



Non-chromate Primer Transition: E-2/C-2 OML Flight Testing of Deflt/PPG 02GN084 NC Primer



AUGUST 2018

Presented by: Julia Russell

ASETS Defense 2018 Workshop



NEED

- Chromate primers contain **hexavalent chromium** which is a known carcinogen.
- 2009 - The DoD issued a memorandum calling for the reduction of chromate across the DoD.
- 2013 – Congress pass into law DFARS Subpart 223.73 – MINIMIZING THE USE OF MATERIALS CONTAINING HEXAVALENT CHROMIUM
- Non-chromate primers are important to reduce chromate waste and effects on the environment as well as ensure the safety of workers applying the primers



OVERVIEW

- NAVAIR has lead non-chromate technology development
 - Maturation on commercial primers
 - Research and development of new technologies

- Funding
 - ESTCP
 - Navy Environmental Sustainability Development to Integration (NESDI) Project # 458



NON-CRITICAL APPLICATIONS

“Non-critical application areas include support equipment and aircraft surfaces that are readily accessible and easily inspected. These are considered to be relatively low risk applications (see Section 3)...The following list covers basic requirements that non-chromate products shall meet in order to be considered for implementation in non-critical applications.”

- *Non-Critical Application Test Criteria:*

- Per applicable military specification and extended screening tests
- Field Testing – 2-years in-service or 2 carrier deployments (see Section 2.2)
- Same or better performance compared to controls using similar protection schemes



CRITICAL APPLICATIONS

“Critical applications include all areas not covered above. Examples of these include, but are not limited to, critical safety items (CSI), dynamic components, wingfold areas, wing flaps, landing gear areas and components, inner mold line, and all interior areas that are not accessible for inspection....Due to the relative technical immaturity of non-chromate products, these criteria may be greater than what was required for legacy applications using chromate products.”

- *Critical Application Test Criteria:*
 - Per applicable military specification and extended screening tests
 - Fatigue/Stress/Component Tests – Per application
 - Flight clearance depending on component/risk
 - Field Testing – More stringent validation path than for non-critical
 - Longer service life, more expensive, more sensitive, broader criteria, etc.



RISK OF IMPLEMENTING NON-CHROMATE PRIMER

Probability of Failure for Non-Chromate Technology vs. Chromate*	Impact of Non-Chromate Technology Failure			
	Mishap, Replacement	Reduced Service Life, High Repair Costs	Increased Maintenance Activities	Negligible
High	Red	Red	Yellow	Green
Medium	Red	Red	Yellow	Green
Low	Red	Yellow	Green	Green
Same as Chromate	Yellow	Green	Green	Green

Red	Critical Application Areas should be avoided until test data supports lowering risk level
Yellow	Application areas that need careful consideration and review based on test data (i.e. OML, IML, faying surfaces)
Green	Non-critical application areas suitable for Dem/val/implementation based on test data (ex: composites without metallic contact, fiberglass, low-impact/low cost components)

***Note: Factors such as platform/component operational environment and inspection intervals must be considered and may justify adjustment to the risk analysis level. Ex. Trainer aircraft operate in a less severe environment than ship based aircraft*



AIRCRAFT DEMONSTRATION



VAW-116 aircraft prepares to land on USS Carl Vinson (CVN 70)



E-2C DEMONSTRATION UPDATE

BUNO	Activity Since Last Depot PMI-2	
164497	08/2009	Delivered to VAW-120
	9/2010-11/2010	PMI-1 Norfolk CN51
	4/2012 - 6/2012	PMI-1 Norfolk CN58
	11/2015	Last time it flew
	Present	Striken AMARG 8945 FH
165650	12/2009	Delivered to VAW-116
	9/2010 – 3/2011	Deployed
	8/2012 – 4/2013	Deployed
	7/2013 - 8/2013	PMI-1 Pt Mugu E350
	2/2014 - 3/2014	VAW-117 Operated 2 months
	04/2014	Down for wing crack
	04/2017	Crack repair complete
	Present	VAW-115. Not deployed
165648	09/2009	Delivered to VAW-120
	5/2010 – 12/2010	Deployed VAW-126
	12/2011 – 8/2012	Deployed VAW-116
	8/2012 - 9/2012	PMI-1 Pt Mugu E347
	9/2014 - 4/2015	Deployed VAW-116
	1/16 - 7/16	PMI-2 NI E500
	Present	Deployed VAW-116
165811	10/2010	Delivered VAW-120
	12/2011 – 8/2012	Deployed VAW-116
	12/2012 - 1/2013	PMI-1 Pt Mugu E349
	9/2014 - 4/2015	Deployed VAW-116
	2/2017 - Present?	PMI-2 NI E504



E-2C DEMONSTRATION UPDATE

BUNO	Activity Since Last Depot PMI-2	
164497	08/2009	Delivered to VAW-120
	9/2010-11/2010	PMI-1 Norfolk CN51
	4/2012 - 6/2012	PMI-1 Norfolk CN58
	11/2015	Last time it flew
	Present	Stricken AMARG 8945 FH

- This aircraft was never deployed as it remained in a training squadron during the entire demonstration period.
- It was stricken and has been transferred to AMARC (“Boneyard”) with 8,945 flight hours.
 - Average Service Life of an E-2C is about 10,000 flight hours.
- Last time aircraft flew was Nov. 2015.



E-2C DEMONSTRATION UPDATE

BUNO	Activity Since Last Depot PMI-2	
165650	12/2009	Delivered to VAW-116
	9/2010 – 3/2011	Deployed
	8/2012 – 4/2013	Deployed
	7/2013 - 8/2013	PMI-1 Pt Mugu E350
	2/2014 - 3/2014	VAW-117 Operated 2 months
	04/2014	Down for wing crack
	04/2017	Crack repair complete
	Present	VAW-115. Not deployed

- This aircraft was carrier deployed twice with non-chromate primer on the OML.
- A crack in the wing found in April 2014 put it out of reporting (OOR).
- No update on next carrier deployment.



E-2C DEMONSTRATION UPDATE

BUNO	Activity Since Last Depot PMI-2	
165811	10/2010	Delivered VAW-120
	12/2011 – 8/2012	Deployed VAW-116
	12/2012 - 1/2013	PMI-1 Pt Mugu E349
	9/2014 - 4/2015	Deployed VAW-116
	2/2017 - Present	PMI-2 NI E504

- This aircraft carrier deployed twice with first non-chromate primer application.
- It was stripped and repainted with a **second** non-chromate primer application during PMI-2 at FRC-SW early 2018.
- Aircraft scheduled for delivery back to the squadron in August or September 2018.
 - A Delivery Letter will be generated at that time.



E-2C DEMONSTRATION UPDATE

BUNO	Activity Since Last Depot PMI-2	
165648	09/2009	Delivered to VAW-120
	5/2010 – 12/2010	Deployed VAW-126
	12/2011 – 8/2012	Deployed VAW-116
	8/2012 - 9/2012	PMI-1 Pt Mugu E347
	9/2014 - 4/2015	Deployed VAW-116
	1/16 - 7/16	PMI-2 NI E500
	Present	Deployed VAW-116

- This aircraft carrier deployed three times with first non-chromate primer application.
- It was stripped and repainted with a second non-chromate primer application during PMI-2 at FRC-SW between January 2016 and November 2016.
- Aircraft recently returned from carrier deployment onboard the USS Theodore Roosevelt (Oct. 2017 to May 2018).
 - 4th Carrier deployment with non-chromate primer



E-2C DEMONSTRATION UPDATE

Senior Chief James Sykes of VAW-116 recently stated:

“BUNO 165648 was by far the **best looking plane** during and after 8 months of sea deployment.”

- He noticed the non-chromate primer decal FRC-SW placed on the aircraft and figured there was something different about this aircraft.
- He hopes all aircraft will get painted with the NC primer as soon as possible.

Delivery Letter →

DEPARTMENT OF THE NAVY
FLEET READINESS CENTER SOUTHWEST
P.O. BOX 37086
SAN DIEGO, CA 92136-7086

IN REPLY REFER TO:
4850
Ser 00/139
APR 13 2017

From: Commanding Officer, Fleet Readiness Center Southwest
To: Commanding Officer, Carrier Airborne Early Warning Squadron ONE ONE SIX (VAW-116)
Subject: FRCSW E-2C DELIVERY LETTER FOR PLANNED MAINTENANCE INTERVAL TWO (PMI-2) IN CASE OF BUNO 165648 (R500)
Encl: (1) Maintenance Requirements Card (MRC) Deck Correlation

1. It is my pleasure to return (E-2C) BUNO 165648 to you ready for tasking. The purpose of this delivery letter is to provide you cost-conscious feedback on the condition of your aircraft and what resources it took to get it ready to return to fleet use. First, provided below is a summary of the Depot hours, material costs, and spare part replacement costs expended during the Phase Maintenance repair of this aircraft, as well as comparisons to our "fleet average" induction. In addition, enclosure (1) provides a listing of areas on the aircraft where we expended depot artisan repair hours that were outside the scope of the PMI-2 specification. These areas also have an associated squadron level periodic maintenance prevention action or inspection practice as highlighted in enclosure (1).

Aircraft Arrival Date: 01/11/16
Scheduled Induction Date: 01/11/16 Actual: 01/11/16
Scheduled Turn Around Time (TAT): 180 Actual: 303
Scheduled Completion Date: 07/09/16 Actual: 11/08/16
Evaluation Estimated Completion Date (EECD): 10/30/16
Revised Estimated Completion Date (RECD): N/A
Aircraft Departure: 11/09/16

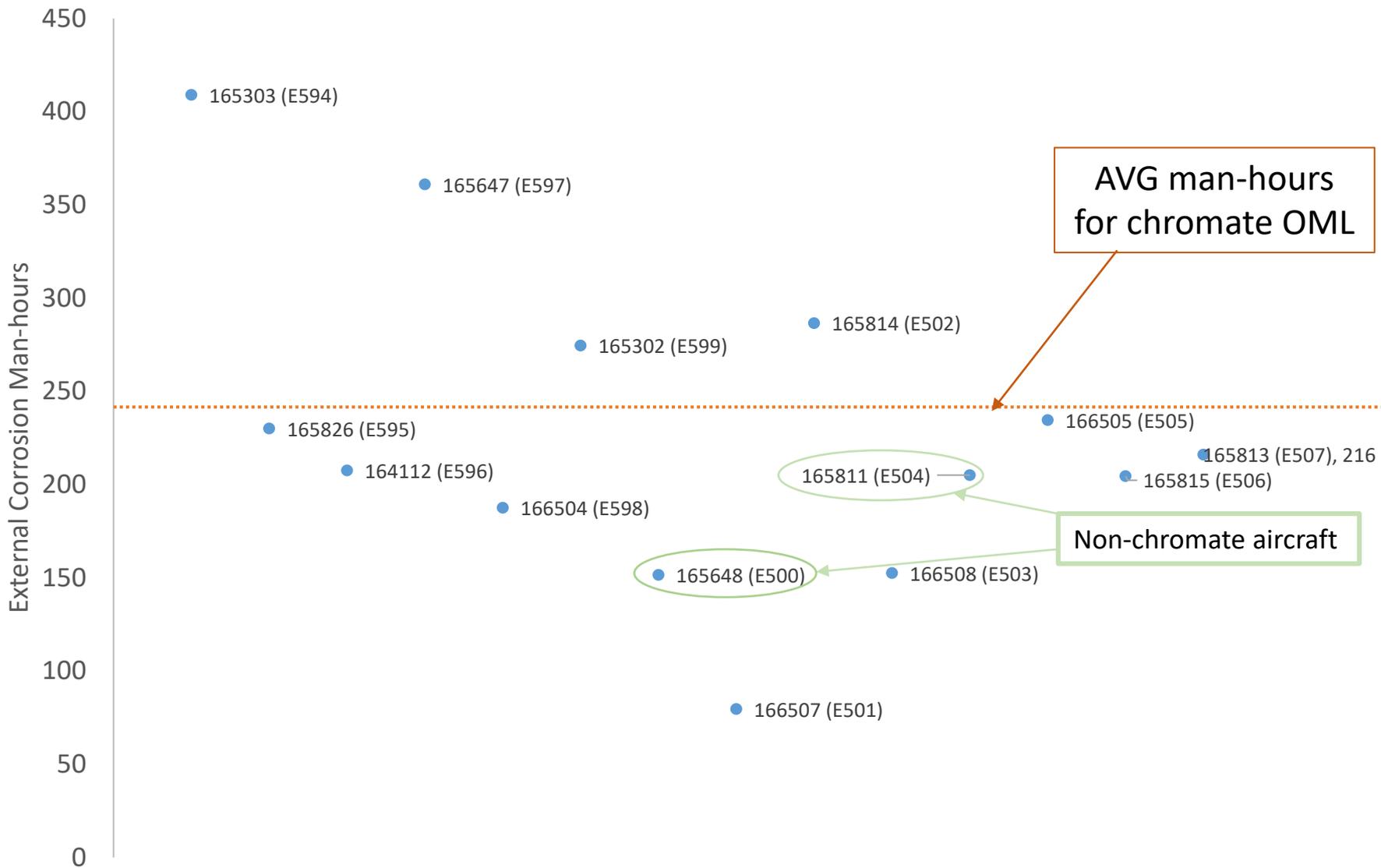
Enterprise Resources	BUNO 165648 Actuals	Funded	"Fleet Average" Induction
Total Hours (less waste) Consumed	19,713	23,253	24,649
Total Material Consumed*	\$3,146,262	\$3,723,236	\$3,263,808
7R Material Consumed	\$2,770,959	(above)	\$2,763,576

* To date material consumed is an estimate of the final material cost. This value is traditionally about 93% of the final number.

ENCLOSURE (1)

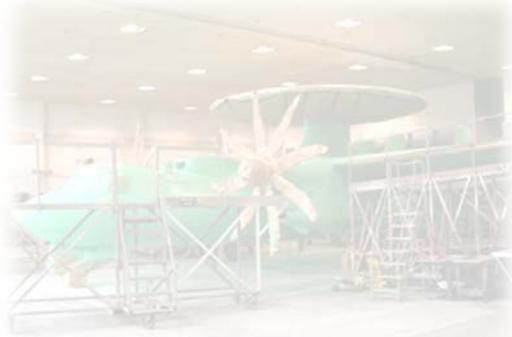


E-2C DEMONSTRATION UPDATE





Other Non-chromate Primer Demos: Gloss Paint Scheme



NAS Meridean and NAS Kingsville *implemented* PPG-DEFT 02-GN-084 as a final prime on the OML of all USN trainers.

Includes the following platforms:

- 1) T-6**
- 2) T-34**
- 3) T-44**
- 4) T-45**





Other Non-chromate Primer Demos: Camo Paint Scheme

H-46

- First full non-chromate coating system demonstration
- Hentzen 17176KEP (23377N, Ty II) over Henkel Alodine T5900 RTU (81706, Ty II)
- Three A/C primed with NC primer



TMS	BUNO	Non-Chrome Primer Date	Carrier Deployments
H-46	154856	Dec. 2010	HMM-268: 1st Deployment USS Makin Island (LHD 8) – Nov 2011 – June 2012
H-46	156474	Jan. 2012	None to date
H-46	153395	Aug. 2012	None to date



Other Non-chromate Primer Demos: Camo Paint Scheme

F/A-18 Induction Coat @ FRC-SW (NAS Jacksonville)



**MIL-PRF-85582 Chromate Primer
Induction Coat**



**MIL-PRF-23377 Non-chromate
Primer Induction Coat**

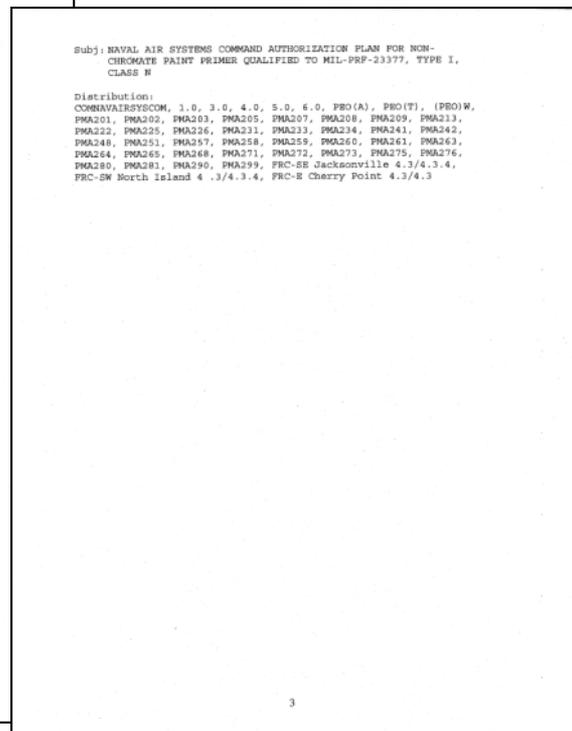
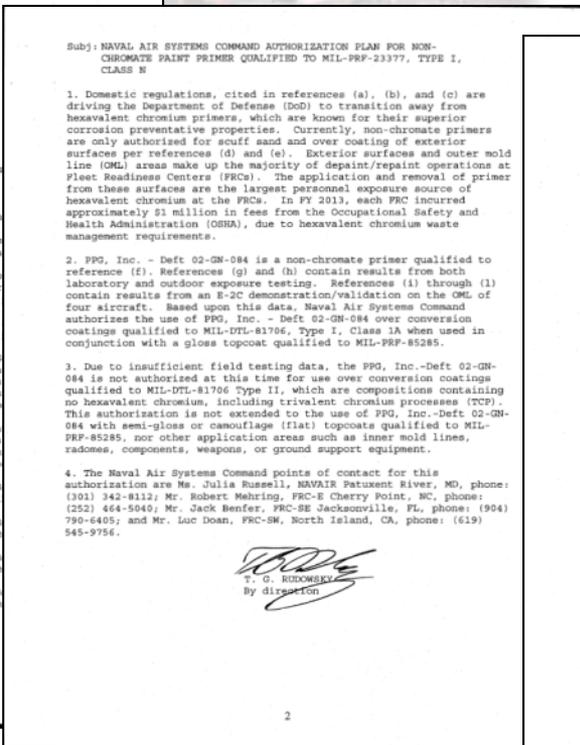
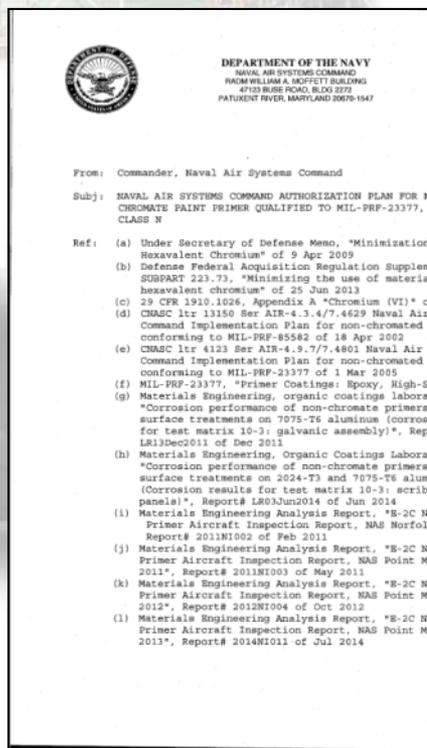
- 17 A/C identified as candidates
- **7 depainted and repainted with NC Primer (Ty I & Ty II)**
- **2 depainted and induction primed with Ty I NC Primer**
 - Remaining 11 scheduled for processing



AUTHORIZATIONS: FY15

PPG Industries-Deft 02GN084

- **NAVAIR Authorization Letter ~ Signed December 2014**
 - **Product # 02GN084 (qualified to MIL-PRF-23377, Ty I, Cl. N) over Chromate Conversion Coating on Outer Mold Line of all USN gloss paint scheme Aircraft**





AUTHORIZATIONS: FY18

MIL-PRF-23377, Class N

- **MIL-PRF-23377 Class N on outer moldline (OML)**
 - BOTH Type 1 & Type 2
 - Over MIL-DTL-81706B Type 1 & Type 2 conversion coatings, anodic coatings and scuff sanded composites
 - Compatible with MIL-PRF-85285, as required
- **Authorization includes all units of issue, such as aerosols, two component bulk and touch up applicators.**
- **Does NOT apply to other aircraft surfaces**
 - Inner moldline
 - Removable components
 - Other (weapons and support equipment)
- **Use of the primers on radomes may require additional transmissivity verification prior to implementation**





AUTHORIZATIONS: FY18

MIL-PRF-23377, Class N



DEPARTMENT OF THE NAVY
NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION
22347 CEDAR POINT ROAD, UNIT 6
PATUXENT RIVER, MARYLAND 20670-1161

From: Head, Materials Engineering Division
Warfare Center Aircraft Division, 48
Maryland 20670

Subj: NAVAL AIR SYSTEMS COMMAND AUTHORIZATION PLAN FOR NON-
CHROMATE PAINT PRIMERS QUALIFIED TO MIL-PRF-23377 CLASS N

Ref: (a) CNASC ltr 4123 Ser 14-0035 Na
Non-Chromate Paint Primer Qua
11 Dec 2014
(b) FRCSEINST 5090.1B CH-1 FLE
ENVIRONMENTAL MANAGE
2 JUN 2016
(c) MIL-PRF-23377, "Primer Coating
(d) Materials Engineering, Organic C
of Non-Chromate Primers with V
(Corrosion Results for Test Matri
#LR13Dec2011 of Dec 2011
(e) Materials Engineering, Organic C
of Non-Chromate Primers with V
Aluminum (Corrosion Results for
#LR03Jun2014 of Jun 2014
(f) Lockheed Martin Aeronautics Cor
130J Outer Mold Line", Air Force
Environmental & Health Risk Ma
Project #AFL08PV10
(g) Materials Engineering, Organic C
Component Aerosol Packaged Ne
#PAX4342_OCT_18_001 of May
(h) NESDI Program Data Consolida
Primer, Project 458", March 2018

1. The protection of United States Navy and historically relied on the use of chromate primer under development for over 40 years due to its ability to eliminate its use, reference (b). New non-potential alternatives for use on the exterior of these new alternatives, their application at exterior surfaces including E-2C, H-46, H-53

Subj: NAVAL AIR SYSTEMS COMMAND AUTHORIZATION PLAN FOR NON-
CHROMATE PAINT PRIMERS QUALIFIED TO MIL-PRF-23377 CLASS N

2. References (a) and (d) through (h) document the technical evaluation and performance of the three qualified non-chromate primer products per reference (c). Two of these products are Type I, for general use, and one is Type II, where low IR reflection is required. Products were applied over standard aircraft exterior surfaces, including conversion coated aluminum (with MIL-DTL-81706 Class 1A Type I or II), anodized aluminum, and composite surfaces, and qualified topcoats were then applied. These references document that the performance of these three products, when applied properly, provide the desired corrosion protection, adhesion, and other performance properties for each type of aircraft.

3. Based on this data, AIR-4.3.4 authorizes the use of qualified Class N products, per reference (c), for use on aircraft exterior surfaces including aluminum with MIL-DTL-81706 Class 1A Type I or II conversion coatings, MIL-A-8625 anodic coatings, and scuff sanded composites. Primers are compatible with topcoats per MIL-PRF-85285 as required for each aircraft type model, and series. This authorization includes all units of issue and types of primer packaging, including two-component aerosols, bulk and touch-up applicator pens. This authorization does not apply to other aircraft surfaces, such as inner mold lines and removable components, or other systems including weapons and support equipment. Use of these primers on radomes may require additional transmissivity verification prior to implementation.

4. The points-of-contact for this application are Dr. Mike Brindza, 301-995-3897 or Mrs. Julia Russell, 301-342-8112.

Darrel R. Tenney Jr.
DARREL R. TENNEY JR.

Distribution:

COMNAVAIRSYSCOM (AIR-1.0; AIR-4.0; AIR-4.3; AIR-4.3.1; AIR-4.3.2; AIR-4.3.3; AIR-4.3.5; AIR-5.0; AIR-6.0); PEO(A); PEO(T); PEO(W); PEO(JSF); PMA201; PMA202; PMA203; PMA205; PMA207; PMA208; PMA209; PMA213; PMA222; PMA225; PMA226; PMA231; PMA233; PMA234; PMA241; PMA242; PMA248; PMA251; PMA257; PMA258; PMA259; PMA260; PMA261; PMA263; PMA264; PMA265; PMA268; PMA271; PMA272; PMA273; PMA275; PMA276; PMA280; PMA281; PMA290; PMA299; ISSC - Jacksonville 4.0/4.3/4.3.4; ISSC - North Island 4.0/4.3/4.3.4; ISSC - Cherry Point 4.0/4.3/4.3.4; NAWC-WD - China Lake 4.3.4; NAWC-AD - Lakehurst 4.3.4



Questions?

Julia Russell

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301-342-8112