NASA TEERM Principal Center Non-Chrome Projects

Technology Programs & Partnerships Branch

Applied Technology Directorate

Kennedy Space Center, FL

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Senior Engineer

TEERM Non-Chrome Systems Phase I Project

Non-Chrome Coating Systems Tested

- Non-Chrome Systems Project:
  - Five Coating Systems Tested for Phase I
  - Two Controls
- C3P Low VOC/Non-Chrome Project:
  - Two Coatings Systems Tested

C	O	D
Alodine 1200s	Alodine 1200s	Boegel AC-131CB
Deft 02-Y-40	PPG Aerospace 515K012 Chromated MB0125-055	Dupont Corlar 13570S
Deft 99-GY-001		Deft 03-GY-321
H	**N**	**S**
Alodine 5700	Prekote	Prekote
Hentzen Primer 05510WEP-X / 05511CEH-X	Mg-Rich Primer	AquaSurTec Crosslinker
Deft 03-GY-321	Deft 03-GY-321	AquaSurTec D45 AMS-MO / D45-AMS
T	**M**	**P**
Alodine 5700	M790E	Prekote SP
Sicopoxy 577-630	Aviox CF Primer	Aviox CF Primer
Deft 03-GY-321	Aviox Finish 77702	Aviox Finish 77702

O - System for Dissimilar Metals Tests Only

M, P - Systems for International Project

TEERM Non-Chrome Systems
Phase I Test Progress

Laboratory Tests Performed:

- Kennedy Space Center, Marshall Space Flight Center
- Hill AFB, Wright-Patterson AFB

Tests:

- Filiform Corrosion – 1,000 Hrs – Complete
- Cyclic Corrosion – 2,000 Hrs – Complete
- Dissimilar Metals – 2,000 Hrs – Complete
- Hydrogen Embrittlement – (Mg Rich Only) - Complete
- Salt Fog – 3,000 Hrs – 2,500+ Hrs as of March 08
- Adhesion Testing – Complete
- Post-Cyclic Corrosion Adhesion – TBD

International Non-Chrome Project

- Laboratory Testing (AMS 3095):
  - Gloss, Initial Color (ISO 2813)
  - Adhesion - Cross Hatch (ISO 7724; AMS 3095 5.3)
  - Reverse Impact (ISO 6272)
  - Flexibility – Conical Mandrel (ISO 6860)
  - Flexibility – Cylindrical Mandrel (ISO 1519)
  - Water
    - Blister (ISO 4628)
    - Grade (ISO 2409)
    - Penetration (ISO 1518)
  - Fluid Resistance (ISO 1518)
  - Filiform Corrosion (EN 3665)
  - Salt Spray Corrosion (3,000 Hrs) (ISO 7253)
  - Artificial Weathering (ISO 2813; ISO 7724)
  - Washability (ISO 2813)
  - Stripability (AMS 3095 5.4)
  - Restoration (AMS 3095 5.5)
  - Heat Stability (ISO 1519; ISO 3270)

- Field Testing:
  - Airbus A319 Service Door – (2 Years, 8 Months in Service)
  - Thickness and Gloss Tests
  - Visual Inspection for Signs of Corrosion

Phase II ~~Non-Chrome Testing~~

Hex-Chrome Free Coatings

(Some Tri-Chrome Coatings Included)

Hex-Chrome Free Coatings
Draft Test Plan

Potential Alternatives for Phase II –

Considerations - Systems H, N, T, P from Phase I & International

- Systems from NAVAIR and Air Force Testing

- **Pretreatments:**
  - Alodine 5200/5700
  - Prekote
  - TCP HF
  - TCP HF/EPA
  - Alodine 5900T
  - VpCI-440
  - Others?

- **Topcoats:**
  - MIL-PRF-85285
    - (PRC-Desoto CA8221/F27925) White Semi-Gloss.

- **Primers:**
  - Hentzen 05510WEP-X / 05511CEH-X
  - Mg Rich Primer (AeroDur 2100)
  - Sicopoxy 577-630
  - Aviox CF Primer
  - Deft 098 (Waterborne)
  - Deft 084 (High Solid)
  - Hentzen 16708TEP / 16709CEH
  - Hentzen 7176KEP / 16709CEH
  - VpCI-373
  - ADD? - **(10PW22-2/ECW-119 (Columbia Primer))**

Hex-Chrome Free Coatings
Draft Test Plan

NASA TEERM COATINGS			
System	***PreTreatment***	***Primer***	***Topcoat***
C1	Alodine 1200s	Koropon (515X346 / 910x520)	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925
C2	None	Koropon (515X346 / 910x520)	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925
S1	PreKote	ANAC / Mg Rich (Version?)	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925
S2	Alodine 5200	Sicopoxy 577-630	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925
S3	METALAST TCP-HF/EPA	Deft 084 (High Solid)	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925
S4	METALAST TCP-HF/EPA	Deft 098 (Waterborne)	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925
S5	METALAST TCP-HF/EPA	Hentzen (Type I - 16708TEP / 16709 CEH)	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925
S6	METALAST TCP-HF/EPA	Hentzen (Type II - 7176KEP / 16709 CEH)	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925
S7	Alodine 5200	Hentzen Primer (05510WEP-X / 05511CEH-X)	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925
S8	VpCI-440	VpCI-373	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925
S9	PreKote	Aviox CF Primer (TC)	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925
S10	GE Shared Vision Coating	GE Shared Vision Coating	MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8211/F27925

Hex-Chrome Free Coatings
Draft Test Plan

ARES UPPER STAGE COATINGS			
System	***PreTreatment***	***Primer***	***Topcoat***
AUPC1	None	STMK719 Superkoropon	None
AUPC2	None	Superkoropon 513-003 / 910x014	None
AUP3	None	Ecoprime CF	None
AUP4	None	Hentzen Epoxzen	None
AUP5	None	Insignia Zcoat	None
AUP6	Metalast TCP-EPA	None	None
AUP7	Surtec 650	None	None
AUP8	Iridite 14-2	None	None

Hex-Chrome Free Coatings
Draft Test Plan

DOD COATINGS			
System	***PreTreatment***	***Primer***	***Topcoat***
MG-CTIO Control 1	Alodine 1200s	Deft-02Y-040	Aerodur 5000
MG-CTIO Control 2	PreKote	PRC CA 7233	PRC 9311
CTIO-MG1	PreKote	Neg Blank Primer	Aerodur 5000
CTIO-MG2	PreKote	ANAC Mg-Rich Alt1	Aerodur 5000
CTIO-MG3	PreKote	ANAC Mg-Rich Alt2	Aerodur 5000
CTIO-MG4	PreKote	ANAC Mg-Rich Aerodur 2100	Aerodur 5000
MG-ANAC Control 1	Alodine 1200s	Deft-02Y-040	Aerodur 5000
MG-ANAC Control 2	PreKote	PRC CA 7233	PRC 9311
ANAC-MG1	PreKote	Neg Blank Primer	Aerodur 5000
ANAC-MG2	PreKote	ANAC Mg-Rich Alt1	Aerodur 5000
ANAC-MG3	PreKote	ANAC Mg-Rich Alt2	Aerodur 5000
ANAC-MG4	PreKote	ANAC Mg-Rich Aerodur 2100	Aerodur 5000

Hex-Chrome Free Coatings
Draft Test Plan

- **Repeat some Phase I Testing (2,000+Hrs Salt-Fog, Adhesion) for newly considered systems** (on AA2195, AA2219, AA7075, AA2024):
  - CorTec - VpCI-440 Pretreat, + VpCI-373 wash primer + Topcoat
  - Mg-Rich – Akzo Nobel Commercial Version (2024 only)
    (Performed by AF, NAVY & Private Companies for Round-Robin Comparison
  - ~~Electro Active Polymer (BAM-PPV)~~ - Not available

- **New Tests:**
  - 18 Month Beach Exposure Testing
  - 6+ Month – Pad Exposure Testing
  - 168/336 Hour Bare Corrosion Resistance (Pretreatments) 6061-T6 (for Electronic Housings)
  - 15-18 Month Corrosion Rate Testing (Pad)
  - 6 Month Galvanic Couple Corrosion Rate Testing (Pad)

Hex-Chrome Free Coatings
Draft Test Plan

Materials Status:

Material	*Vendor*	*Type*	panels	emailed	called	ordered	received
10PW22-2/ECW-119 (Columbia Primer)	Dexter / Metro (now ANAC)	Primer	30	x	xx	xx	?
Alodine 1200s	Henkel	Pretreatment	60	x	xx	Q	?
Alodine 5200	Henkel	Pretreatment	35	x	xx	Q	?
ANAC / Mg Rich (Version?)	Akzo Nobel	Primer	35	x	xx	x	1Qt
Aviox CF Primer (TC)	Akzo Nobel	Primer	30	x	xx	x	1Qt
Deft 083 / Deft 084 (High Solid)	Deft	Primer	NA	x	x	x	2Gal
Deft 084 (High Solid)	Deft	Primer	30	x	x	x	2Gal
Deft 098 (Waterborne)	Deft	Primer	15	x	x	x	2Gal
GE Shared Vision Coating-PT	LOCKHEED	Pretreatment	65	x	x	x	OK
GE Shared Vision Coating-PR	LOCKHEED	Primer	65	x	x	x	OK
Hentzen (Type I - 16708TEP / 16709 CEH)	Hentzen	Primer	30		x	x	1Gal
Hentzen (Type II - 7176KEP / 16709 CEH)	Hentzen	Primer	30		x	x	1Gal
Hentzen Primer (05510WEP-X / 05511CEH-X)	Hentzen	Primer	35		x	x	1Gal
Koropon (515X346 / 910x520)	PRC Desoto	Primer	75	x		x	2Gal
METALAST TCP-HF/EPA	Metalast	Pretreatment	135			x	1Gal?
MIL-PRF-85285B Type 1, Class H PRC-Desoto CA8221/F27925	PRC-Desoto	Top-Coat	455	x	xx	x	?
PreKote	Akzo Nobel	Pretreatment	65	x	xx	x	1Gal
Sicopoxy 577-630	Sico	Primer	30	x	xx	xx	?
VpCI-373	Cortec	Primer	50	x	x	x	4pt
VpCI-440	Cortec	Pretreatment	65	x	x	x	1pt

Hex-Chrome Free Coatings
Project Participants

- NASA:
  - Orion
  - Ares I Upper
  - Ares I Lower
  - MSFC M&P
  - KSC Corrosion Lab

- DOD:
  - Army
  - Air Force
  - Navy

- Private Sector:
  - Raytheon, Lockheed Martin, Spirit Aerosystems, Boeing, BAE Systems

Hex-Chrome Free Coatings
Project Participants

- NASA –
  - Orion – Mike Pedley (NASA), David Shindo (NASA)
  - Ares I Upper – Rhonda Libb (NASA)
  - Ares I Lower – John Bailey (USA)
  - Others – Steve Hudson (NASA)

- DOD:
  - Army
    - Steve Carr - AMRDEC
  - Air Force
    - Joel Johnson – AFRL/RXBC
    - Corey Bliss – AFRL/RXSSO
  - Navy
    - Craig Matzdorf (NAVAIR)
    - Steve Brown (NAVAIR)
    - Fred Lancaster
    - Bill Nickerson

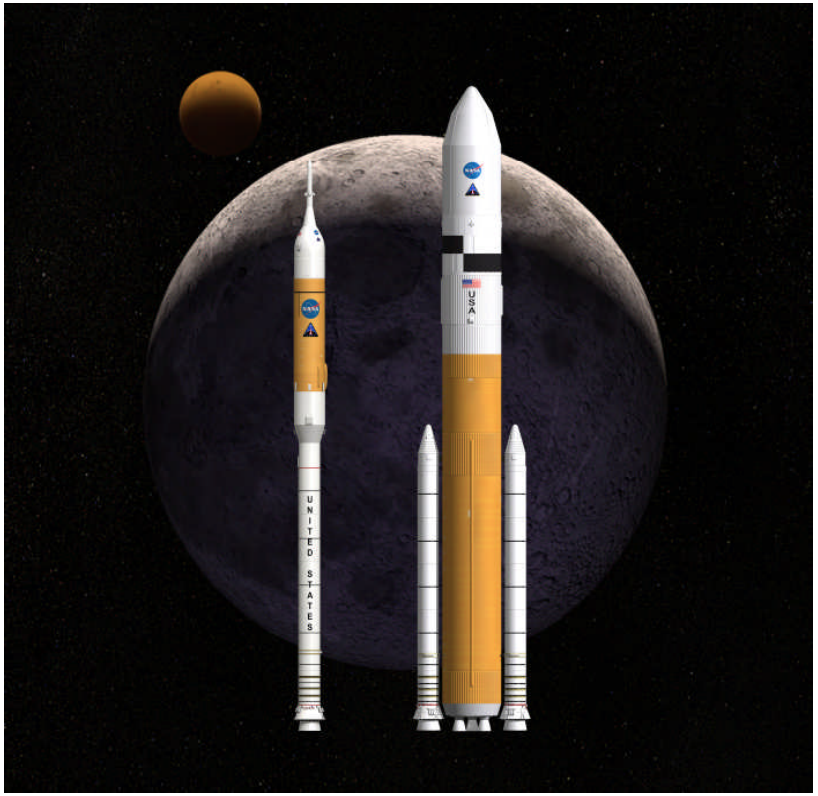
- Private Sector (Included in distribution / participants)
  - Raytheon, Lockheed Martin, Spirit Aerosystems, Boeing, BAE Systems

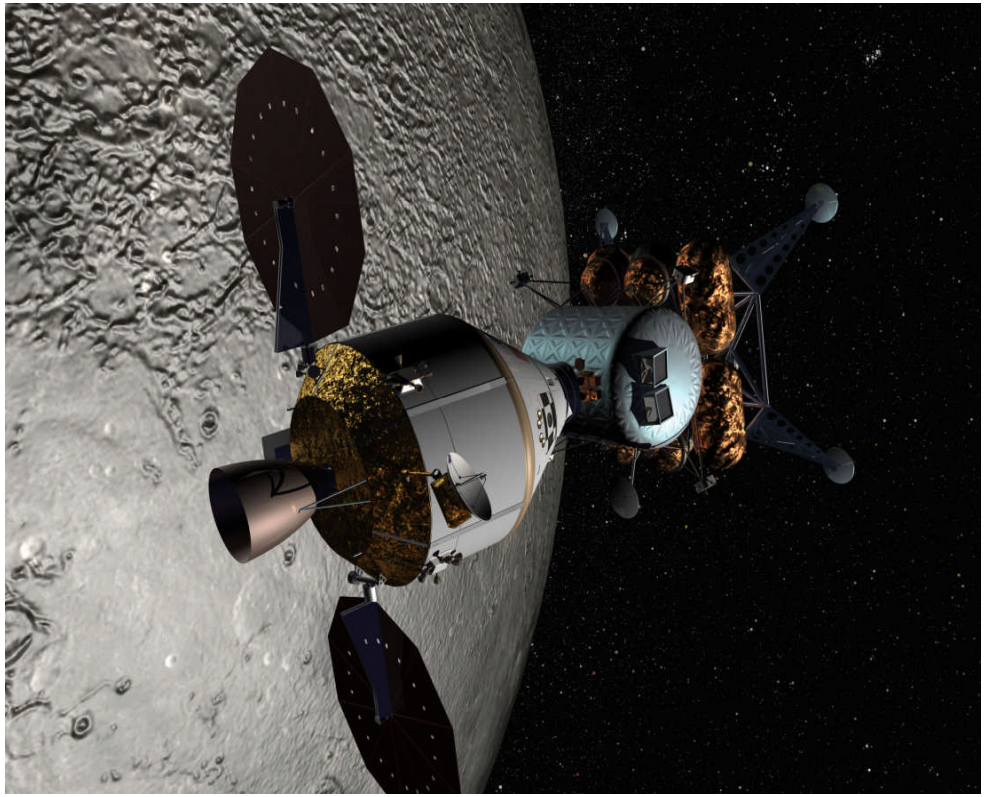
Hex-Chrome Free Coatings
Project Participants (Developing)

- Developing (NASA):
  - Boeing (TBD) – Upper Stage / Avionics
  - Lockheed Martin (TBD) - Orion
  - ATK (TBD) – Lower Stage
  - Hamilton Sundstrand (TBD) – Upper Stage
  - Moog (TBD) – Upper Stage
  - Northrup Grumman (TBD) – Upper Stage
  - USA (Others - TBD) – Upper Stage

- Developing (DOD):
  - Air Force Space Command (TBD)
  - NAVSEA (TBD)
  - Army (Others – TBD)
  - Marine Corps (TBD)

NASA TEERM Principal Center





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