

Army Corrosion Prevention and Control (CPC) Program for *Facilities and Infrastructure*

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ARMY UNIVERSE

(Data collected 30 Sep 09)

Land Acreage

| | |
|------------------|------------|
| • United States | 13,506,291 |
| • Europe | 139,981 |
| • Asia | 21,405 |
| • Other Overseas | 15,309 |

Roads (paved and unpaved)

59,286 Miles

Paved Area (excluding roads)

423 Million square yards

Railroads

2,522 Miles

Family Housing Units

| | |
|--------------|--------|
| • Owned | 18,721 |
| • Leased | 8,544 |
| • Privatized | 86,092 |
| • Conveyed | 79,477 |

Barracks

Adequate Spaces

| | |
|-------------------|------|
| • Permanent Party | 150K |
| • Training | 5K |
| • ORTC | 112K |

Plant Replacement Value

\$296B

Army Installations

| | |
|------------------|------------|
| • IMCOM | 74 |
| • Army Reserves | 4 |
| • National Guard | 47 |
| • AMC | 30 |
| • SMDC | 1 |
| • MEDCOM | 2 |
| • DLA | 5 |
| TOTAL | 163 |

Army Demographics

58% married
8.9% dual military
6.7% single parents
854,112 family members

Environmental Clean-up Remaining *(Installation Restoration Program & Military Munitions Response Program)*

| | |
|-------------------------------|-------|
| • Active Sites | 1,327 |
| • BRAC Sites | 318 |
| • Formerly Used Defense Sites | 1,953 |

Army End-Strength

| | |
|-----------|---------|
| Active | 549,015 |
| USAR | 205,297 |
| ARNG | 358,391 |
| Civilians | 245,248 |
| Retired | 838,927 |

Airfield

- 145 Fixed Wing
- 738 Heliports

Buildings

(Million square feet)

| | |
|-----------------|-----|
| • United States | 796 |
| • Europe | 117 |
| • Asia | 34 |
| • Other | 7 |

Utilities

Electric, gas,
water and sewer

- 68,613 Miles

FY09 Installation Management Resources = \$28B

(Including \$3B -American Recovery and Reinvestment Act Funding (ARRA))

War on Corrosion

- The 2007 DoD Cost of Corrosion Study determined that the total cost of corrosion for both equipment and infrastructure was \$20 billion/year
- Corrosion of facilities and infrastructure costs the DoD approximately \$1.8 billion/year (FY05 dollars).
 - ▶ 15.1% of the total maintenance budget
- The cost of corrosion in Army facilities and infrastructure was approximately \$0.45 billion/year (FY05 dollars).
 - ▶ 15.8% of the total maintenance budget
 - ▶ Based on Army FY09 SRM, that equates to over \$.5 billion/year

Army Corrosion Prevention and Control Program (CPC)

Facilities & Infrastructure

- Reduce life-cycle cost of facilities and infrastructure
 - ▶ Develop strategy for implementing CPC within the Army acquisition life cycle
 - Develop and implement policy and guidance on corrosion prevention and control for Army facilities.
 - Provide guidance for improving maintenance and training in corrosion.
 - Prioritize science and technology requirements to advance the state of the art.
 - Ensure that CPC is fully considered throughout the asset life cycle.

INFRASTRUCTURE ACQUISITION LIFE CYCLE

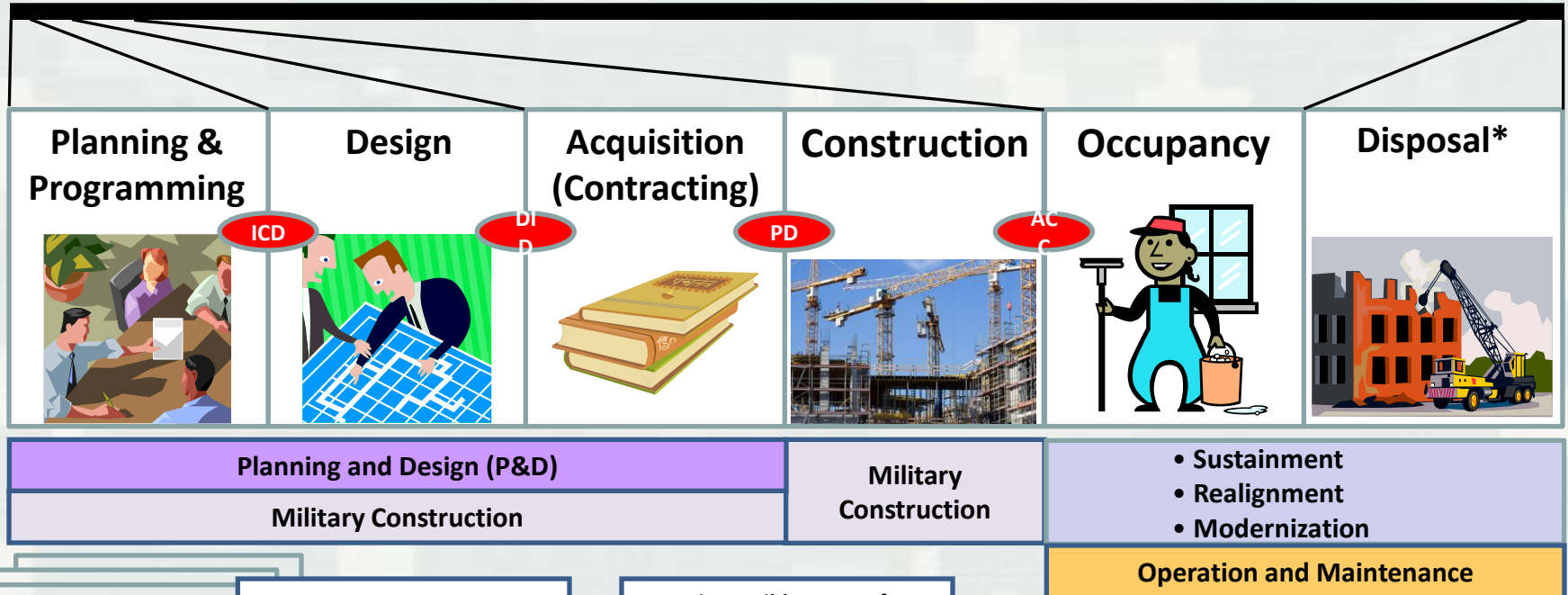
RDTE 6.1 (Basic Research)

RDTE 6.2 (Applied Research)

0 1 3 6

Time (years) →

73 75



DD 1390, DD 1391,
Military Construction
Program/Project Data

Unified Facilities
Criteria (UFC)

Unified Facilities
Guide Specifications
(UFGS)

Industry
Standards

Design-Build Request for
Proposal (RFP)

Construction Contract
Documents

Maximum impact on facility life
cycle costs at planning and
design stage

ICD = Initial Capabilities Document
DID = Design Intent Document
PD = Procurement Documents
ACC = Acceptance / Beneficial Occupancy

* Reduce, Reuse, Recycle

Systemic problems will not be solved by individual technical solutions

Army Facilities CPC Program

- Technology Demonstration
 - ▶ Validate benefits
 - ▶ Develop engineering guidance
- Supports
 - ▶ Readiness
 - ▶ Sustainability
 - ▶ Safety



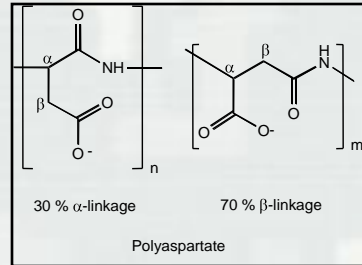
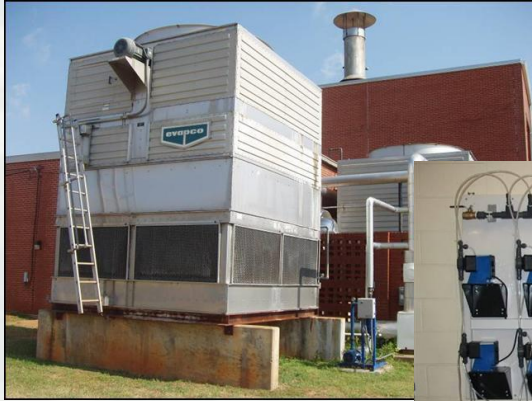
Army Investments

Funds expended on corrosion prevention and control through the OSD Program:

Army Facilities CPC Program Funding Summary

| | OSD (\$000) | Service Match (\$000) | Installation Supplemental (\$000) | Total Funding (\$000) |
|--------------|------------------------|----------------------------------|--|--------------------------------------|
| FY09 | 5,357 | 5,000 | 1,120 | 11,477 |
| FY08 | 3,853 | 5,000 | | 8,853 |
| FY07 | 4,050 | 5,000 | | 9,050 |
| FY06 | 4,430 | 5,000 | 336 | 9,766 |
| FY05 | 4,540 | 3,905 | 700 | 9,145 |
| Total | 22,230 | 23,905 | 2,156 | 48,291 |

AR-F-314 Green Chemical Treatment and Smart Control System for Heating and Cooling Systems



- **Where:** Ft. Rucker, Ft. Hood, Red River Army Depot, Redstone Arsenal, and Brooke AMC
- **When:** FY 2005 - 2006
- **Benefits:** Reduced corrosion and fouling of boilers and cooling towers, greater energy efficiency and reduced environmental impact.
- **Cost:** \$2,600K
- **ROI:** 13
- **Payback:** 2.6 years

F07AR19 – Epoxy Coating System Formulated with Carbon Nanotubes



- **Where:** Ft. Bragg, NC
- **When:** FY 2007 - 2008
- **Benefits:** Improved coating performance (flexibility, impact resistance, adhesion). Reduced use of heavy metal pigments.
- **Cost:** \$950K
- **ROI:** 8
- **Payback:** 3.7 years

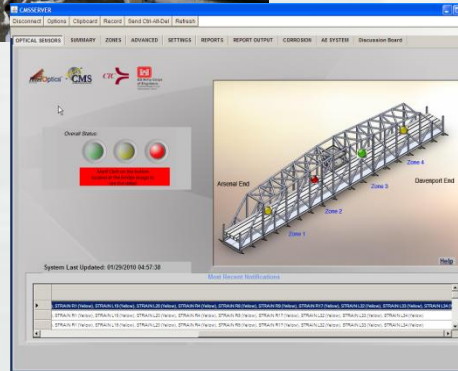
F08AR13: Remote Structural Health and Degradation Monitoring of Bridges

Steel Bridges

Rock Island Arsenal



I-20 Vicksburg, Mississippi



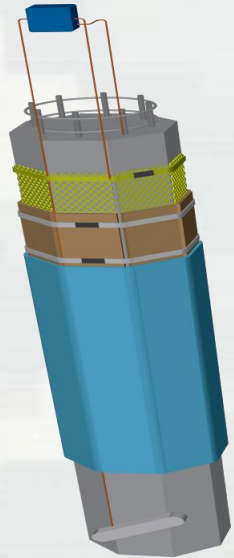
Thermoplastic Composite Bridges



Fort Bragg, NC

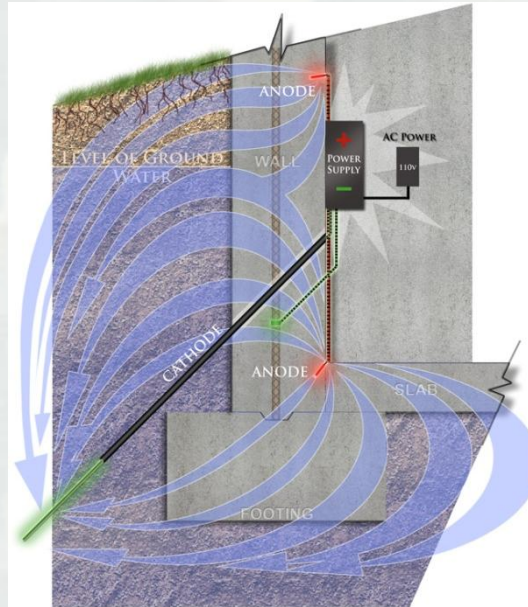
- **Where:** Rock Island Arsenal, I-20 Vicksburg, Mississippi, and Fort Bragg, NC
- **When:** FY2008 - 2010
- **Benefits:** Real time assessment of the condition of critical steel bridge infrastructure and warning of degradation processes that could cause failure. Assessment of long-term performance of innovative thermoplastic composite timber bridges.
- **Cost:** \$2,183K
- **ROI:** 26
- **Payback:** 1.2 years

F08AR07: Polymer Composite Wrapping and Galvanic Cathodic Protection System for Pilings



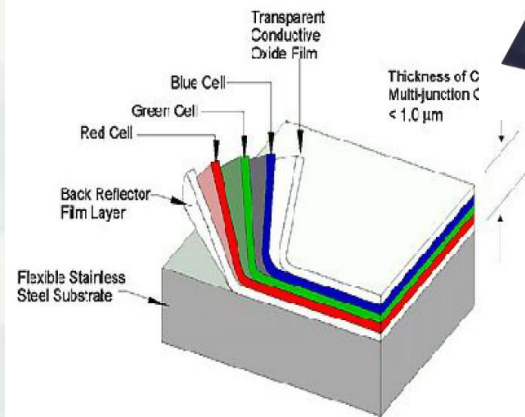
- **Where:** Kawaihae Harbor, HI
- **When:** FY2008 - 2010
- **Benefits:** Polymer composite pile wrap that incorporates galvanic cathodic protection system provides corrosion resistance to steel reinforcements as well as impact and abrasion resistance.
- **Cost:** \$1,092K
- **ROI:** 16
- **Payback:** 1.9 years

F08AR23: EOP & Dehumidification Technologies in Ammunition Bunkers



- **Where:** Kawakami Ammunition Depot, Japan and Naval Ordnance Station, Guam
- **When:** FY2009 - 2010
- **Benefits:** Stop water intrusion into earth covered magazines; maintain interior relative humidity to prevent corrosion and biological growth.
- **Cost:** \$1,205K
- **ROI:** 59
- **Payback:** 0.5 years

F09AR04: Corrosion Resistant Roofs with Integrated Sustainable PV Power Systems



- **Where:** Kilauea Military Camp, HI
- **When:** FY2009 - 2011
- **Benefits:** Metal roofs with high performance coatings and thin film laminate PV appliques can provide corrosion resistant sustainable roofs and cheap electric power.
- **Cost:** \$688K
- **ROI:** 20
- **Payback:** 1.7 years

F09AR16: Lightweight Fiber Reinforced (Thermoset) Polymer Composite Bridge Decks as Replacement for Steel Reinforced Concrete Decks



- **Where:** Redstone Arsenal, AL
- **When:** FY2009 - 2011
- **Benefits:** Reduced corrosion due to elimination of metallic rebar, reduced weight equates to reduced dead load and increased dynamic live load, low maintenance.
- **Cost:** \$850K
- **ROI:** 10
- **Payback:** 3.0 years

Technology Transfer is Key

- Technology-specific updates to UFCs, TMs, ETLs, and other relevant criteria documents
- Incorporation into Installation Design Standards
- Inclusion in industry standards such as ACMA, ASTM, AASHTO, NACE, AWWA, ICRI
- International data exchange agreements concerning corrosion prevention, control and mitigation:
 - ▶ Australian DoD (executed)
 - ▶ UK Ministry of Defense and Germany (in development)
- Cooperative Research & Development Agreements (CRADAs) with Industry

Challenges

- R&D
- Technology Transfer
- Funding
- Training/Awareness