

SERDP-ESTCP Research and Development in Surface Engineering

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ASETSDefense Workshop
1 September 2009



SERDP



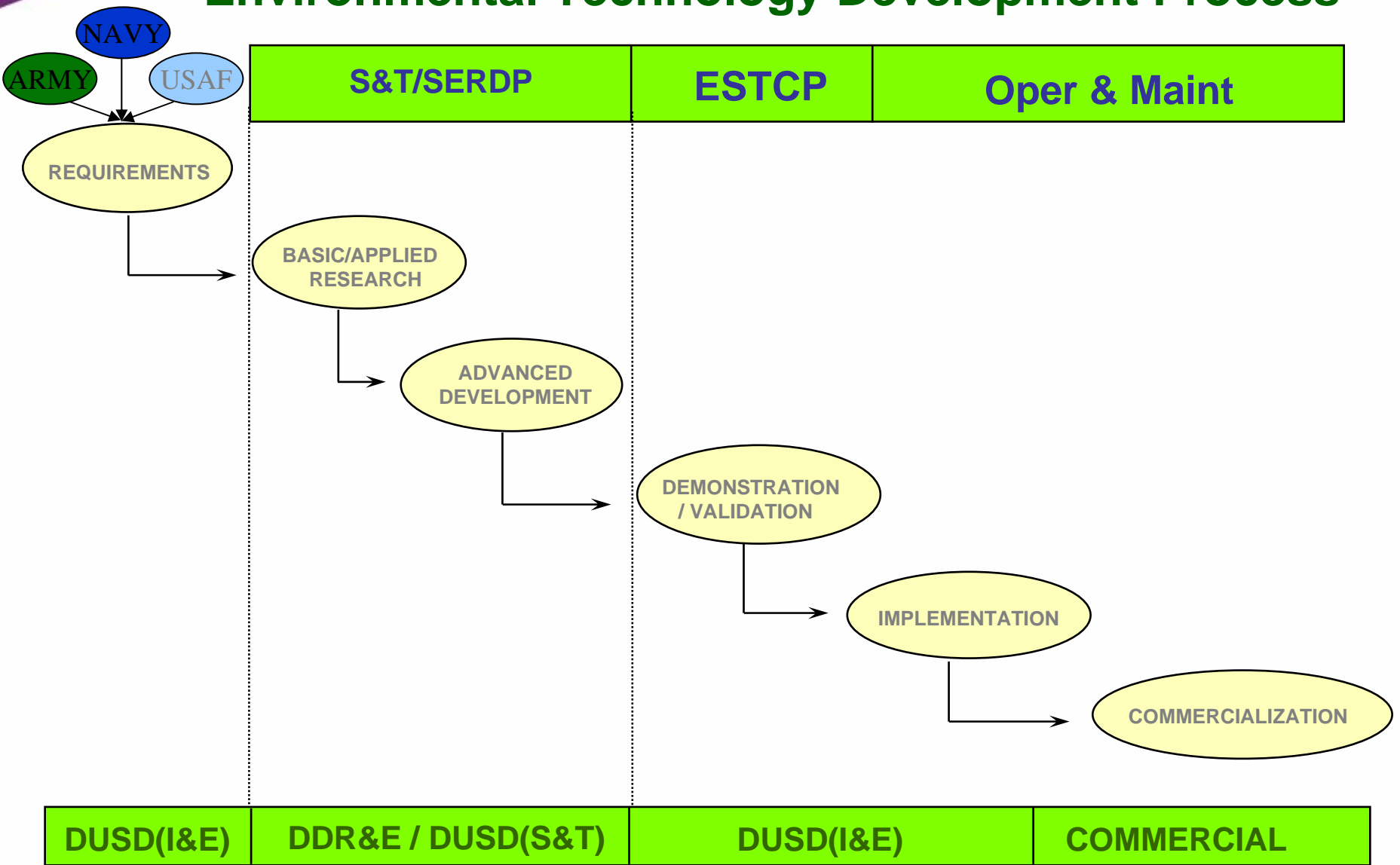
Report Documentation Page

*Form Approved
OMB No. 0704-0188*

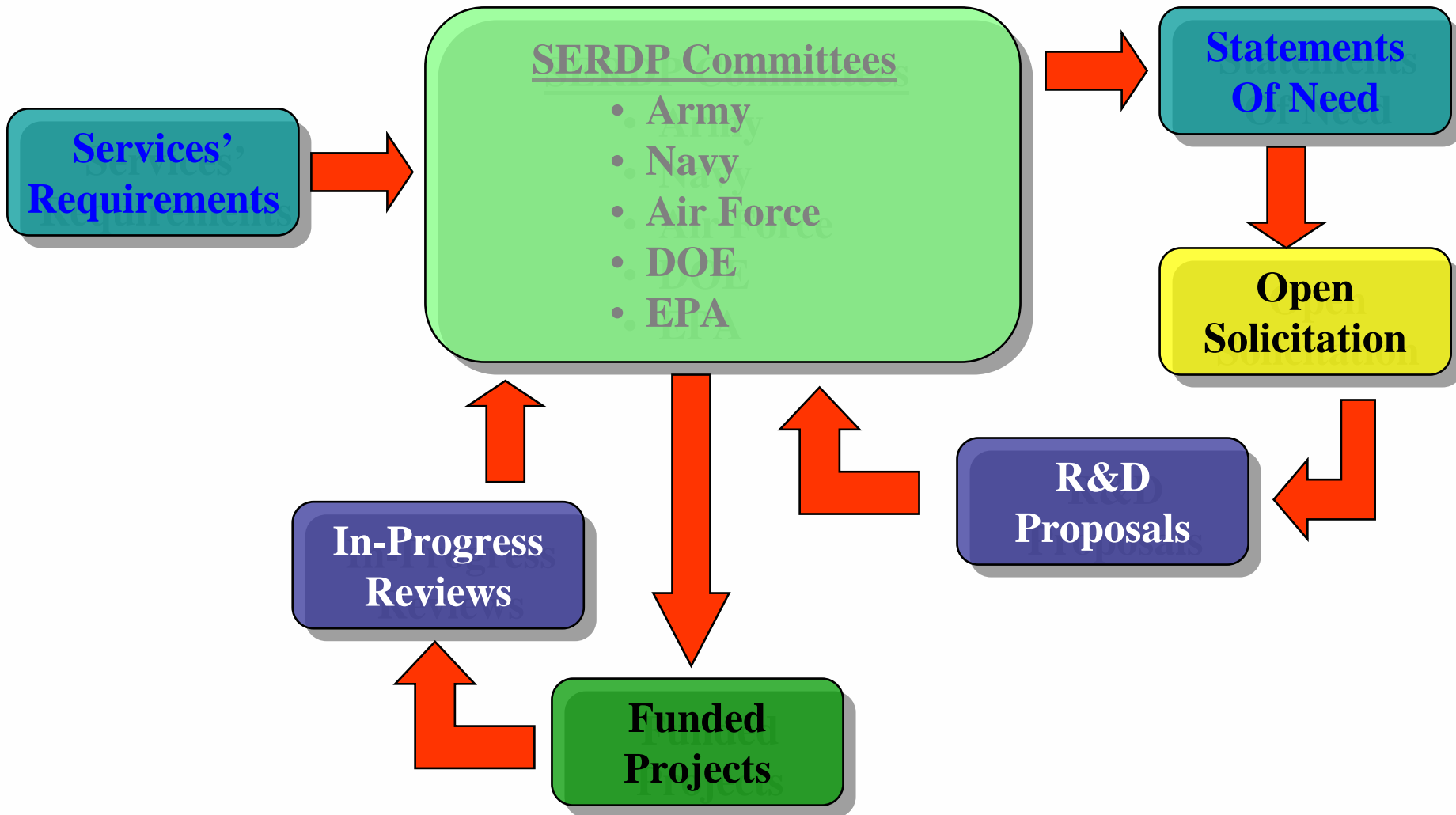
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1. REPORT DATE 01 SEP 2009		2. REPORT TYPE		3. DATES COVERED 00-00-2009 to 00-00-2009	
4. TITLE AND SUBTITLE SERDP-ESTCP Research and Development in Surface Engineering				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Strategic Environmental Research and Development Program (SERDP), Environmental Security Technology Certification Program (ESTCP), 4800 Mark Center Drive, Suite 17D08, Alexandria, VA, 22350-3605				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 2009: Sustainable Surface Engineering for Aerospace and Defense Workshop, August 31 - September 3, 2009, Westminster, CO. Sponsored by SERDP/ESTCP					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 20	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Environmental Technology Development Process



Management Process



SERDP Method



SERDP



- **Annual Solicitations to Meet DoD Needs**
 - ◆ **Two Solicitations**
 - ◆ **Open to All: Government, Academia, Industry**
- **Competitive Award**
 - ◆ **External Peer Review**
 - ◆ **Internal and Scientific Advisory Board Review**
- **Transition to Demonstration/Validation**

Environmental Security Technology Certification Program

PROGRAM GOALS

- **Demonstrate innovative cost-effective environmental technologies**
 - Capitalize on past investments
 - Transition technology out of the lab
- **Promote implementation**
 - Direct technology insertion
 - Gain regulatory acceptance

Priority: needs of the DoD user community

ESTCP Method

- **Partner with stakeholders and test at DoD facilities**
 - ◆ Developer, regulators, end-user
 - ◆ Direct transition
- **Validate operational cost and performance**
 - ◆ Independent test and evaluation
 - ◆ Satisfy regulatory and user communities
- **Identify DoD market opportunities**
 - ◆ Technology transfer across federal and private sector

Weapons Systems and Platforms

- **Manufacturing and Maintenance**
 - Green materials and processes (principally related to surface engineering technologies)
 - Control and monitoring
 - Depots, Field, Shipyards & OEM
- **Green Energetics**
 - New Materials
 - Alternative Manufacturing
- **Air and Noise Emissions**
 - Diesels and Gas Turbines
 - Weapons and Munitions
 - Ship and Industrial

**Partner with Acquisition
and
Maintenance Community**



SERDP Statements-of-Need Related to Surface Engineering Since 2000

FY2000

- **Alternative Technologies to Hard Chrome Electroplating**

FY2001

- **Environmentally Innovative Technologies for Low Observable Coatings Applications, Removal and Repair**

FY2002

- **Low Temperature Powder Coatings**
- **Environmentally Acceptable Alternatives for Non-Destructive Inspection with Fluorescent Penetrant Dyes**

SERDP Statements-of-Need Related to Surface Engineering Since 2000

FY2003

- **Chromium-Free Coating Systems for DoD Applications**
- **Environmentally Innovative Technologies for Metal Parts Cleaning for Electroplating and Surface Finishing**
- **Environmentally Acceptable Alternatives for Liquid Spray Paint Pre-Mix Components**
- **Environmentally Benign Methods for the Removal of Radar Absorbing Material Coatings**
- **Environmentally Acceptable Alternatives for Chromated Shielded Metal Arc Welding Rods**

FY2004

- **Environmentally Benign Alternatives for Cadmium Plating on High Strength Steels**
- **Alternatives for Class II ODS Solvents for DoD Cleaning**

SERDP Statements-of-Need Related to Surface Engineering Since 2000

FY2005

- Environmentally Benign Medium Caliber Gun Barrels

FY2006

- Environmentally Benign Finishing/Coating Systems for DoD Substrates

FY2007

- Environmentally Benign Approaches for the Repair of Composites for Military Applications

FY2008

- Environmentally Benign, High-Strength Fasteners for Weapons Systems
- Scientific Understanding of Non-Chromated Corrosion Inhibitors Function

SERDP Statements-of-Need Related to Surface Engineering Since 2000

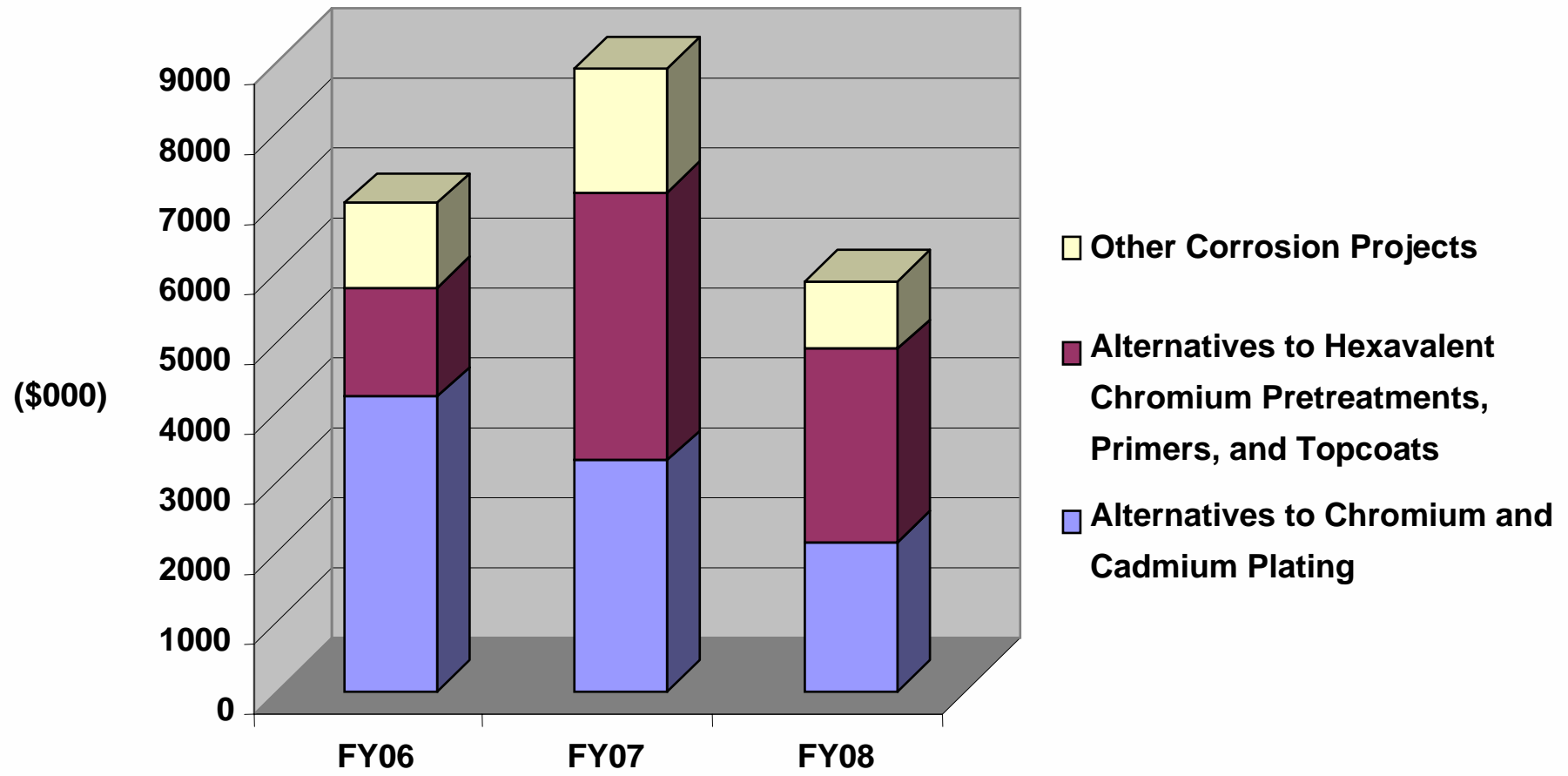
FY2009

- **Dynamic Accelerated Corrosion Test Protocol**
- **Environmentally Acceptable, Direct-to-Substrate Pretreatments for Multi-Material Systems**
- **Understanding the Science Behind How Methylene Chloride/Phenolic Chemical Paint Strippers Remove Coatings**

FY2010

- **Environmentally Friendly, Non-Aqueous Cleaners for Use on Weapons Systems and Platforms**
- **Environmentally Benign, High-Performance Non-Media Paint Strippers**

SERDP/ESTCP Investments Related to Corrosion



\$70M over the last 10 years

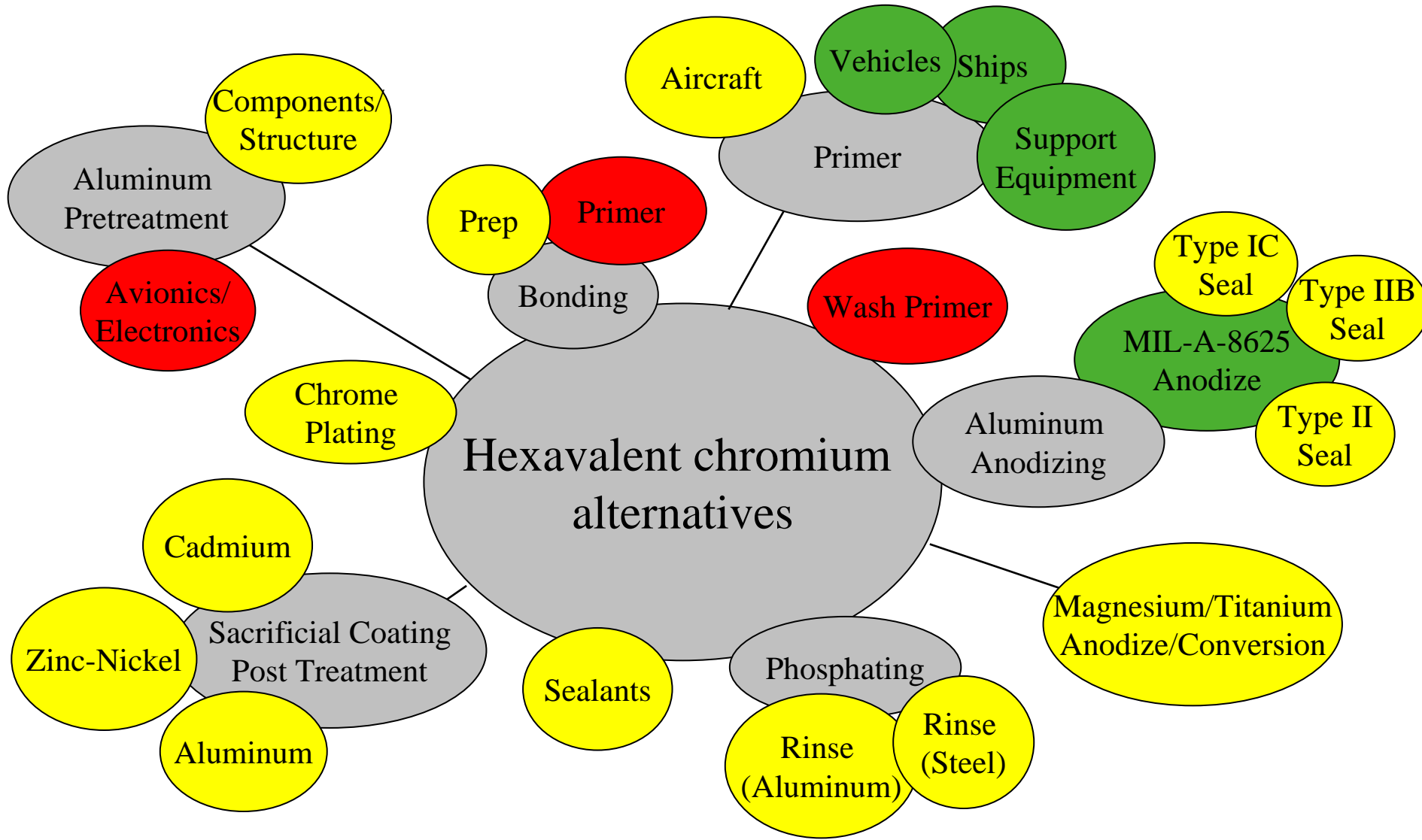
Application Areas for Chromate Alternatives

Green: Alternatives implemented; niche chromate use remains

Yellow: Limited implementation; near-term validation

Red: No or very limited implementation

Slide courtesy of NAVAIR



ESTCP Projects to Address Cr⁶⁺

- **FY2000:** Non-chromate Aluminum Pre-treatments (**NAVAIR Pax River**)
- **FY2005:** Validation of Novel Electroactive Polymers as Environmentally Compliant Coatings for Replacement of Hexavalent Chromium Pretreatments (**NAVAIR China Lake**)
- **FY2006:** Low Temperature Powder Coatings (**Hill AFB**)
- **FY2007:** Joint DOD Demonstration and Validation of Magnesium Rich Primer Coating Technology (**NAVAIR Pax River**)
- **FY2008:** Ultraviolet Curable Powder Coatings (**AFRL**)
- **FY2008:** Ultraviolet Curable Coatings for Aerospace Applications (**Hill AFB**)
- **FY2009:** Validation/Demonstration of Anti-Corrosion Inhibitor Primer Formulations as Replacements for Hexavalent Chromium Military Primer Coatings (**NAVAIR China Lake**)
- **FY2009:** Non-Chromate, ZVOC Coatings for Steel Substrates on Army and Navy Aircraft and Ground Vehicles (**ARL**)

Accelerated Corrosion Testing

- Qualification of alternative corrosion-resistant coating systems requires accelerated test methods that represent real-world conditions and result in same mechanisms of corrosive attack

Allan Grobin, IBM Corporation, member of ASTM Committee G-1 (corrosion-related), October 5, 1977: "The salt spray test while initially developed as a corrosion test was very quickly found not to be a corrosion test. Many of the metal plating specifications disqualified the salt spray test as a corrosion test. It is a comparative test for quality control and should not be used as an evaluator of corrosion resistance. It should not be used to compare the resistance of one type of plating against another."

In 2008, the salt spray test (ASTM B117) is still being specified in qualifying alternative coating systems



Technician loading test panels into salt-fog (salt spray) test cabinet (ASTM B117)

Dynamic Accelerated Corrosion Test Protocol

Because qualification of alternative coating materials and processes is critical, SERDP decided to issue Statement-of-Need for development of accelerated test methodology

Objective

- To develop an accelerated corrosion testing protocol that more accurately reflects the operational environments of Department of Defense (DoD) end users and would be acceptable across the DoD.

Focus

- Stress new protective systems in an effort to understand how they perform compared to the standard systems that are currently in use.
- Use several material “stack-up/mock-up” geometries selected from those currently being used by the military services.
- Ability to adjust protocol to provide accurate predictive data for most operational environments, ranging from land-based ground vehicles to carrier-based aircraft.

Projects Being Funded by SERDP

	Luna Innovations Inc. FY09 New-Start	Air Force CTIO FY09 New-Start
Objective	Develop a next generation accelerated corrosion test methodology.	Develop a comprehensive test protocol to accurately predict all aspects of the performance lifetime of DoD coatings.
Technology/ Approach	Measure the evolution of electrolyte composition and corrosion morphology in the lab and at outdoor sites to determine relevant solution composition as well as deficiencies in current test methods. Identify specific regimes that govern corrosion processes and different corrosion failure modes by systematically varying environmental and mechanical inputs. Integrate the data sets and calculate test chamber conditions where realistic failure modes (or combinations of failure modes) will result. Deliver a set of test coupon configurations, exposure regimes, and analysis tools to evaluate the performance of materials and structures in corrosive environments.	Investigate the corrosion products generated in various outdoor environments on a variety of substrates to accurately identify the reactive species present in each environment. Generate a simulated exposure environment that mimics the corrosion products found outdoors. Combine reactive species to duplicate synergistic effects through modification of an existing weatherometer. Kinetics of the simulated environment will be investigated to accelerate (by increasing temperature and/or concentration of reactive species) the performance evaluation.



Example of Requirements for New Coating Implementation

- **Implementation Path**
 - ◆ Lab validation – process and product performance
 - ◆ Field validation – process and product performance
- **Implementation**
 - ◆ **Sign-Off**
 - Engineering/Materials
 - Depot/Production
 - Program: Fleet Support Team (FST)/Class Desk/OEM
 - ◆ **Revise specs (Local/MIL/AMS...)**
 - ◆ **Revise General Series and Equipment Manuals**

SERDP/ESTCP Initiative



- Numerous surface-engineering-related projects executed by SERDP, ESTCP and other organizations to develop and evaluate new technologies that are more environmentally friendly and reduce life-cycle costs
- Problem is that stakeholders and weapons systems owners do not have ready access to data to determine if new technology can be implemented
- ASETSDefense is initiative intended to develop information data bases and organize workshops associated with technologies in the surface engineering field; web site www.asetdefense.org is entry point to engineering data and materials selection data bases under development

www.asetdefense.org

ASETDefense
ADVANCED SURFACE ENGINEERING TECHNOLOGIES FOR A SUSTAINABLE DEFENSE

VIEW MORE NEWS

ESTCP
SERDP

Search Site

Welcome to the ASETDefense website

MAIN MENU

- Surface Engineering Database
- Clean Alternatives Information
- ASETDefense workshops
- DoD Policies, Government Regulations
- Team workspaces
- Tools
- Assistance
- News
- Links
- Contact ASETDefense

QUICK INFORMATION on clean alternatives

- Cd plate alternatives
- Chromium conversion alternatives
- Chromated primer alternatives
- Chromic acid anodize alternatives
- Hard chrome plate alternatives
- Low VOC topcoat alternatives

This site is designed to provide background information and detailed technical data on alternatives to coatings and surface treatments that are environmental or health hazards, such as:

- Coatings that contain hexavalent chromium or use it in the deposition process
- Coatings that contain cadmium
- Coatings that contain volatile organic compounds (VOCs)

ASETDefense
Advanced Surface Engineering Technologies for a Sustainable Defense - ASETDefense - is a Department of Defense (DoD) initiative sponsored by [Strategic Environmental Research and Development Program \(SERDP\)](#) and the [Environmental Security Technology Certification Program \(ESTCP\)](#). Its objective is to facilitate the implementation of new, environmentally friendly technologies for surface engineering (coatings and surface treatments) by providing ready access to information and data from research, development, test, and evaluation efforts as well as the status of approvals and implementations. ASETDefense provides defense organizations with information and assistance to improve weapons system performance and life-cycle cost while reducing or eliminating environmental safety and occupational health (ESOH) impacts.

Surface Engineering Database
This is a relational database designed with search capability to provide access to the available information needed to make informed decisions on the use of alternatives to materials and technologies used for surface engineering that pose environmental or health hazards. This information includes detailed engineering data, background documents, and information on processes and products that have been validated, authorized or implemented.

[> more details...](#)

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One-page technology descriptions