New Publication Provides Corrosion Prevention and Control Guidance

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Department of Defense (DoD) program managers (PMs) and other acquisition officials are being asked to include corrosion prevention and control as one of the key elements in acquisition planning, design, and development. Although the acquisition community has long recognized the insidious and pervasive effects of corrosion on operational systems and support facilities, corrosion planning has largely focused on maintenance and logistics methods for detecting, assessing, treating, and repairing systems and components that have already been affected by corrosion.

The effects, impact, and cost of corrosion have been steadily increasing to the point that we have been obliged to review the current state of corrosion in military systems and facilities and take across-the-board action to resolve this growing problem.

Recent studies reveal that it costs the DoD between $10 billion and $20 billion each year to mitigate corrosion effects or try to prevent corrosion. The lion's share of these dollars go toward mitigation: assessing corrosion and its effects on operational systems and facilities; treating these systems and facilities to prevent or retard further effects; or repairing system and facility components that have suffered unacceptable damage from corrosion. Corrosion adversely impacts operational performance, readiness, safety, manpower, maintenance hours, and spare parts inventories. The ultimate effect is often the early retirement of expensive systems and facilities and the need to replace them with even more expensive assets.

Corrosion Prevention and Control (CPC) Planning Guidebook

In order to assist the acquisition community to implement the CPC policy of the under secretary of defense (acquisition, technology & logistics) expressed in the policy letter on page 73, the CPC task force appointed by the under secretary [*see "Corrosion Prevention and Control: Status and Update" on page 32*] developed and published the *Corrosion Prevention and Control Planning Guidebook*, which is available at <www.dodcorrosionexchange.org>.

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The task force also generated responses and *Guidebook* references to frequently asked questions (FAQs) regarding the CPC policy. One FAQ is "Why should I follow the *Guidebook*?" The response reflects the source, overall content, and reason for the *Guidebook*: "The CPCP Guidebook has been developed by DoD science and technology, acquisition, and logistics experts who have combined their insight and experience with an understanding of new corrosion prevention and mitigation program requirements to produce this publication. The resulting *Guidebook* is a compilation of approaches and processes designed to improve readiness, lower life cycle cost, and improve safety by ensuring successful corrosion prevention and control."

The *Guidebook* provides acquisition PMs with guidance in developing and implementing a CPC program for DoD weapon systems and infrastructure. This guidance includes programmatic considerations as well as corrosion-related technical aspects that should be addressed for a viable design. The *Guidebook* structure is built on a foundation of general knowledge and basic requirements; it then expands to cover detailed requirements, methods, and examples of approaches that might be taken by program managers and others in the acquisition community.

Corroded antenna base (left). HiTak(c) gasket (right) offers environmental barrier and protection. Images provided by Av-Dec, LLC.

Section 1: Requirements

The first section of the *Guidebook* addresses the scope and application of the document. Requirements for materials, processes, techniques, and tasks required to integrate an effective corrosion prevention and control program are to be implemented during all phases of DoD weapon systems and infrastructure development. The guide is applicable to all DoD procuring activities and their respective contractors involved in the design, procurement, and upgrades of DoD systems. And detailed plans and specifications apply to all elements of DoD systems, including spare parts.

Sections 2 and 3: Documents and Definitions

The next two sections of the *Guidebook* address documents and definitions that form the framework for corrosion prevention and control planning and execution. Since the status of corrosion-related documents frequently changes, the *Guidebook* gives Web links to the latest list of applicable documents.

Section 4: Corrosion Prevention and Control Plan

The fourth section of the *Guidebook* presents general requirements for effective corrosion prevention and control. This section highlights management planning (Figures 1 and 2) as well as technical and design considerations (Figure 3). Development and implementation of a corrosion prevention and control plan (CPCP) needs to take place early in the acquisition cycle and a corrosion prevention advisory team (CPAT) should be formed as part of the corrosion management structure. General design and technical guidance articulates the need for PMs to consider materials, manufacturing methods, and protective treatments that reduce failures as a result of deterioration. As they select suitable materials and appropriate processing manufacturing methods to satisfy system requirements, PMs should also consider materials, processing methods, and protective treatments that reduce deterioration. The section also describes deterioration modes that contribute to failures caused by corrosion. Other technical guidance addresses material selection, preventive coatings, design geometries, and environmental considerations.

FIGURE 1. **Corrosion Management Structure and Basics**

- Government PM sets up corrosion prevention advisory team (CPAT)
  - Develop corrosion prevention and control plan (CPCP)
- RFP evaluation factor for contractor CPCP
- Government and contractor establish technical design guidelines for life of system
  - How the particular program will implement CPC
  - Process/finish specification or equivalent document
  - Verification plan at system, assembly, and component level
  - Corrosion technical manuals and maintenance concepts
- Issues
  - Acquisition cost to implement changes
  - Warranties difficult to track and enforce
  - Priority of corrosion control versus other performance parameters

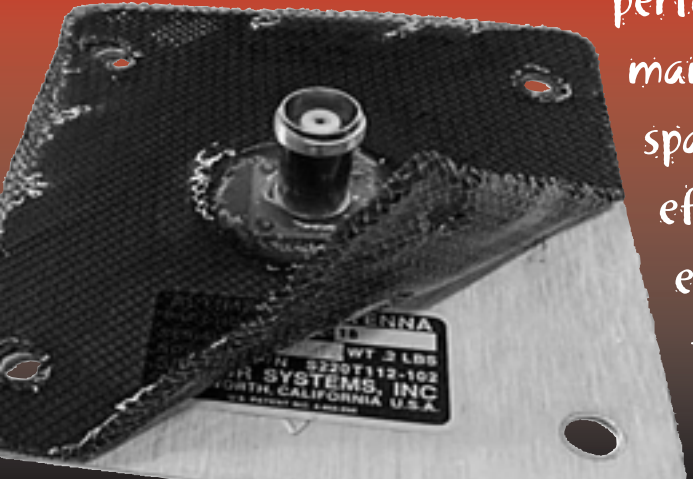

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FIGURE 2. **Program Management**

- Prepare a Corrosion Prevention and Control Plan (CPCP)
  - Define CPC requirements
  - List applicable specifications and standards
  - Address facility/system definition, design, engineering development, production/construction, and sustainment phases
- Corrosion Prevention Advisory Team (CPAT)
  - Established by PM as early possible in a program or before program initiation
  - Membership
    - Chaired by designated representative of procuring agency
    - Includes specialists from procuring agency
    - Includes representatives from the development contractor
  - Duties
    - Guide and document overall CPC planning efforts
    - Interface with the contractor's corrosion team (CCT)
    - Guide design, manufacture, test, and support of the system
- Contractor Corrosion Team (CCT)

Section 5: Suggested Courses of Action

The first four sections of the *Guidebook* form the foundation for the detailed requirements described in Section 5. This section provides acquisition program managers with details and suggested actions concerning the establishment of requirements and the resolution of corrosion-related issues. It explains different aspects of program management, describes corrosion performance specification issues, discusses programmatic issues, and goes into significant detail regarding technical issues. The specific programmatic issues discussed in this section consist of acquisition costs, warranties, and corrosion control priorities. Important technical issues include variables influencing corrosion, potential solutions to corrosion problems, assessment of corrosion impacts, and corrosion-related testing.

Section 5 also discusses the integration of corrosion planning in the acquisition process. Along with a visualization of the time-phasing of corrosion-related planning activities during the acquisition cycle (Figure 4), it prescribes the inclusion of corrosion prevention and control language in acquisition documentation (such as the initial capabilities document (ICD), capability development document (CDD), capability production document (CPD), request for proposal (RFP), and various specifications); and it provides examples of the language that could be used. Since the acquisition process for weapons systems varies from that for facilities and infrastructure, this section describes these processes separately.

Perhaps the most important paragraphs in Section 5 are concerned with the details of corrosion prevention and control planning. Initial requirements should be determined before creating the RFP to ensure that the selected contractor understands and abides by the requirements needed for successful corrosion prevention planning and execution. This planning includes provisions for establishing the CPAT, which will consist of both DoD and contractor members once the contract is awarded. The contractor also needs to have a contractor corrosion team (CCT) that includes a representative or representatives from the following: project design integrated product teams(IPTs); materials and process engineering; operations/manufacturing; quality control; material (or subcontractor) procurement; and contracts. Primary CCT functions include planning and implementing adequate corrosion prevention and control requirements for systems during all phases of the system life cycle. DoD members of the CPAT will interface with CCT members to en-

FIGURE 3. **Precautionary Design Measures**

- Material Selection
  - Avoid materials unsuitable to operational environment if possible
  - Consider material compatibility
  - Isolate dissimilar materials from each other
- Protective Coatings
  - Use to isolate vulnerable materials from the environment
- Design Geometries
  - Avoid crevices when possible
  - Avoid design features that make it difficult for protective coatings to function (sharp corners, for instance)
  - Avoid geometries that unnecessarily trap contaminants/moisture
- Modify the Environment
  - Consider a design that allows for the modification of the environment to which materials will be exposed
  - Dehumidification and sheltering can be effective to modify the environment

sure that corrosion prevention and control requirements and goals are met.

The CPCP is described in detail in Section 5 where it prescribes these organizations, processes, and other requirements. If possible, the initial draft of the CPCP should be complete before Milestone B. The initial purpose of this plan is to set up the CPC program or project management approach, document corrosion-related design needs, and identify materials and corrosion control methods for use in the manufacture of the system. The CPCP should also outline how the contractor will assure vendor and subcontractor compliance with the corrosion plan approved by the program or project manager, including installation of government-furnished equipment. After contract award, the CPCP should be maintained by the contractor and approved by the CPAT and program or project manager. Revision of this document should be accomplished as required to properly record a change or changes to materials and processes being used for corrosion prevention and control. The CPCP should provide the following information:

- The organization, procedures, and responsibilities for a CCT
- Roles and responsibilities of quality assurance, process control, production operations, manufacturing planning, environmental compliance, personnel safety, and other contractor organizations for the CPC effort
- Discussion of corrosion prevention techniques employed in design and of how the design will meet the projected environmental spectrum
- Specifications detailing application of coatings and other corrosion prevention compounds. These process instructions should address personnel training and qualification, material inspection, surface preparation, and coating or compound application procedures
- Any test data developed or to be developed for coatings or other corrosion-related materials and processes.
- Identification of coating/substrate combinations for which no testing is to be performed, with assessment of risk levels in the absence of testing
- Recommended corrosion control-specific maintenance.

Other important documents are also described in Section 5. A process/finish specification (or equivalent) must be developed by the contractor to identify the specific organic and inorganic surface pretreatments and coatings and other corrosion prevention and control materials and processes the contractor intends to apply. Likewise, a system verification plan must be submitted to define the types and levels of corrosion testing and qualification that should be incorporated in the environmental test and verification plan.

The appendices in the *Guidebook* provide added information and supporting documentation for acquisition program managers: the policy letter of the acting under secretary of defense (AT&L); examples of corrosion prevention and control plans; an example of a CPAT charter; and design guidance for facilities and infrastructure.

User-friendly Guidance

In creating the *Guidebook*, the CPC task force attempted to create a document that is comprehensive, flexible, and easy to use. We expect its usefulness will be enhanced by corrosion training to be provided by the Defense Acquisition University and other training organizations. Acquisition PMs will find they have considerable latitude in applying the requirements and approaches described in the *Guidebook*.

The message is clear. Corrosion and its effects cost the DoD dearly in readiness, safety, and resource consumption. The Congress (and the GAO) recognize the problem and potential solutions and have provided significant direction and motivation to resolve the corrosion problem. The DoD has responded positively to the congressional direction by establishing a strong, proactive corrosion prevention and control program under a dedicated DoD directorate.

Analyses show that the highest payoff on corrosion control investment occurs when we prevent corrosion during the design and manufacture of systems and facilities. Now it is up to the acquisition community to embrace the corrosion prevention culture and implement corrosion prevention and control planning as an integral part of system design and acquisition. The *Corrosion Prevention and Control Planning Guidebook* provides us with the primary tool to accomplish this goal.

Editor's note: The authors welcome comments and questions. Dunmire can be contacted at daniel.dunmire@osd.mil and Lee at larry.lee@osd.mil.

FIGURE 4. **The Acquisition Process and CPC Planning**

Approximate timing for CPC planning is indicated by numbers placed in reference to the phases of an acquisition program:

1. Initial corrosion prevention and control plan (CPCP) drafted
2. Government-only corrosion prevention advisory team (CPAT) established
3. Contractor corrosion team(s) (CCT) established
4. Joint government/contractor CPAT established
5. CPCP updated