

Department of Defense Environmental Coatings Programs

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Outline

- Background – DoD Environmental Programs
- Pollution Prevention Coatings Technology
 - Material solutions
 - Equipment solutions
- Conclusions

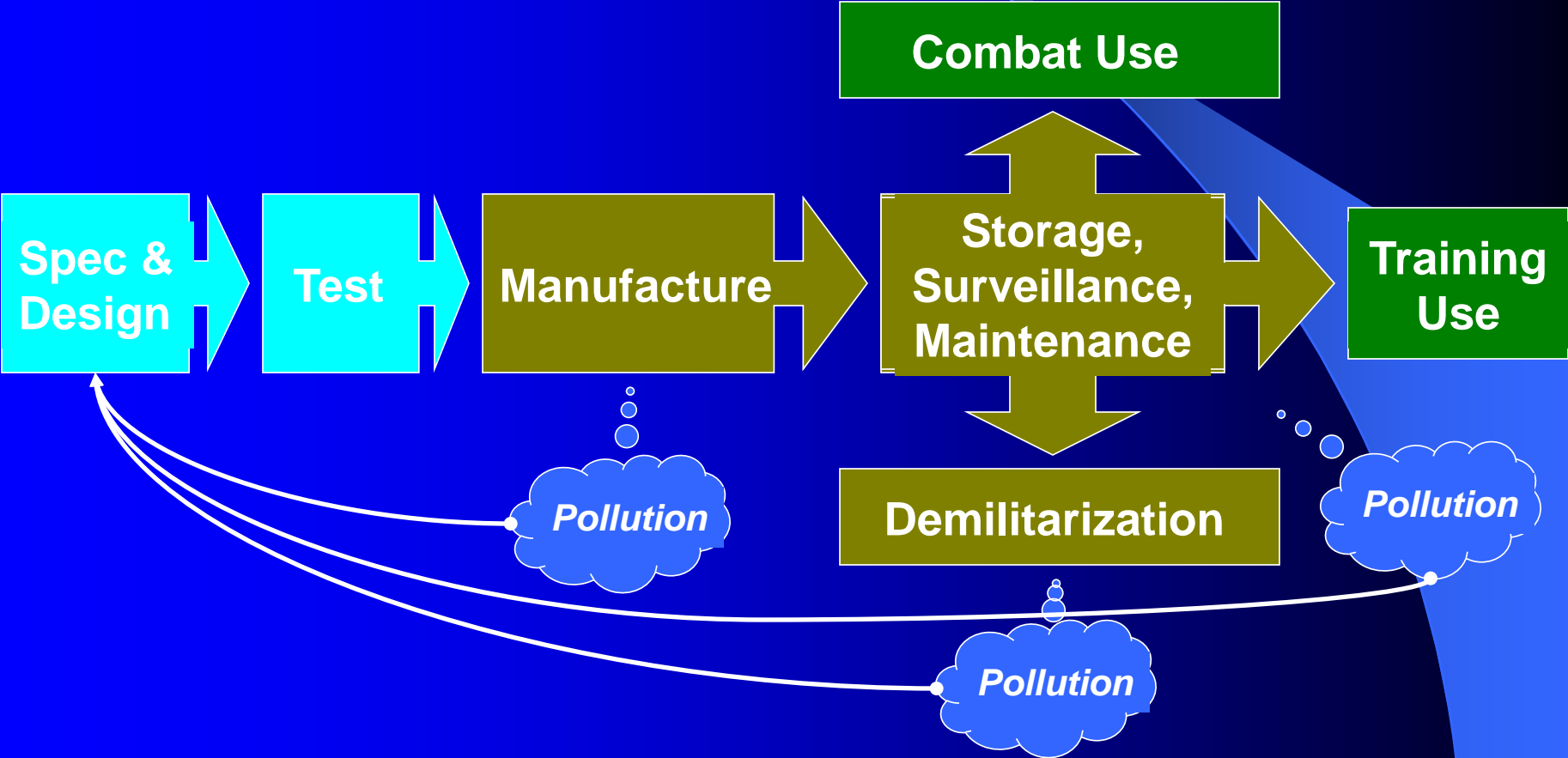
Background

DoD Environmental Programs

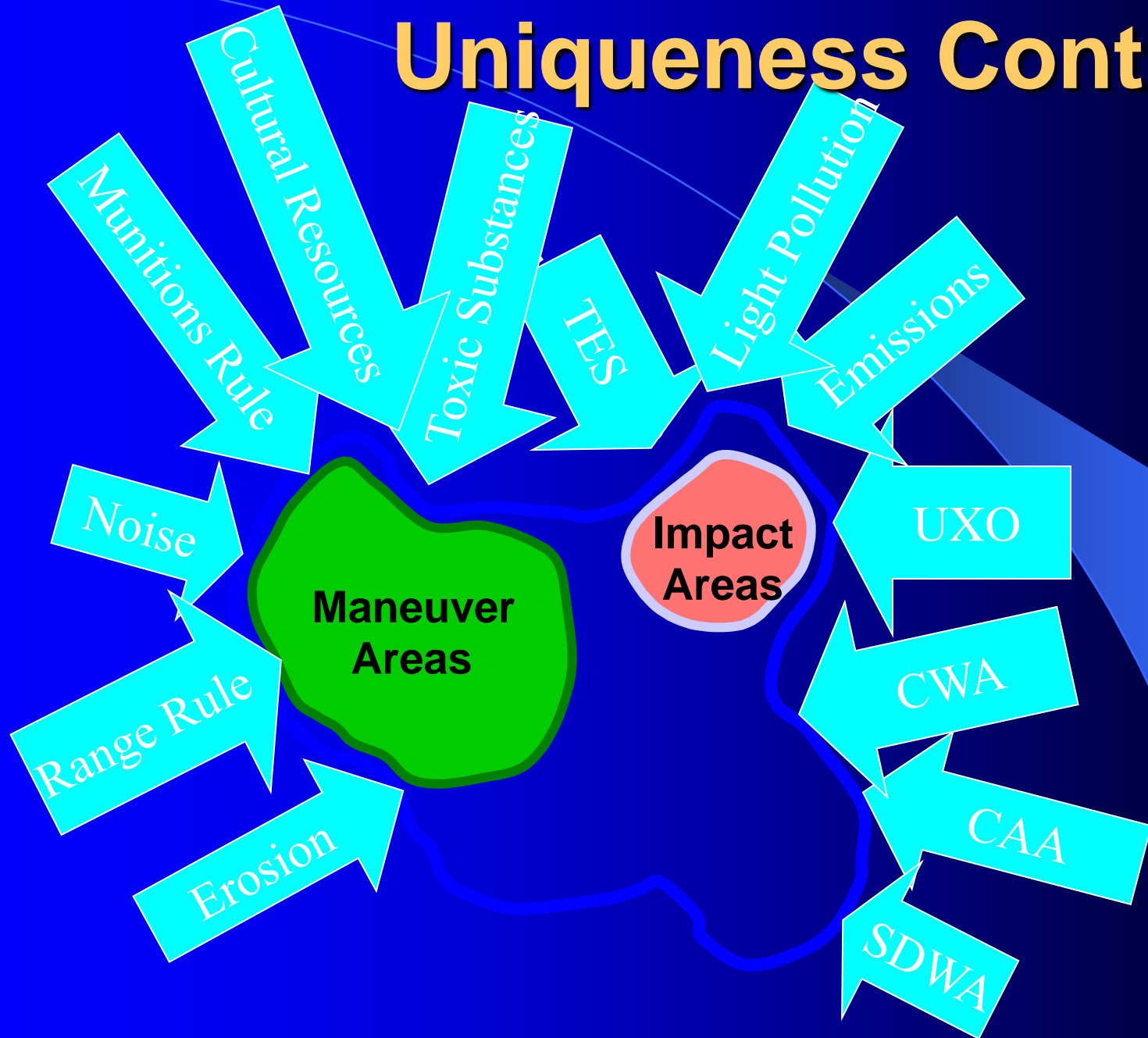
Introduction

- DoD environmental response is unique
 - Compliance without a loss of readiness or operability
 - Military operations require use of bad things
 - Both a leader and follower of regulations

Military Uniqueness



Uniqueness Cont'd



Environmental Pillars

- 1) Cleanup
- 2) Compliance
- 3) Conservation
- 4) Pollution Prevention

Cleanup

- Restore areas effected from past activities
- Restoring sites to safe conditions
 - Ranges
 - UXO

Compliance

- Programs geared toward complying with current or impending regulations.
- Bound by Federal, State, local, and DoD regulations.
 - Regulates to the strictest standard
 - Example: South Coast Air District VOC regulations

Conservation

- Environmental planning practices
- Protect and enhance:
 - Natural and cultural resources
 - Wetlands, historic sites, endangered species, etc...
- Programs that review current practices and equipment to identify new areas where environmental benefits can be found.

Pollution Prevention

- Funding R&D programs to innovate to comply with future environmental requirements.
- Reducing use of HAZMATs at the source
- Reducing the creation of HAZMATs at the source

Pollution Prevention Coatings Technology Focus

Problem, Response, Approach, and Results

P2 Coatings Technology Focus

- Material Solutions
 - Low/no copper anti-fouling coatings
 - Cadmium alternatives
- Equipment Solutions
 - High solids coatings/Plural component spray
 - Powder Coating

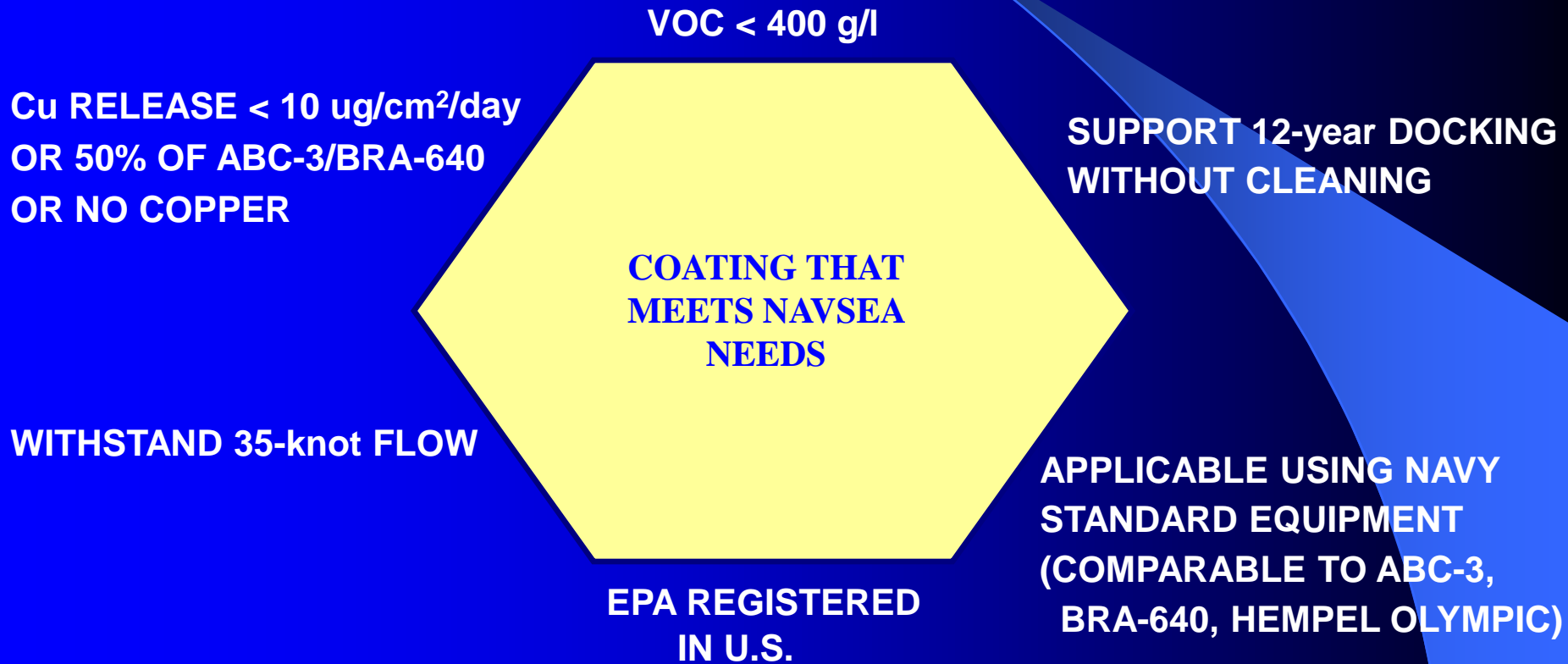
Material Solutions

Low/no Copper Antifouling Coatings

Low/no Copper AF

- Problem: AF coatings are being regulated through the IMO ban on TBT. Copper hull coating leachate is being regulated through the UNDS.
- Navy Response: R&D program to identify new environmentally friendly AF coatings
- Approach: Work with industry to test promising new AF's for performance and environmental efficacy.
- Results: 3 no copper coatings, 2 low-copper

Low/no Copper AF Environmental Summary



Low/no Copper AF Program

**ENVIRONMENTAL &
PERFORMANCE GOALS**

OPTION 1: NON-COPPER

- DEVELOPMENTAL COATINGS.
- NOT EPA REGISTERED.
- SHORT HALF-LIFE (e.g., 10-hour) BIOCIDES.

ONE VENDOR'S PRODUCTS UNDER TEST

THREE VENDORS DEVELOPING PRODUCTS

OPTION 2: LOW-COPPER CO-BIOCIDE COATING

- COMMERCIAL PRODUCTS
- SOME CO-BIOCIDES, NOT EPA REGISTERED.
- SHORT HALF-LIFE (e.g., 10-hour) BIOCIDES.

BEST OPTION 2 PRODUCTS UNDER TEST.

TWO OTHER VENDOR'S PRODUCTS DON'T MEET NAVY NEEDS.

OPTION 3: FOUL-RELEASE NON-TOXIC COATINGS

- COMMERCIAL COATINGS.
- NAVSEA SPECIFICATION REVISION IN PROGRESS.
- TEST INSTALLATIONS ON MCM-1 & MCM-14.

MIL-PRF-24647C INCLUDES CATEGORY.

INTERNATIONAL INTERSLEEK INCLUDED ON QUALIFIED PRODUCTS LIST

ONE PRODUCT FROM SMALL BUSINESS UNDER TEST.

Low/no Copper AF Summary



BRA-640



OPTION 2



OPTION 2



OPTION 1



FAILED SYSTEM

**24 months, full immersion, Pearl Harbor
Panels located on rafts in Pearl Harbor
& at USCG Maintenance Facility, Miami, FL**



Low/no Copper AF Summary Cont'd

- NAVSEA EVALUATING PANEL TEST DATA FROM MIAMI MARINE & BATELLE TEST SITES.
- OPTION 1 & 2 PRODUCTS BEING TESTED AND COMPARED WITH ABLATIVE-COPPER CONTROLS.



OPTION 1 COATING
ABLATIVE RESIN BASE
(20-months)

ABLATIVE
COPPER
CONTROL

Material Solutions

Cadmium Alternatives

Cadmium Alternatives

- Problem: Cadmium is a suspected carcinogen, elimination from components necessary to promote worker health & safety
- Response: Army's AAPPSO funded research into alternative materials to Cad for fasteners and electrical connectors.
- Approach: Corrosion performance test were conducted on alternative materials for various components.
- Results: Recommendations for alternative materials for specific components were publish on the AMSS-CD.

Approach

- Accelerated corrosion testing
 - Marine Exposure
 - Accelerated Corrosion Chamber



Results - Accelerated Corrosion Testing



Figure 1. Electroless Nickel Circular Connector.



Figure 2. Electroless Nickel Microminiature Connector.

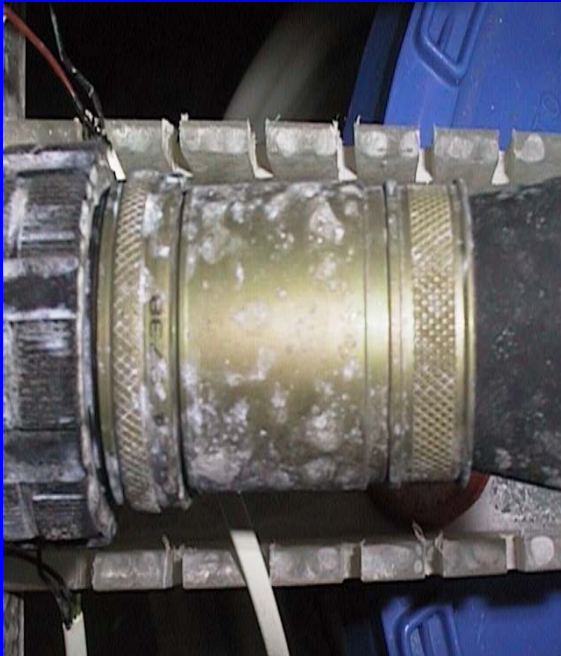


Figure 3. Zinc/Nickel Circular Connector.

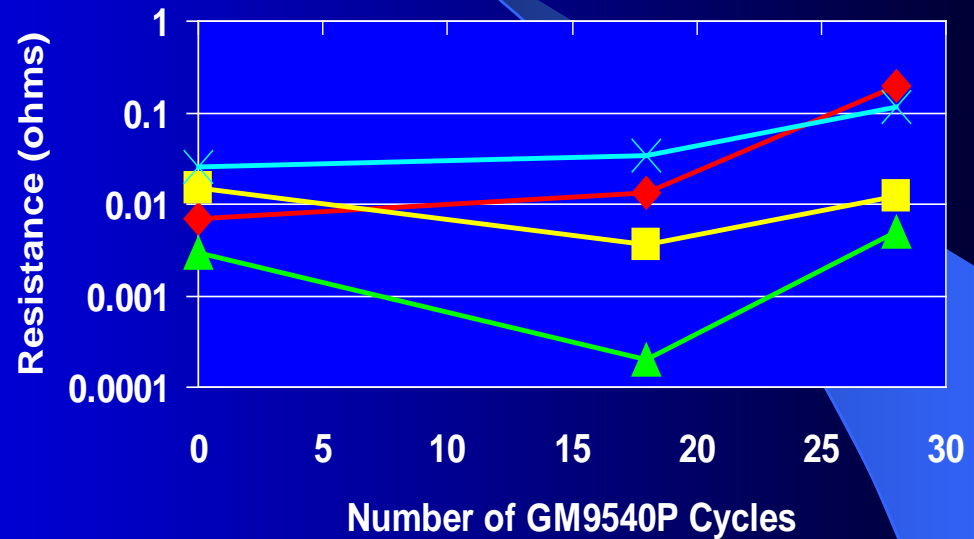


Figure 4. Zinc/Nickel Microminiature Connector.

Results - Electrical Connectors



**Zinc/Nickel backshell
after 28 cycles**



Cadmium Alternative Summary

- On aluminum substrates, IVD aluminum and tin/zinc platings best overall performance
- On steel substrates, zinc/nickel and IVD aluminum platings best overall performance
- Platings that showed less than optimal performance may be suitable for use depending on the environment

Equipment Solution

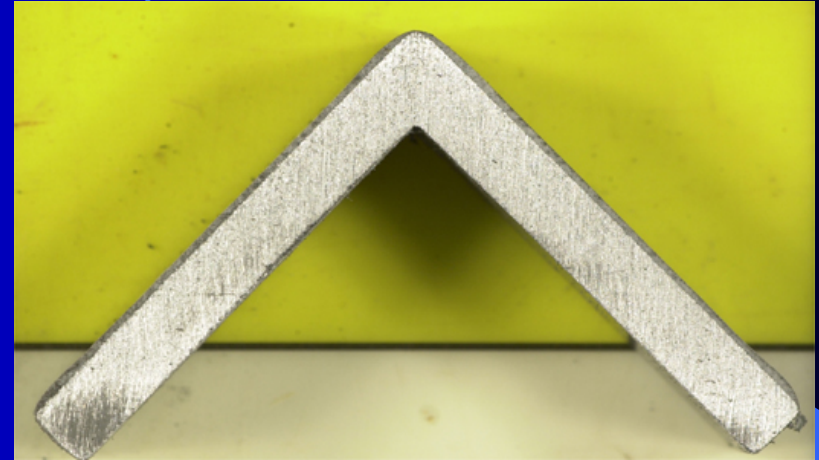
Plural Component Coatings Application

High Solid Coatings/Plural Component Equipment

- Problem: Continuing efforts to lower VOCs and extended Dry-docking cycles increase the performance requirements for US Navy Tank coatings.
- Response: R&D program to survey industry for innovations in high solids coatings
- Approach: Support Plural Component equipment education and use at US Navy Facilities.
- Results: 20 year tank coating <1% VOC coatings.

High Solids Coatings

- Edge Retention
- High build coating
 - No solvent entrapment
- Fast cure
- <1% Solvent
- 20 year service

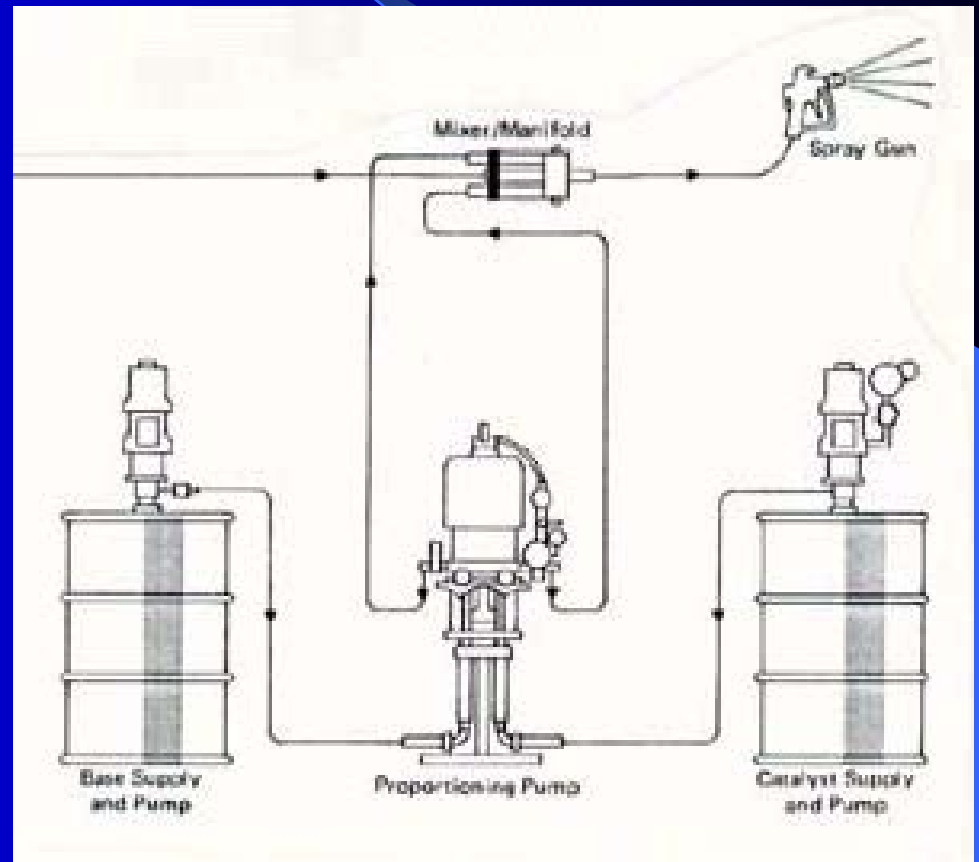


Poor Retention



Good Retention

Plural Component Equipment



High Solids/Plural Component Summary

- Key issues

- Short pot life materials
- Heated lines
- Adjustable proportions/alarms
- Gun reliability
- Equipment cleanup/maintenance
- Painter training
- QA training

- Current uses

- Tanks
 - Ballast, CHT, Fuel
- Bilges
- Well deck overheads

- Future

- Underwater Hull
- Non-skid deck coatings

Equipment Solution

Powder Coatings

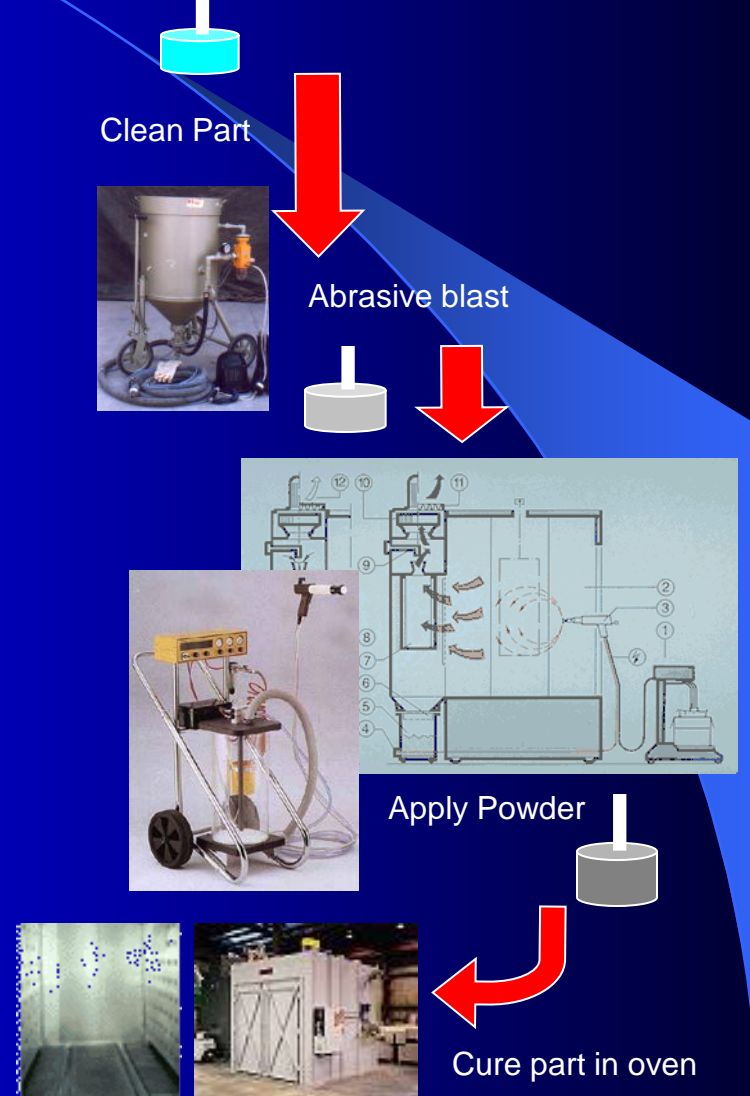
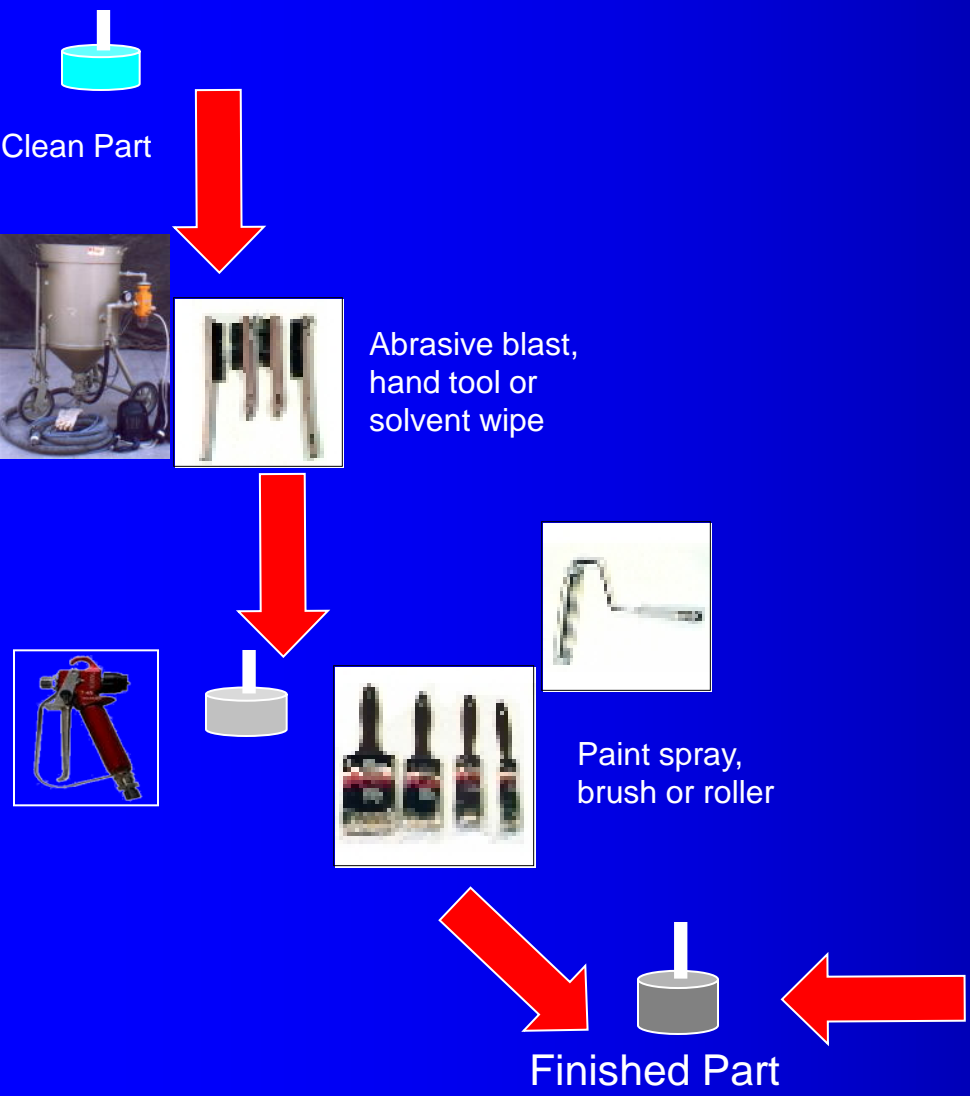
Powder Coating

- Problem: No qualified material that would meet the current Military Specification for powder coatings. Using powder coatings can lower VOC emissions from coating operations.
- Response: R&D program to identify Powder Coating materials appropriate for shipboard use.
- Approach: Survey industry of materials and test materials to current liquid coating standards.
- Results: Identified functional powders for immersion service, decorative powders for interior dry service and exterior powders for topside service.

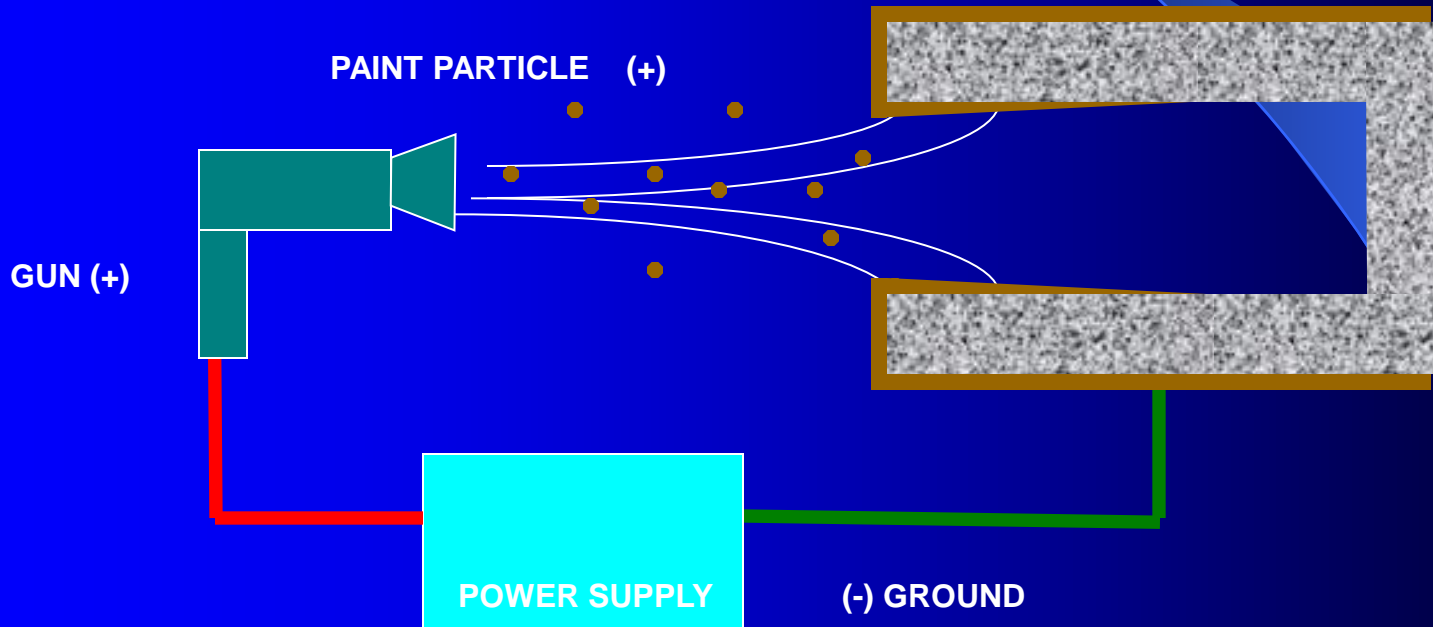
Coating Process

CURRENT LIQUID PROCESS

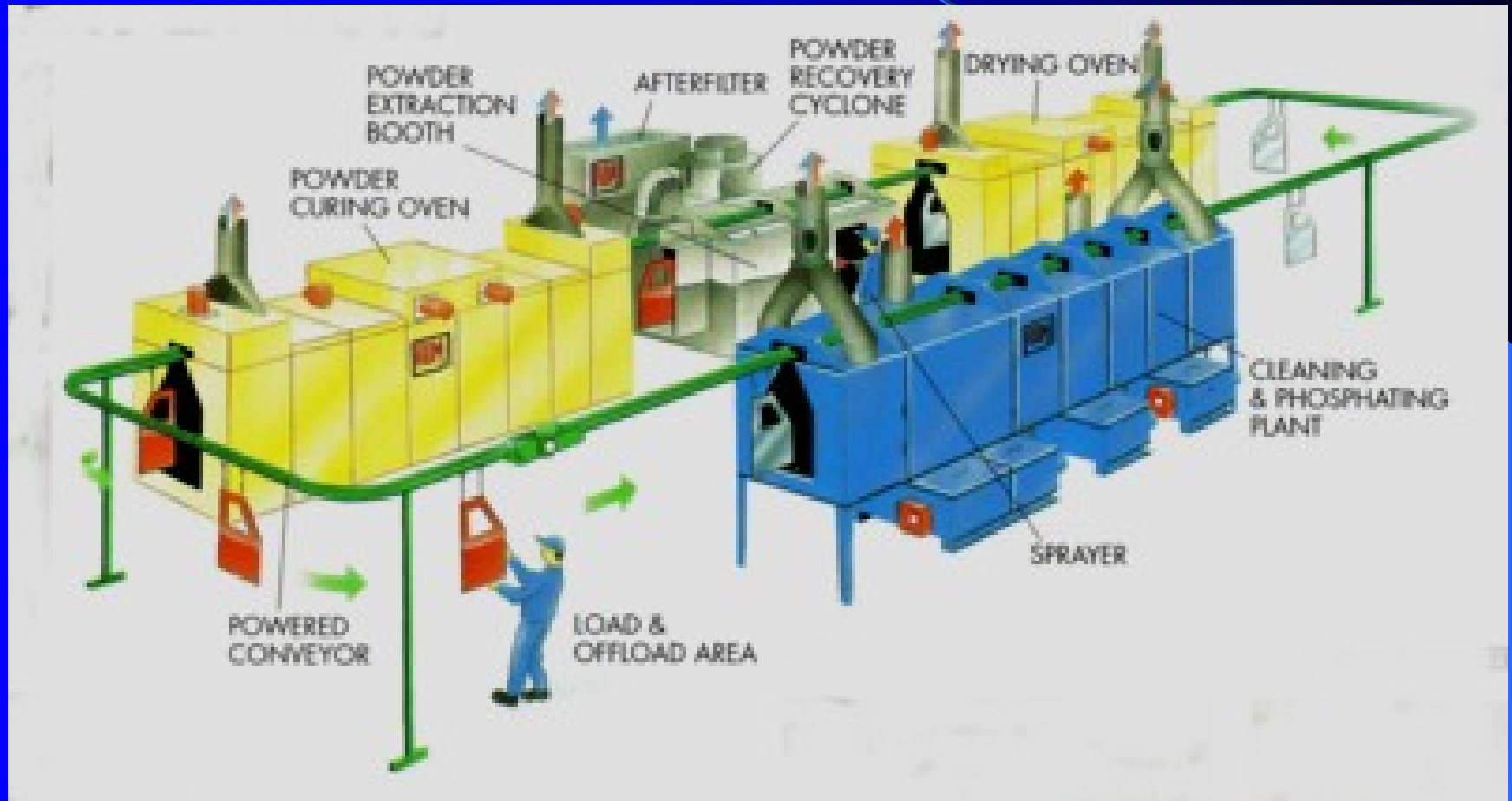
POWDER COATING PROCESS



Coating Process Cont'd



Coating Process Cont'd



Powder Coating Summary

- Key issues
- Part selection
 - Heat treatments, portability, repairability
- Material selection
 - Functional powders for harsh service
 - Pipe line/rebar FBE
 - Exterior powders for UV resistance
 - TGIC Polyester
- Process control
 - Powder thickness, temp control, cure time
- Current Uses
 - Ship's force removable pieces
 - Vent screens, water tight doors, hand wheels
 - New Construction
 - Pipe hangers, RO foundations
- Future
 - Tank parts

The background is a dark blue gradient. A thin, light blue curved line starts from the top left and curves towards the center. A larger, light blue shape, resembling a quarter-circle or a wedge, is positioned in the lower right quadrant, overlapping the main background.

Conclusions

Conclusions

- DoD works with industry to comply with current or impending environmental regulations.
- DoD funds R&D efforts to stay ahead of environmental regulations.
- DoD seeks to take the lead with environmental regulations without hindering readiness and/or military maneuverability.