOC Coating System	Demonstrate and validate coating system for steel ground support equipment
Crosslink	Optimize and mature primer formulation for general use

Mg-Rich Primer

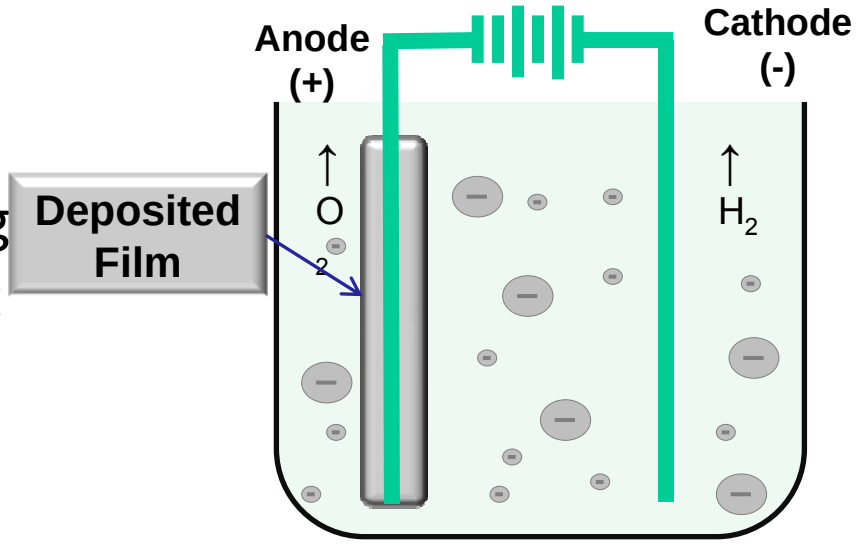
- Assessing MgRP003 formulation in testing:
  - P003 performs better than 1st and 2nd generation formulations (MgRP XP406/XP417)
- Modifications have greatly improved performance
- For use in Naval environment, self-corrosion failure mechanism in accelerated (NSS/SO_2) and beach environment must be understood and overcome
- NAVAIR pursuing cooperative research and development agreement (CRADA) with AkzoNobel to further improve performance to meet NAVAIR requirements

Early Akzo Nobel formulation after 1056 hrs SO2

Latest version from Akzo Nobel after 1176 hrs SO2

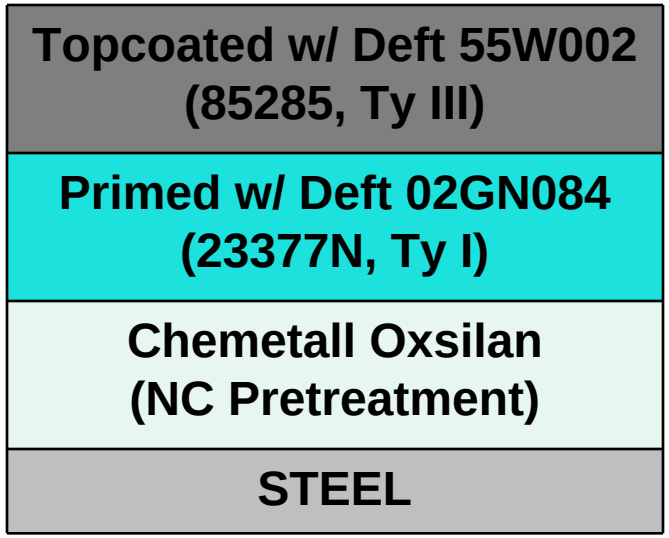
Electrocoat Primer

- Primer formula optimization in progress – NSS, SO_2, Galvanic assembly, Beach Exposure Testing
- Dem/Val location: FRC-Southwest (NAS NI)
  - Electrocoat tank installation
  - Demonstrate primer on aluminum components, such as wheel assemblies



Non-Chromate, Zero VOC Coating System

- Current coating process for steel: grit blast & paint direct to metal
- NC/ZVOC coating system to be demonstrated at FRC-East on Navy ground support equipment
- Laboratory Testing Complete – Humidity, RSL and WTA performed at NAS PAX, GM9540P & Pull-off Adhesion performed at ARL, Beach Exposure testing conducted at Cape Canaveral by Army.

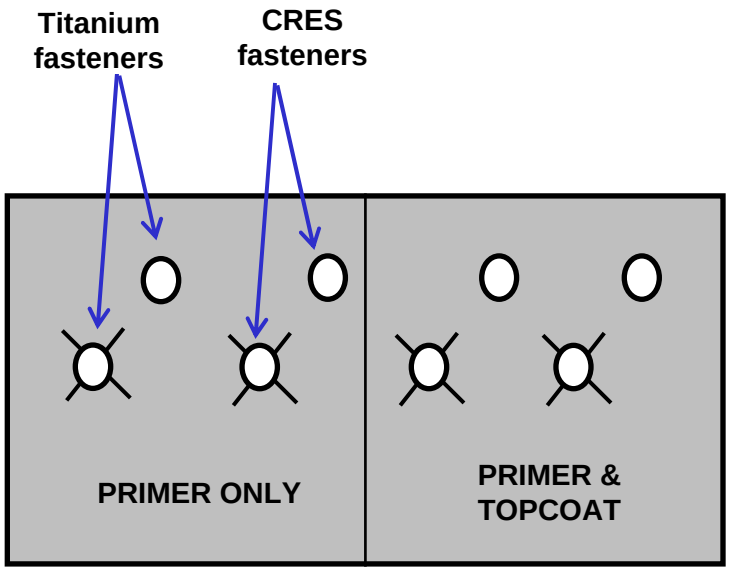


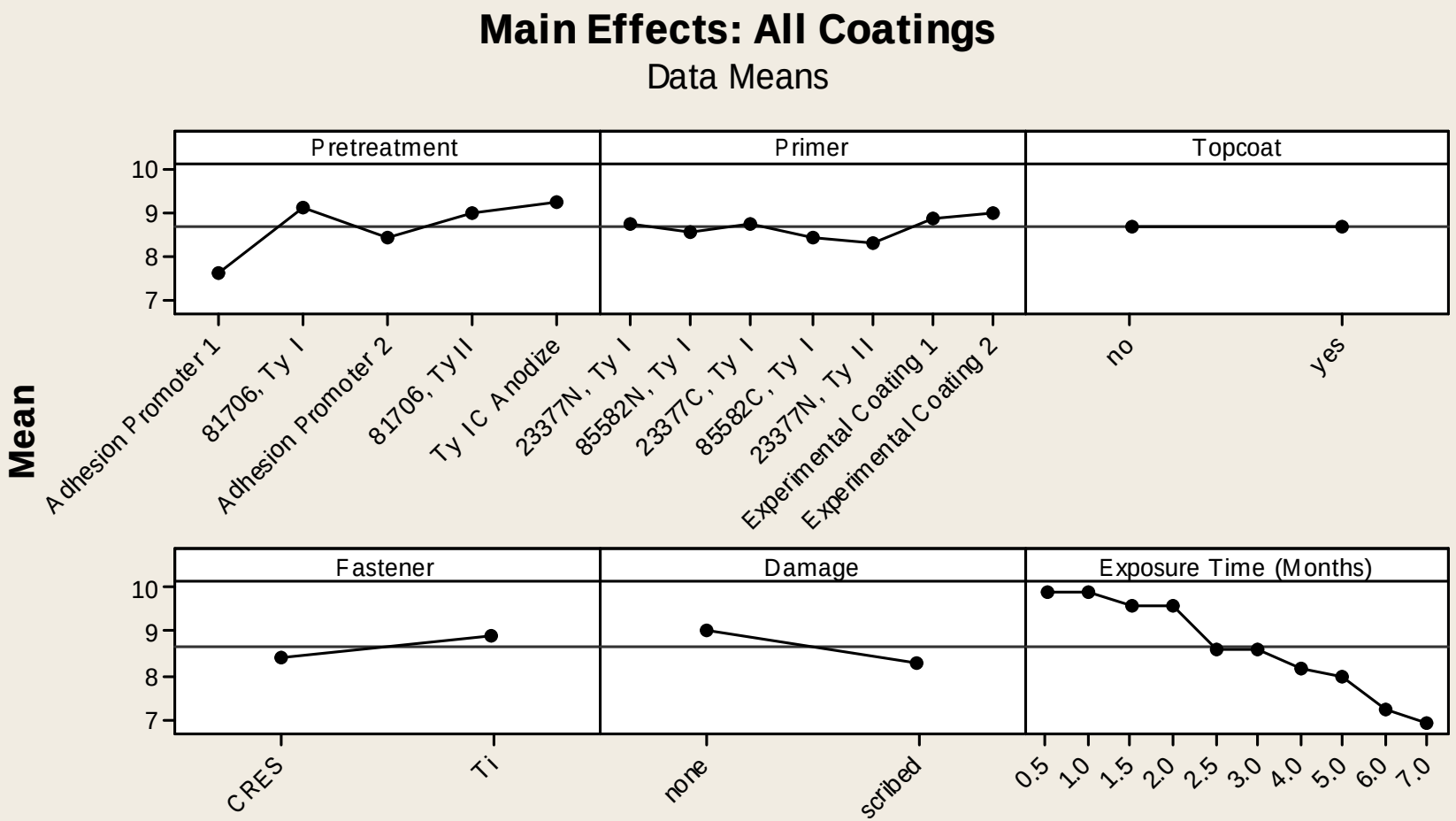
Crosslink Primer

- Previously funded through ESTCP Project #WP-200904
- 3-component primer based on promising new NC pigment package
- Crosslink partnered with Hentzen Coatings, Inc. and Wayne Pigment Corporation to optimize and mature primer formulation
- In-house NSS/SO_2 testing in-progress

NC Primer Comprehensive Evaluation: (In-house Study)

- Evaluated coatings systems made up of 5 different pretreatments and 7 different primers.
- Scribed flat panels and galvanic assemblies tested in NSS, SO_2, and beach exposure
- Minitab - statistical analysis




Main Effects: All Coatings
Data Means
Mean
Pretreatment
Primer
Topcoat
Fastener
Damage
Exposure Time (Months)
10
9
8
7
Adhesion Promoter 1
81706, Ty I
Adhesion Promoter 2
81706, Ty II
Ty I C Anodize
23377N, Ty I
85582N, Ty I
23377C, Ty I
85582C, Ty I
23377N, Ty II
Experimental Coating 1
Experimental Coating 2
no
yes
CRES
Ti
none
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1.0
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2.5
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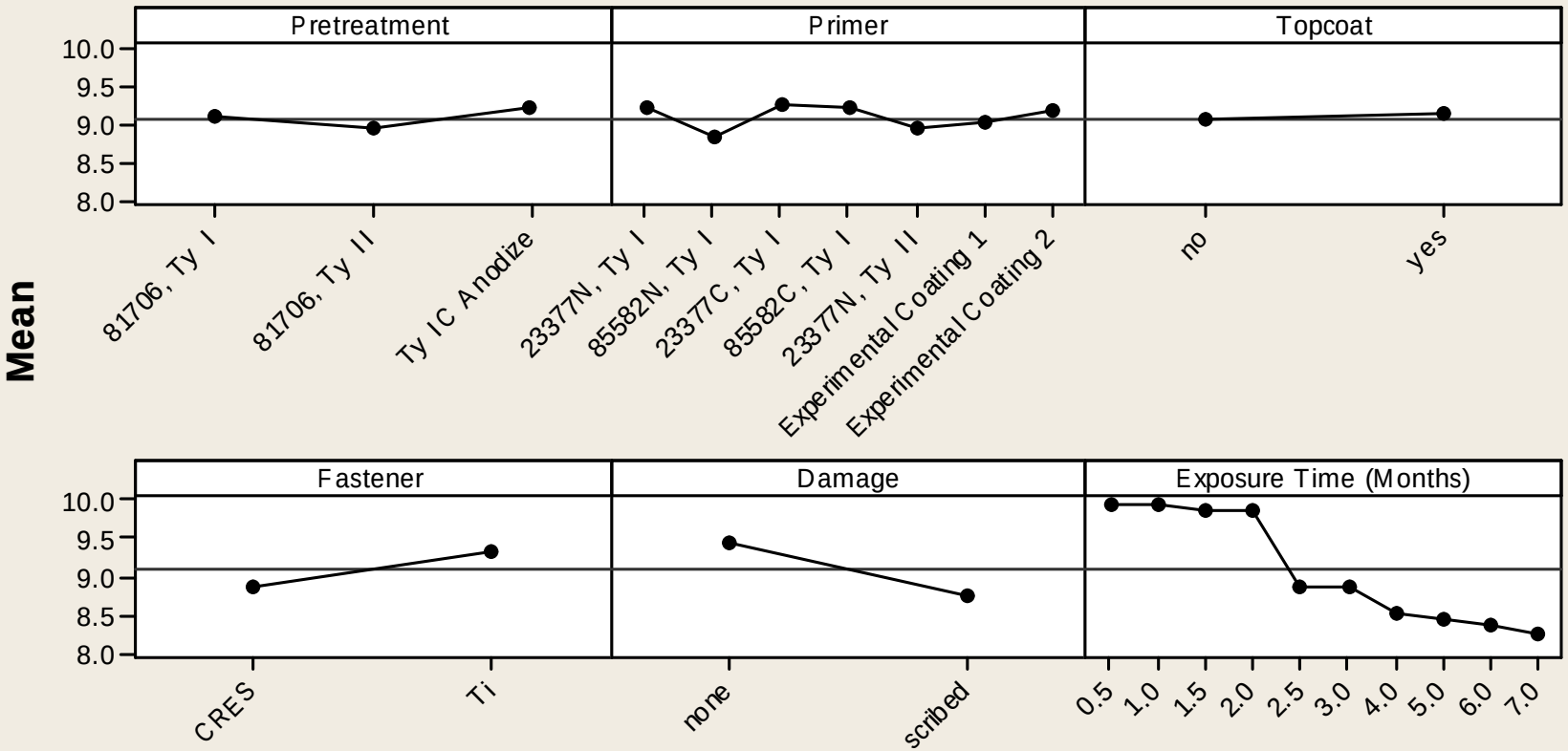
Main Effects: Best Surface Treatments, All Primers
Data Means
Mean
Pretreatment
Primer
Topcoat
Fastener
Damage
Exposure Time (Months)
10.0
9.5
9.0
8.5
8.0
81706, Ty I
81706, Ty II
Ty IC Anodize
23377N, Ty I
85582N, Ty I
23377C, Ty I
85582C, Ty I
23377N, Ty II
Experimental Coating 1
Experimental Coating 2
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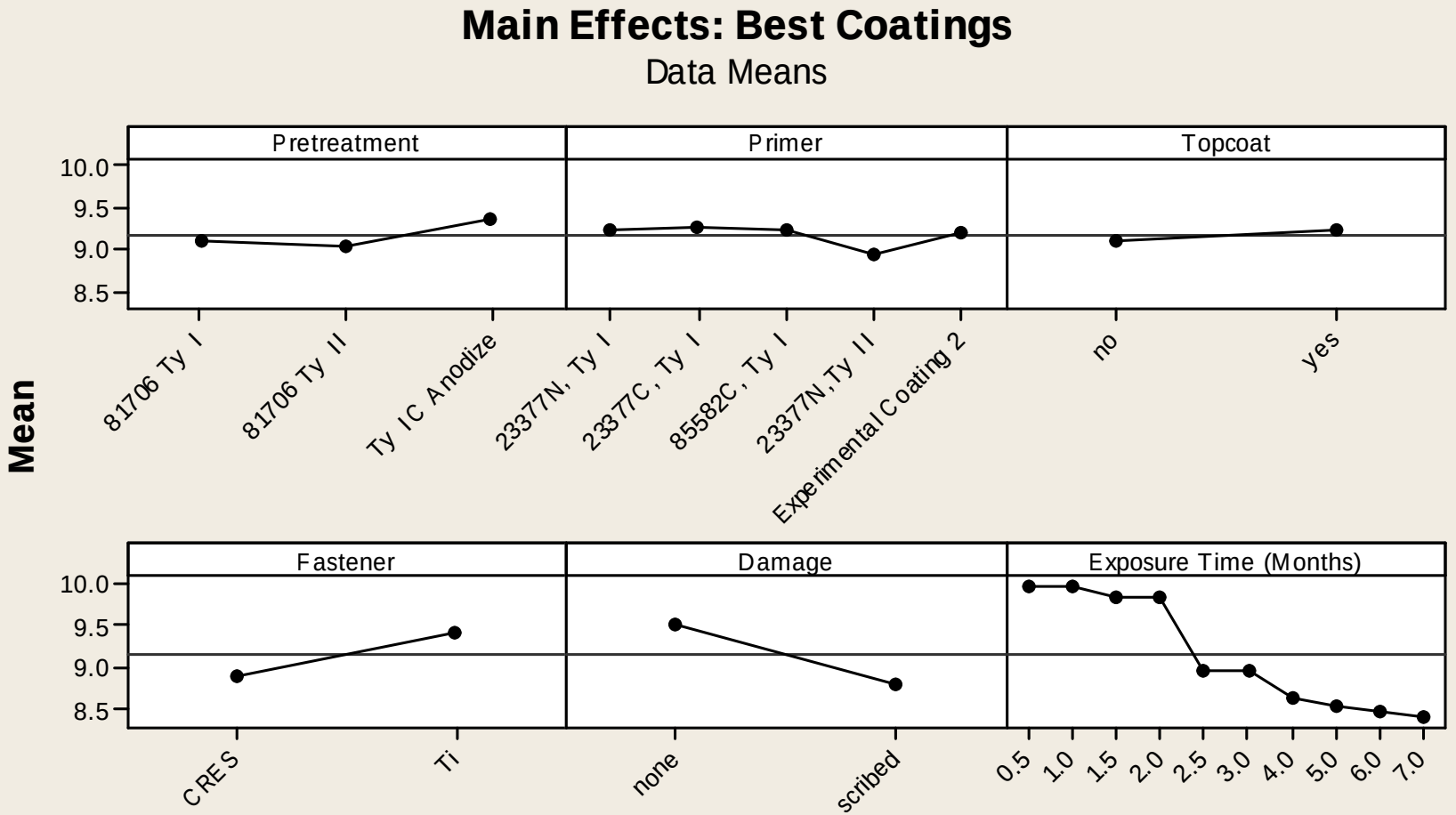
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Primer
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10.0
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81706 Ty I
81706 Ty II
Ty IC Anodize
23377N, Ty I
23377C, Ty I
85582C, Ty I
23377N,Ty II
Experimental Coating 2
no
yes
Fastener
Damage
Exposure Time (Months)
CRES
Ti
none
scribed
0.5
1.0
1.5
2.0
2.5
3.0
4.0
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6.0
7.0

Implementation Strategy

- Based on primer risk assessment
- Application Axis vs. Platform/Basing Axis
- Application Axis: Low-to-High Risk
  - 1 (L) – Composite/Fiberglass Surfaces
  - 2 (L) – Non-critical Metallic Surfaces – External Fuel Tanks, etc.
  - 3 (M) – Airframe Tie-Coat Applications
    - 3A – OML / 3B – IML – Topcoat or inspectable areas only
  - 4 (M-H) – Airframe Direct-to-Metal Applications
    - 4A – OML / 4B – IML
  - 5 (H) – Interior/Faying Surface/HS Components.

Implementation Strategy

- Platform Axis
  - 1 (L) – Trainer Aircraft – T-45, T-34, etc.
  - 2 (M) – Land based Aircraft – KC-135, C-40, etc.
  - 3 (M-H) – Special Land – P-8, H-53, etc.
  - 4 (H) – Ship-based Aircraft – E-2, H-60, etc.
  - 5 (H) – Ship-based Aircraft – *Specialty Coatings
    - F/A-18, EA-18G, F-35, etc.

Comprehensive Evaluation and Transition of NC Primers

- **GOAL:** *Evaluation & dem/val of mature non-chromate primers for corrosion/environmental performance over a range of platforms and applications, starting with lower risk implementation strategies*
- Focus on Navy-specific requirements:

FRC-East	FRC-Southeast	FRC-Southwest
•**V22:** NC primer as tie coat with Type IV topcoat •**H-46:** Ty II conversion coating w/ mature Ty II, NC primer •Dem/val NC primer on composite components	• Ty I & II NC coating systems, including Ty II conversion coating and NC anodize sealing •Dem/val NC primer on composite and avionics components	•**E-2/C-2**: Leading Ty I NC Primer over CCC on outer moldline; if successful, implement coating system on interior/components •Transition E-2 coating system to **F/A-18 Hornets**

Comprehensive Evaluation and Transition of NC Primers

- **GOAL**
  - *"Top down" assessment of current NC primer technology, including coating process MRL and coating TRL*
  - *Dem/val NC primers and processes with sufficient process and coating maturity and invest in development of promising newer technologies*
- Test multiple substrates, surface conditions, exposure environments and coating combinations, comparing to CCC
- Joint service demonstration (Army, AF, USCG, USMC)

Where are we going?

- Use the NESDI and ESTCP efforts to address the DoD Cr^{6+} memos and anticipated new DFARS contract language and *accelerate* the transition of NC primers at DoD and OEM/Sub-contractors.

- Efforts will provide the data required to make authorization and implementation decisions, starting with low-risk applications and moving toward medium and high-risk applications as warranted by products

Questions?