



# Fleet Readiness Center - Southeast TECHNOLOGY DEVELOPMENT PROGRAM (Cadmium & Hexavalent Chromium Reduction)

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***Jack Benfer***  
***Senior Materials Engineer***  
***Corrosion Science & Engineering***

**NAVAIR Jacksonville**  
**Phone: (904) 790-6405**  
**Email: [john.benfer@navy.mil](mailto:john.benfer@navy.mil)**



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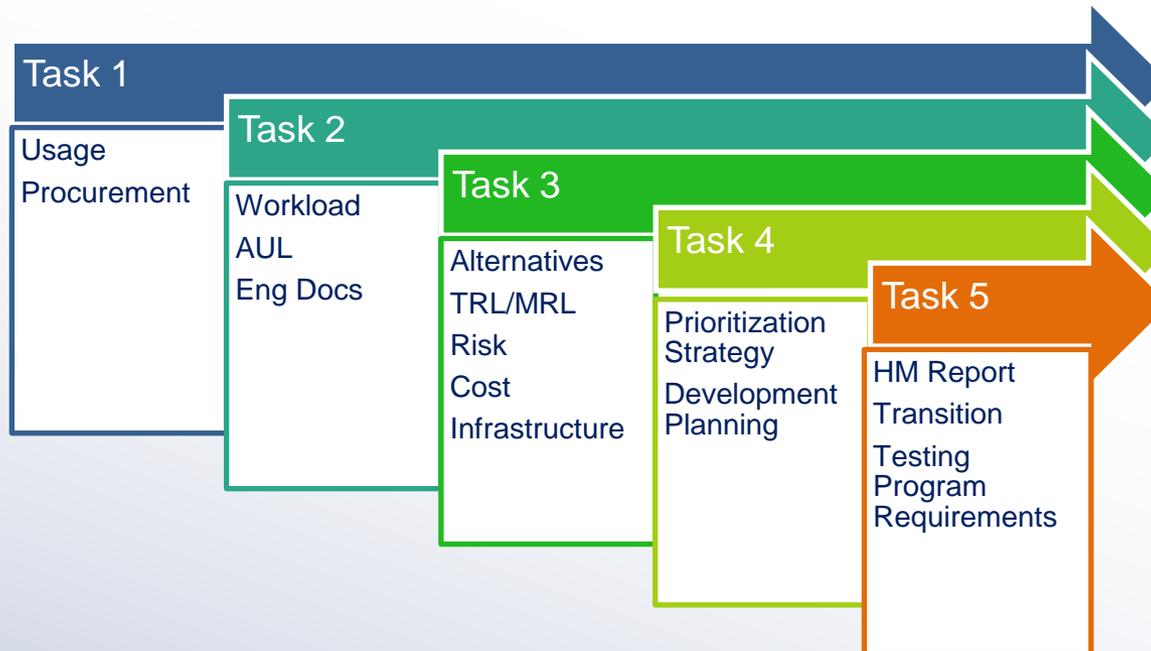


# NAVAIR HM Reduction

- **NAVAIR Technology Implementation Assessment for Reduction of Heavy Metals Usage**
- **Goal: 90% Reduction Within 5 Years**
  - Task 1 – Identify HM Usage
  - Task 2 – Workload Correlation and AUL
  - Task 3 - Identify Process Alternatives
  - Task 4 - Prioritize Implementation
  - Task 5 - HM Analysis Report & POA&M



**ESTCP Project Funded  
(July 2014)  
5 Core Tasks**

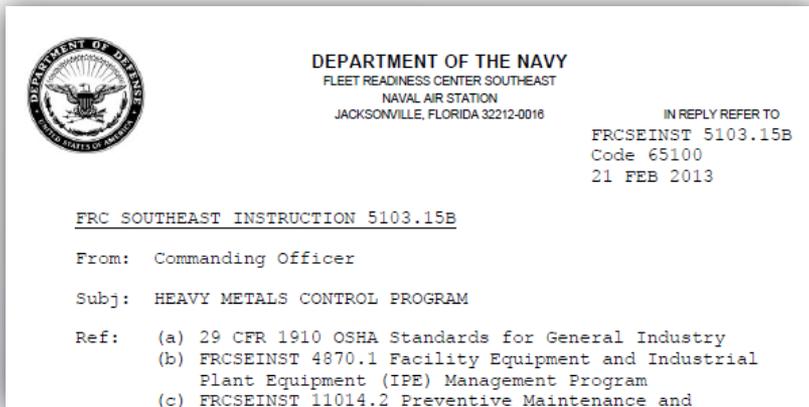




# Policy Guidance

## ❑ FRCSEINST 5103.15

- FRCSE Responsibilities
- “Do not introduce new sources of heavy metals into repair, overhaul or modification processes...”

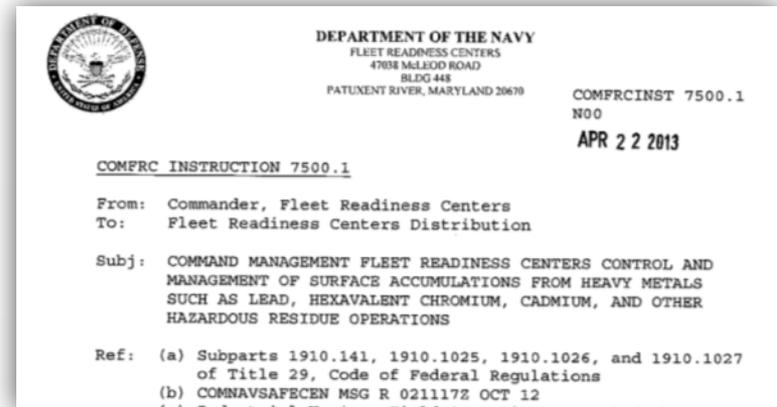


### c. Research and Engineering Group (code 40000)

(1) Ensure that revisions to FRCSE managed technical documentation (e.g., MIMs, Local Engineering Specifications (LES), drawings, etc.) do not introduce new sources of heavy metals into repair, overhaul, or modification processes unless technically required.

## ❑ COMFRCINST 7500.1

- FRC Responsibilities
- Reduced Exposure
- Revision Requested



n. Evaluate emergent technology to reduce or eliminate potential HM exposure.

o. Review engineering controls for effectiveness and modify/tailor appropriately.

b. Paragraph 4.n – “Evaluate, approve and implement the use of viable alternative technologies to reduce or eliminate HM usage and potential HM exposure.”

**Requested Revision per 2014JX00417**



# Site Locations

**NAVAIR MATERIALS ENGINEERING**

**Materials Engineering Division**

- Metals & Ceramics Branch
- Industrial / Operational Chemicals Branch
- Nondestructive Inspection Branch
- Polymers & Composites Branch
- Analytical Chemistry & Testing Branch
- Corrosion & Wear Branch

NAWCAD Lakehurst

NAWCAD Pax River

FRC/ISSC Cherry Point

FRC/ISSC Jacksonville

NAWCWD China Lake

FRC/ISSC North Island

- FRC East
- FRC Southeast
- FRC Southwest
- NAWC-AD





# HM Cleaning Requirement(s)

## Daily Break Room Cleaning

BREAK ROOM AND LUNCH ROOM DAILY CLEANING LOG						
SECTION I - BASIC INFORMATION						
1. SBT	2. BREAK ROOM NUMBER & LOCATION	3. DATE				
		DAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
SECTION II - A SHIFT						
1. CLEAN ALL SURFACES OF THE FOLLOWING ITEMS (Initial each block <b>DAILY</b> once completed):						
a. Interior & exterior parts of doors (including handles & knobs)						
b. All food preparation surfaces						
c. Tables/chairs/benches (including legs)						
d. Refrigerators, coffee pots, toasters, ice machine						
e. Vending machines (including key pads & doors)						
f. Microwave ovens (including handles & keypad)						
g. Shelving/Cabinets						
h. Televisions, radios, fan guards & blades						
i. All other horizontal surfaces (molding, chair rails, window/door & picture frames, pipe/conduit/ducts, bulletin boards etc.) (8 feet & below)						
2. Mop floor - HEPA vacuum first if necessary, DO NOT DRY SWEEP						
3. Ensure tacky mats are still effective						
4. A SHIFT CLEANER - AFTER ALL ITEMS ARE CLEANED AND INITIALED, PRINT NAME & SIGN		PRINT NAME				
		SIGNATURE				

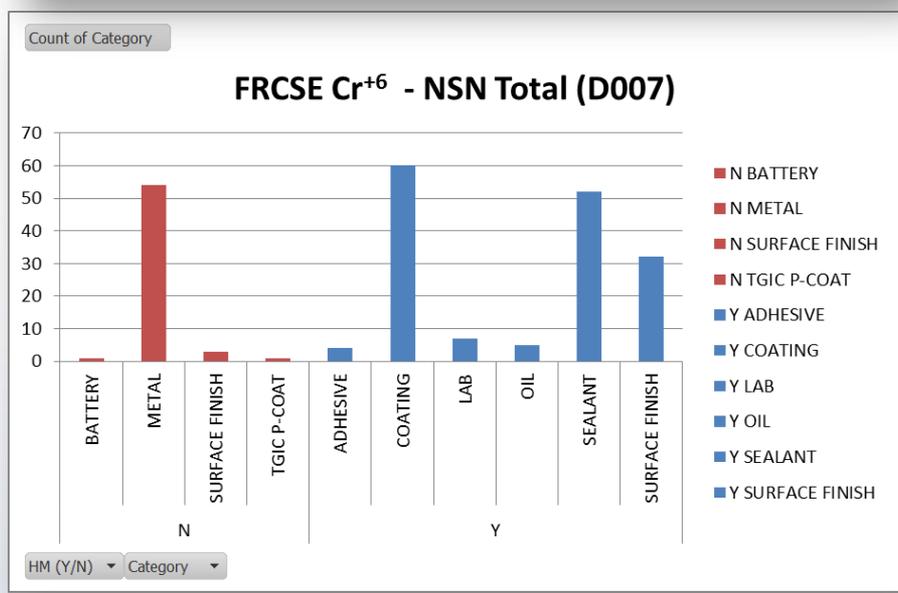
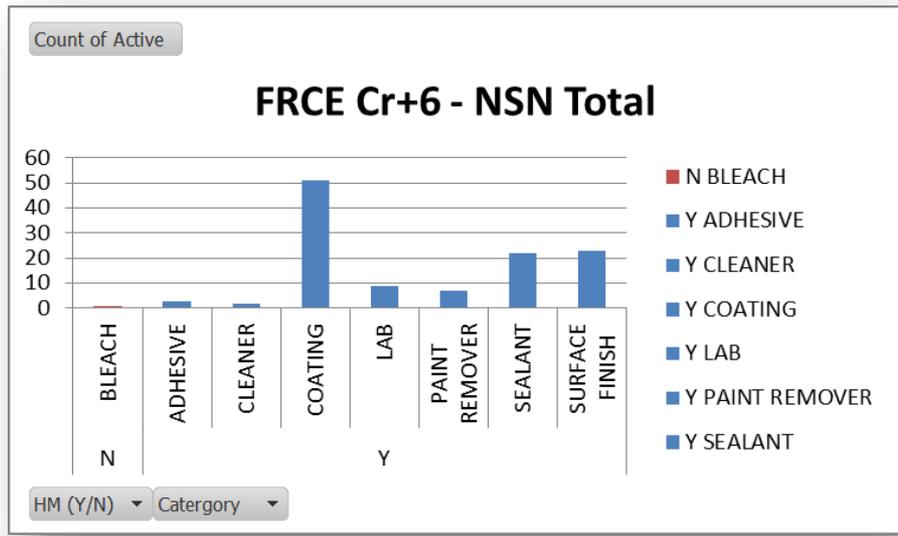
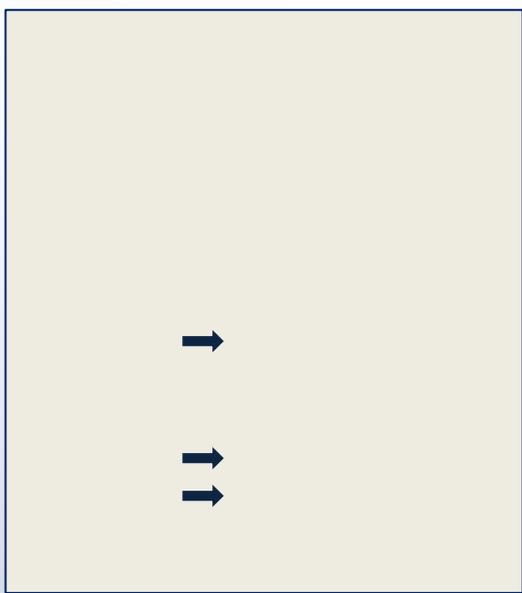
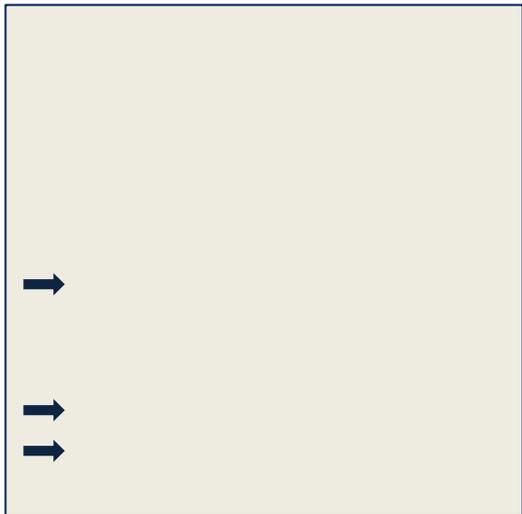


Approximately \$1M/year labor/materials for HM daily cleaning at FRC



# Task 1: Active Usage by NSN Cr+6

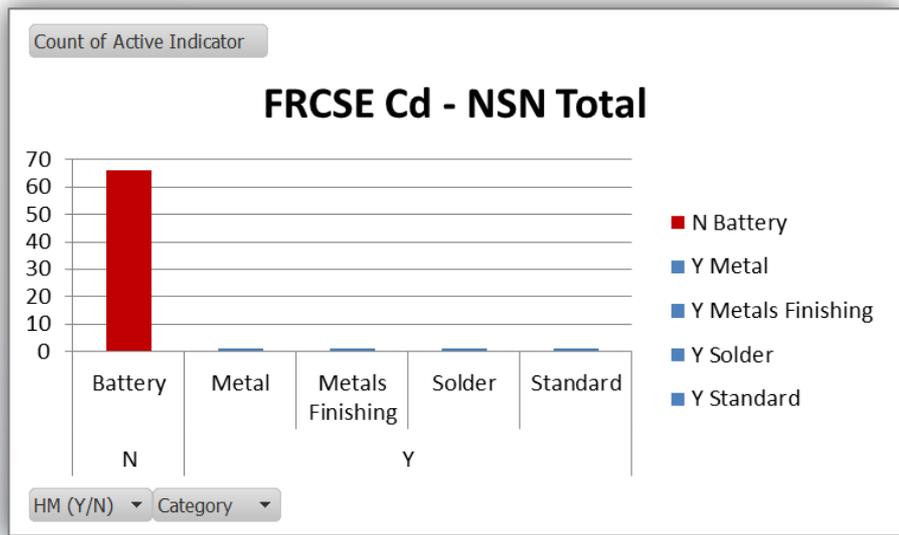
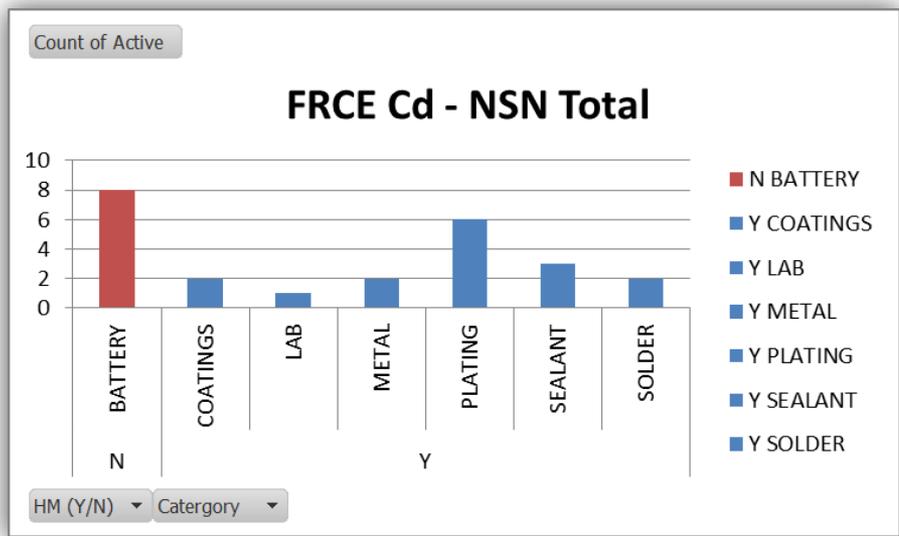
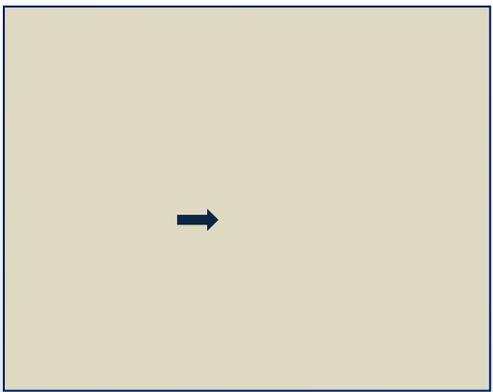
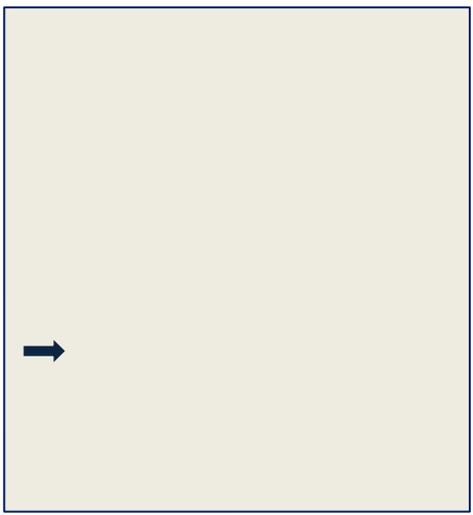
Hazardous Materials Management System (HMMS)





# Task 1: Active Usage by NSN Cd

Hazardous Materials Management System (HMMS)  
iHS





# Task 2: AUL Correlation

## AUL - Authorized Use List

07-MAY-2007 15:56:07

### Zone Material Authorization Report by NSN

Zone: ALL

**Production Code  
62722 -  
Electroplating**



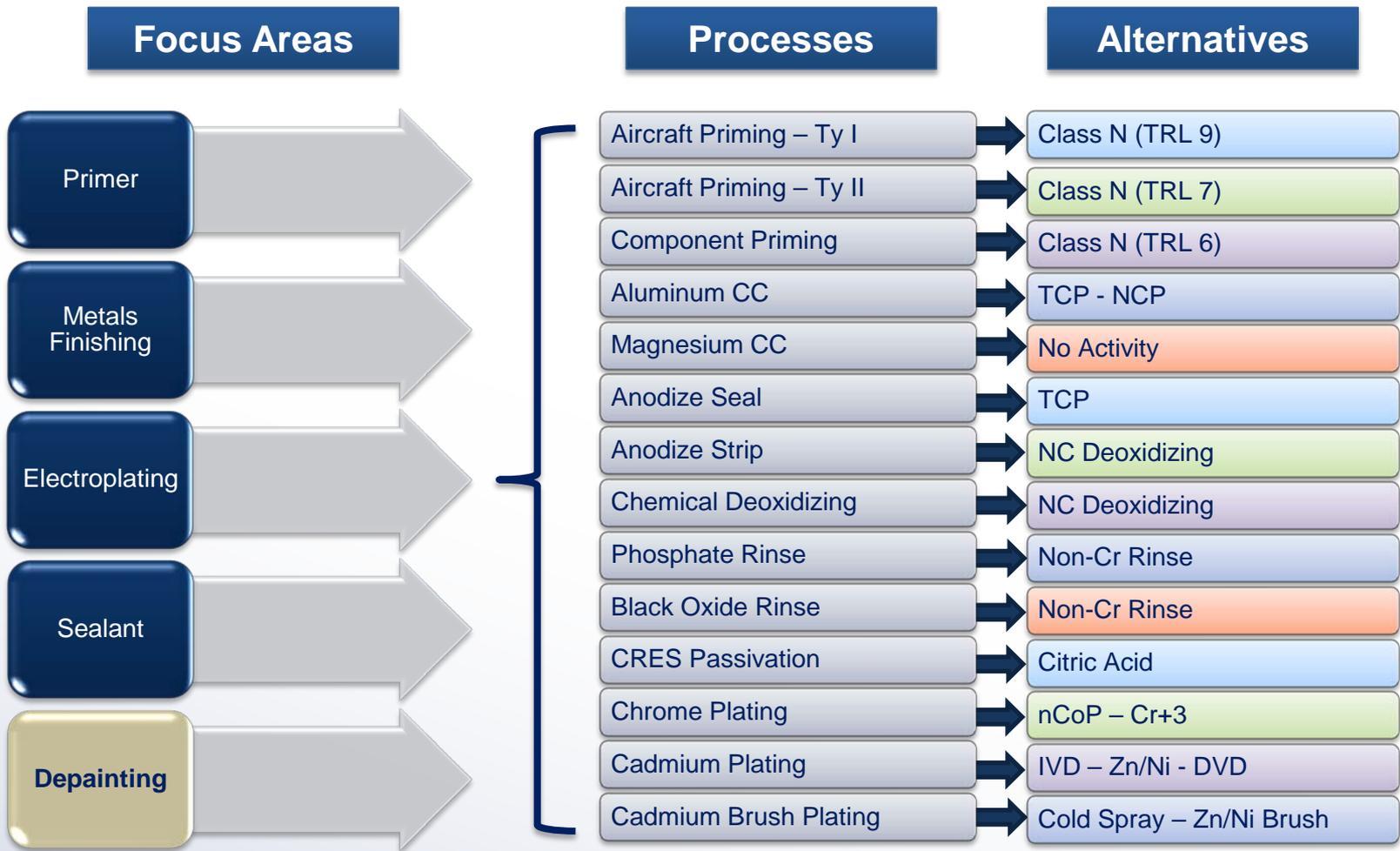
**National Stock Number**



Zone	NSN	Part Number	Trade Name	Item Name	AU
62722	6810002643939	TECHNICAL	TECHNICAL	TECHNICAL	
		CHROMIUM TRIOXIDE, CHROMIC ACID	CHROMIUM TRIOXIDE, CHROMIC ACID	CHROMIUM TRIOXIDE, TECHNICAL	
	6810002646713	SODIUM STANNATE, TRIHYDRATE	SODIUM STANNATE, TRIHYDRATE	SODIUM STANNATE, TRIHYDRATE ANALYZED REAGENT	
		6810002812035	7790, CUPRIC SULFATE	7790, CUPRIC SULFATE	CUPRIC SULFATE, PENTAHYDRATE TECHNICAL
	6810002812686		SODIUM BICHROMATE CRYSTAL	SODIUM BICHROMATE CRYSTAL	SODIUM DICHROMATE, DIHYDRATE TECHNICAL
		SODIUM DICHROMATE DIHYDRATE	SODIUM DICHROMATE DIHYDRATE	SODIUM DICHROMATE, DIHYDRATE TECHNICAL	
		SODIUM DICHROMATE, DIHYDRATE, TECHNICAL	SODIUM DICHROMATE, DIHYDRATE, TECHNICAL	SODIUM DICHROMATE, DIHYDRATE TECHNICAL	
	6810002816933	SODIUM CYANIDE, TECHNICAL BRIQUETTE	SODIUM CYANIDE, TECHNICAL BRIQUETTE	SODIUM CYANIDE, TECHNICAL TECHNICAL	
		6810002818804	CADMIUM OXIDE	CADMIUM OXIDE	CADMIUM OXIDE, TECHNICAL
			CADMIUM OXIDE/	CADMIUM OXIDE/	CADMIUM OXIDE,



# HM Process Areas





# Project Planning

## FRCSE Listing of Cd and Cr+6 Processes

FRCSE - Cadmium & Hexavalent Chromium Usage & Alternatives						
Process Area	Description	Specification	Material	Technical Instruction	Alternatives	FRCSE Active
Painting	Epoxy Primer	MIL-PRF-23377, MIL-PRF-85582	DEFT 44-GN	LPS 650	Class N	Y
Painting	Epoxy Primer	MIL-PRF-23377, MIL-PRF-85582	DEFT 44-GN	LPS 650, LPS 660	Low Temp P-Coat	N
Painting	IFT Coating	AMS-C-27725	PRC 825X309	LPS 670	None	N
Painting	Polysulfide Sealant	MIL-PRF-87133, Ty III	PR-1436	LPS 680	Grade B (No Products)	Y
Surface Finishing	Aluminum Chromate Conversion Coating	MIL-DTL-81706	Alodine 600	LPS 320	TCP	Y
Surface Finishing	Magnesium Chromate Conversion Coating	AMS-M-3171, Ty III	Sodium Dichromate - Technical Grade	LPS 315	Tagnite, TCP	N
Surface Finishing	Passivation	AMS-QQ-P-35, Ty II, AMS 2700	Sodium Dichromate - Technical Grade	LPS 325	Citric Acid (All Alloys)	N
Surface Finishing	Aluminum Deox		Turco Deox 6/16	LPS 310	Smut Go NC or Metalast 3300	Y
Surface Finishing	Aluminum Deox - Spot Weld Cleaning		Turco Deox 6/16	LPS 261		N
Surface Finishing	Anodize Strip		Turco Deox 6/16	LPS 305, LPS 310	Metalast AOS 100, Stone Chem AN775	Y
Surface Finishing	IVD Post Treatment	MIL-DTL-81706	Alodine 600	LPS 300	TCP	Y
Surface Finishing	Cadmium Post Treatment	AMS QQ-P-416, AMS 2400	Sodium Dichromate - Technical Grade	LPS 430	None	N
Surface Finishing	Anodize Sealing	MIL-A-8625	Sodium Dichromate - Technical Grade	LPS 305, LPS 310	TCP	Y
Surface Finishing	Black Oxide - Chromic Acid Rinse	MIL-DTL-13924	Chromic Acid - Technical Grade	LPS 350	TCP	N
Surface Finishing	Phosphate Rinse - Chromic Acid Rinse	MIL-DTL-16232	Chromic Acid - Technical Grade	LPS 350	TCP	N
Electroplating	Chrome Plating	AMS QQ-P-320, AMS 2460	Chromic Acid - Technical Grade	LPS 420	HVOF, nCoP	Y
Electroplating	Cadmium Plating	AMS QQ-P-416, AMS 2400	Cadium Oxide, A-A-50800	LPS 430	IVD-AI, IZ-C17+ (Zinc-Nickel), Cold Spray,	Y
Electroplating	Copper Stripping		Chromic Acid - Technical Grade	LPS 430	Alumiplate	
Electroplating	Silver Plating - Tarnish Resistance	ASTM B700, Grade A	Sodium Dichromate - Technical Grade	LPS 430		
Coating Removal	Sanding			NA 01-1A-509	Vacumn Sanding	Y
Coating Removal	Chemical Depaint			LPS 250		N
Coating Removal	PMB			LPS 250		N

- **Prioritize to develop implementation strategy based upon FRC impact and engineering approval.**



# FRCSE Aspect List

## FY14 Process Activities with 'Significant' Environmental Aspects and Impacts (Top 20%)

- Industrial Waste Water Treatment
- Aircraft & Component Paint Removal (ABM & Chemical)
- **Chrome Electroplating**
- **Corrosion Treatment**
- **Aircraft & Component Paint Operations**
- **Chromate Conversion (A/C & Components)**
- Hazardous Material Management
- Oxygen Cleaning (ODS)
- **Cadmium & Silver (cyanide) Electroplating**
- **Metal Finishing – Anodize (Hex Chrome post treatment)**
- Energy Use; Electrical (& Steam)
- NDI- Florescent Penetrant
- Solvent Tank Cleaning
- Water (& Sanitary) Use

Generated from EMS Metrics



# Aircraft Priming

## ■ NAVAIR Fleet Readiness Center Jacksonville

- MIL-PRF-85582 Epoxy Primer (Class C1)
- Type I -Class N Authorization Pending
- Type II – Class N Authorization (Dem/Val)



A/C Paint Bay - Shop 62716

**Ty II Epoxy Primer  
Approval is Required**

**Dem/Val Delays w/ A/C  
Delivery Schedules**

- H-60 Seahawk
- P-3 Orion
- F/A-18 Hornet
- F/A-18 Superhornet
- EA-6B Prowler
- T-34 Mentor
- T-44 Pegasus



# Anodize Sealing

## ■ NAVAIR Fleet Readiness Center Jacksonville

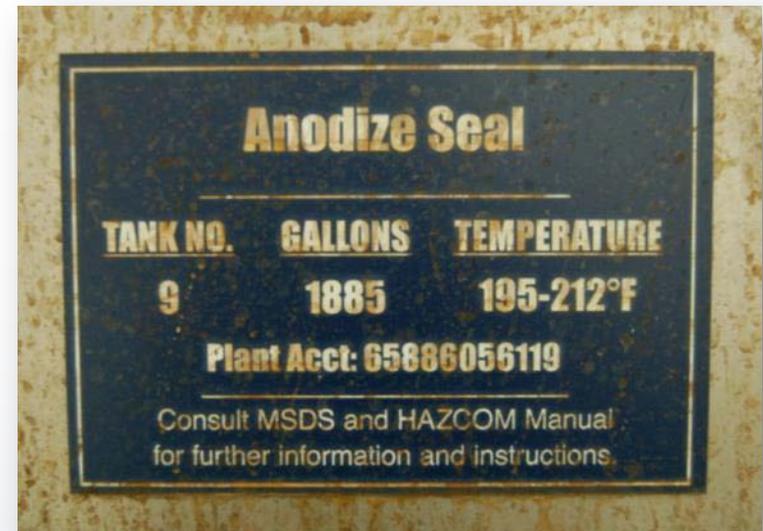
- 1885 gallon process tank
- TCP Substitution Authorized
- Boiling chromate solution

CIP Project Scheduled for  
Installation 2014

Major Modification of  
Anodize Process Line



Tank 9 – Shop 62713





# Magnesium Treatment

## ■ NAVAIR Fleet Readiness Center Jacksonville

- 740 gallon process tank
- Boiling chromate Solution

**NO Active Development  
TCP – Potential Solution**

**Drop in replacement,  
minor modification**



Tank 30 – Shop 62713



# Aluminum Conversion Coating

## ■ NAVAIR Fleet Readiness Center Jacksonville

- 598 gallon process tank
- TCP Substitution Authorized
- Aluminum Alloys & IVD post treatment

Color Additive Recommended  
for process control  
NESDI Proposal in Review

Drop in replacement, minor  
modification



Tank 8 – Shop 62713



# CRES Passivation

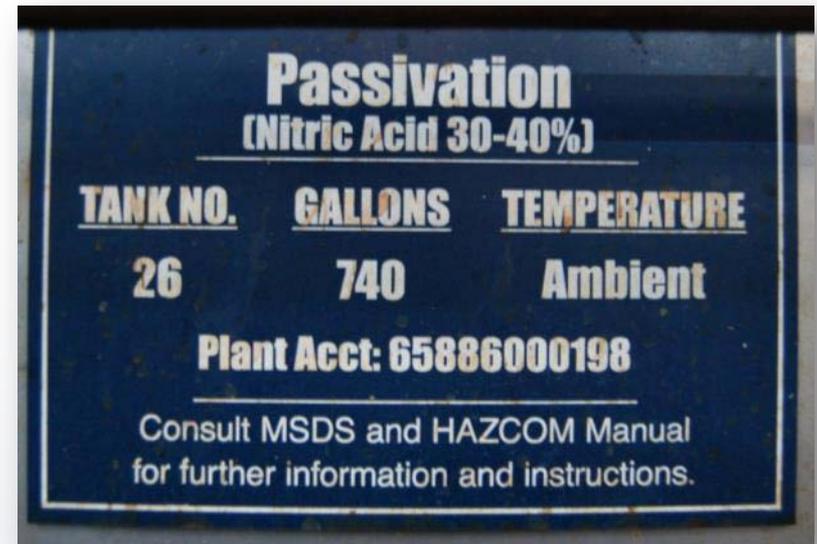
## ■ NAVAIR Fleet Readiness Center Jacksonville

- 740 gallon process tank (120-130F)
- Need all in one replacement
- FRC alloy systems (Citric Acid?)

Minor Modification of  
Process Line



Tank 26 – Shop 62713



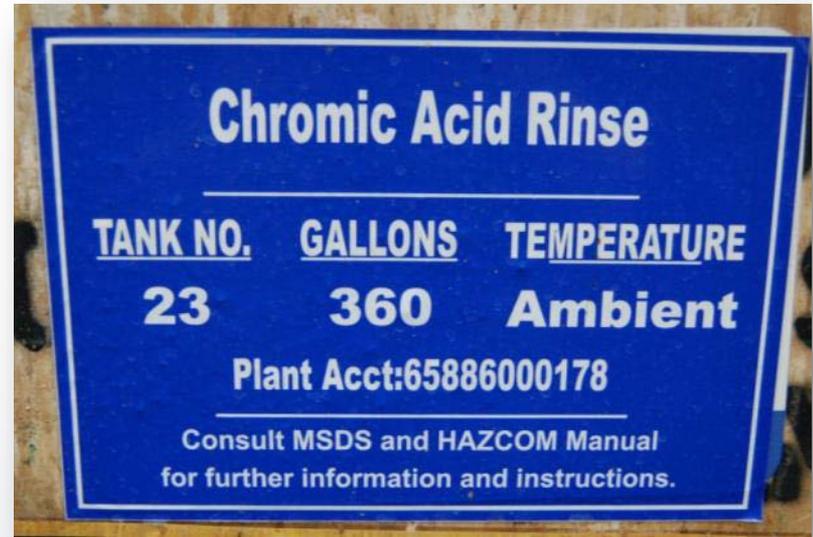


# Chromic Acid Rinse

## ■ NAVAIR Fleet Readiness Center Jacksonville

- 360 gallon process tank (150-190F)
- Phosphate - Steel Alloys
- Black Oxide – Steel Alloys

No Active Development  
TCP Potential Solution  
Drop In Replacement  
Minor Modification to Process  
Tank



Tank 23 – Shop 62713

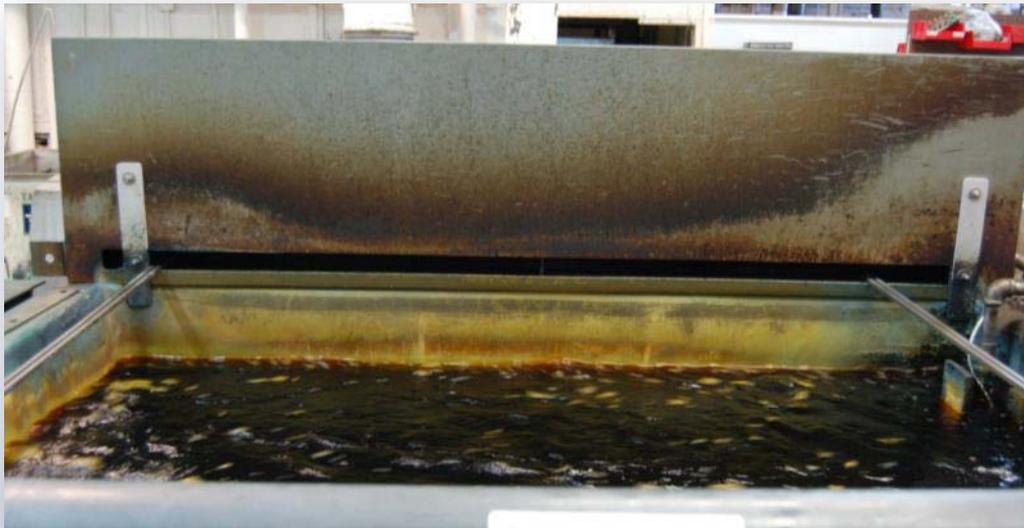


# Aluminum Deoxidizer

## ■ NAVAIR Fleet Readiness Center Jacksonville

- 1885 gallon process tank
- Turco Deox 6/16
- Required for Spot Weld Cleaning
- Anodize Strip

**Non-Cr Alternative Exists  
Need development for spot  
weld cleaning  
Drop In Replacement  
Minor Modification to Process  
Tank**



Tank 12 – Shop 62713



# Hard Chrome Plating Tanks

## ■ NAVAIR Fleet Readiness Center Jacksonville

- Various process tanks
- Chromic Acid (130F -140F)

ESTCP Dem/Val In Progress  
Cobalt Electroplating  
Major Modification to Process  
Line

HVOF Transition of line of  
sight areas





# Cadmium Electroplating

## ■ NAVAIR Fleet Readiness Center Jacksonville

- 658 gallon process tank (Post Treatment)

IZ-C17+ Dem/Val In Progress  
Drop In Replacement w/ TCP

Moderate Modification to  
Process Line



Tank E-2 – Shop 62722





# Coating Removal – Chemical/Mechanical

## Aircraft Depainting Operations



## Chromate Waste Stream



# Technology Development



# Advanced Aluminum Anodize



- FY11 CIP – New Process Line
  - Increase Tank Size
  - Automated Hoist Controls

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- MIL-A-8625 Update Required



Improved Corrosion  
Performance



# nCoP (Cobalt –Phosphorus Plating)



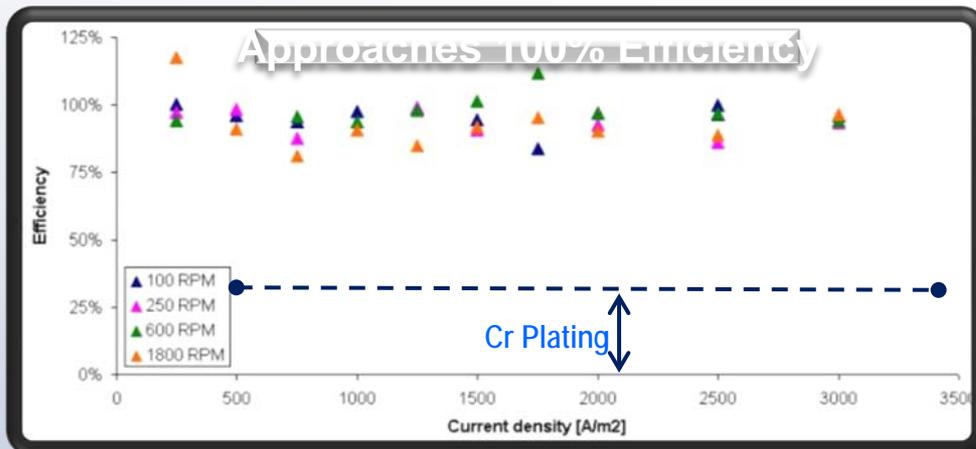
## Process Comparison

	Nanovate™ CR	EHC
Deposition Method	Electrodeposition (Pulse)	Electrodeposition (DC)
Part Geometries	LOS and NLOS	LOS and NLOS
Efficiency	85-95%	15-35%
Deposition Rate	0.002"-0.008" /hr	0.0005"-0.001" /hr
Emission Analysis	*Below OSHA limits	Cr+6



Nanovate™ CoP Plating Tank at FRCSE

## Cathode Efficiency



- Up to 8X faster than Chrome plating
- Increased throughput
- One Nanovate CR tank can replace several EHC tanks
- More efficient (~ 90% Reduced power consumption)
- Bath is Stable



# IZ-C17+ (Zinc-Nickel Plating)



## Operational Need/ Objective:

- Assess the corrosion fatigue and stress-corrosion cracking performance of IZ-C17+ zinc-nickel sacrificial coating for high-strength steel components
- Process and coating are being demonstrated/validated at FRC Southeast.

## Proposed Solution/ Technology:

- IZ-C17+ zinc-nickel with a trivalent chromium passivation as alternative to cadmium with hexavalent chromium passivation
- Acceptable SCC and CF data is required to authorize
- Process is planned to be implemented at FRCs, with FRC Southeast as lead site

## DoD/Naval Impacts/Benefits:

- Cadmium and hexavalent chromium are carcinogens and targeted by DoD/Navy/FRCs for minimization
- Compliance costs to use cadmium and hexavalent chromium will remain





# Cold Spray Metallization

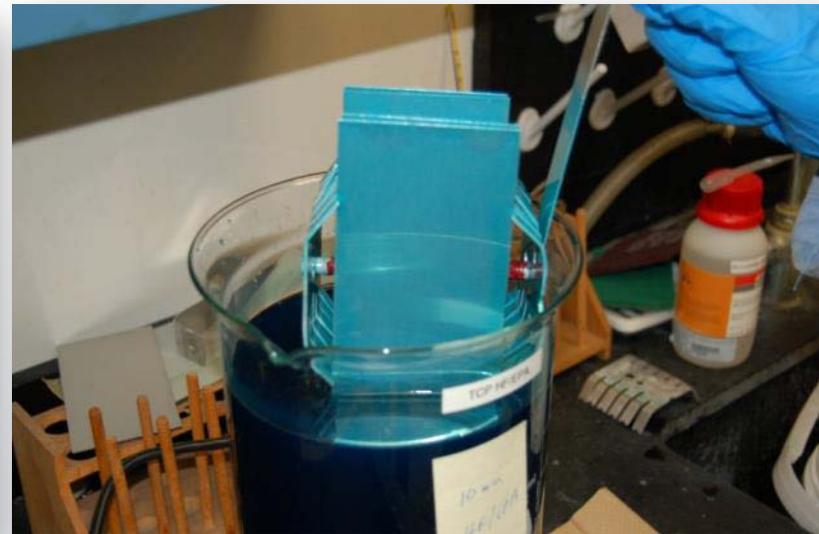
- ❑ AERMIP Funded
- ❑ National Team (PAX)
  - ❑ Brush Cadmium Alternative
  - ❑ Dem/Val F/A-18 Bomb Rack
  - ❑ Modifying Equipment for Pure Al Powder





# eTCP w/ Color Additive

- ❑ NESDI Proposal
- ❑ National Team (JAX, PAX, CP, NI)
  - COTS TCP Vendors
  - COTS Color Additives
  - 2015 Proposed Start





# Aluminum IVD



## ION VAPOR DEPOSITION OF ALUMINUM

LPS/JX 342-154 (1987)  
LPS/JX 300 (2000)





# Powder Coat Technology

- A/C O2 & Fire Bottles
  - Zinc Rich Epoxy Primer
  - TGIC Topcoat



Powder coating implemented within the FRC Engine Finish Shop to eliminate the usage of chromated epoxy primer during finish system restoration of a/c oxygen and fire bottles.



# P-3 Application, Class N Primer

**P-3 SEQ 539  
BUNO 156510  
(Sept 2011)**



Processing of P-3 a/c using MIL-PRF-23377, Class N non-chromate primer. Process implemented to reduce artisan exposure to hexavalent chromium during application and maintenance.



# T-44 Application, Class N Primer

(OCT 2011)



Processing of T-44 a/c using MIL-PRF-23377, Class N non-chromate primer. Process implemented to reduce artisan exposure to hexavalent chromium during application and maintenance.



# F/A-18 Application, Class N Primer

- F/A-18 dem/val on 12 aircraft
- paints split between FRC-SW
- and FRC-SE

*Shop prime applied to  
F/A-18 dem/val aircraft in  
October 2013 at FRC-SE - 1  
March 2014 at FRC-SE - 2*

- On-going dem/val on H-53
- painted at FRC-E





# Extended Life Paint & Non-Chrome Primer Technology Implementation



**The T-45 GOSHAWK is a two seat, single engine jet trainer aircraft used for advanced jet training of the US Navy carrier based pilots.  
It's based in Kingsville TX, Meridian MS and Pensacola FL.  
It's a derivative of the United Kingdom's Hawk.**



# Questions

