Department of Defense

Report to Congress on:

The Capability and Capacity of the Corrosion Prevention and Control Workforce

June 2020

Office of the Under Secretary of Defense for Acquisition and Sustainment

The estimated cost of this report or study for the Department of Defense is approximately $38,000 for the 2020 Fiscal Year. This includes $28,000 in expenses and $9,510 in DoD labor.

Generated on 2020Apr30 RefID: D-C56F13C

Executive Summary

The House Armed Services Committee Report 116-120, page 95, accompanying the fiscal year 2020 National Defense Authorization Act requires the Assistant Secretary of Defense for Sustainment to assess the capability and capacity of the Department of Defense (DoD) workforce to perform corrosion prevention and control (CPC), including the application of preventative coatings. The report also requested a determination regarding the need to establish a center focused on training and research for the development and application of paint and coatings.

DoD has extensive CPC capabilities, including basic research, applied research, maintenance, and sustainment; these capabilities are focused on improving system readiness and reducing the $20 billion annual cost of corrosion. The capacity of the DoD sustainment workforce is difficult to quantify for two reasons. First, most personnel working on CPC sustainment tasks do so as a part of other job functions. There are no military career fields or government civilian occupations that are specifically designated for CPC. Second, maintenance records kept by the Military Departments do not typically separate CPC-related maintenance efforts from other forms of maintenance, so the amount of CPC work performed by DoD can only be estimated.

The primary DoD organizations performing CPC research and development are the Army Combat Capability Development Command–Army Research Laboratory, the U.S. Naval Research Laboratory, and the Air Force Research Laboratory. Applied CPC research is performed primarily at or in conjunction with various DoD laboratories and engineering organizations since they understand DoD needs as well as technology transition requirements and processes. Including research capabilities in a painter training center would be inefficient and, therefore, is not recommended.

It is DoD policy to invest in training and professional development activities for civilian employees and military personnel that will enhance the mission performance of functional communities and DoD Components. The DoD CPC workforce currently receives training from both internal and non-government providers.

This report details three conceptual approaches for implementing a painter training center. The high initial investment and reoccurring costs as well as the implementation risks associated with establishing a physical painting training preclude recommending this option. Additional information on the specific training requirements at depot and field maintenance levels, the training demand signal for the number of personnel and frequency of training, the specific training requirements for each Military Department, the optimum training delivery method, and the most efficient way to meet the requirement is needed to evaluate whether enhancing the current approach to training or establishing a training coordination office will offer the greatest benefit at the lowest cost and risk. Reviewing the military services' assessments of the effectiveness of depot hiring, training, and retention programs resulting from the recommendations of Government Accountability Office (GAO) Report 19-51 will contribute to the acquisition of this data.

CONTENTS

Introduction

The House Armed Services Committee Report accompanying the fiscal year (FY) 2020 National Defense Authorization Act (NDAA) required the Assistant Secretary of Defense for Sustainment to assess the capability and capacity of the Department of Defense (DoD) workforce to perform corrosion prevention and control (CPC), including the application of preventative coatings. The report language states:

> *"Therefore, the committee directs the Assistant Secretary of Defense for Sustainment to provide a report not later than November 1, 2019 that assesses the current capability and capacity of its workforce to perform corrosion prevention and control, to include the application of preventative coatings. The report should address any identified training shortfalls, to include whether there is a need to establish a center focused on training and research related to the development and application of paint and coatings."*

To obtain the necessary information and data to meet the report requirement, the Acting Deputy Assistant Secretary of Defense for Materiel Readiness issued a data call to the Military Departments (MilDeps) through their respective Corrosion Control and Prevention Executives (CCPEs) on October 17, 2019 (Appendix A). The data call requested information for both installations and depots on the following:

- Type of CPC training;
- Duration of training;
- Whether the training is performed in the classroom or on-the-job (OJT);
- The occupation designator for military or government civilians; and
- The number of personnel trained annually.

The quantity and complexity of data required from the MilDeps to prepare this report and evaluate the benefits of a center focused on training and applied research related to the development and application of paint and coatings precluded responding by the timeline stated in the FY 2020 NDAA.

Background

The annual cost of corrosion to DoD is approximately $20 billion.[1] Corrosion is also a leading driver of lost system availability. As a result, it is important that personnel involved in CPC are trained to perform their jobs efficiently and effectively. However, the wide and diverse range of assets (e.g., military equipment, weapon systems, and facilities and infrastructure) owned and operated by DoD and the varying corrosion protection schemes used on these assets makes standardized DoD-wide training impractical and ineffective.

Almost every weapon system and type of infrastructure owned by DoD uses protective coatings and paints. The coatings perform an array of functions, including corrosion mitigation; aesthetics; marking; providing wear and mechanical damage resistance; thermal management; and controlling visual, infrared, and radar signatures. To perform these functions, many coating types are used, including epoxies, polyurethanes, vinyls, latexes, acrylics, alkyds, enamels, and polysiloxanes. Coating application methods range from common brushes and rollers to sophisticated multi-component spray equipment and automated systems. The wide range of uses, coating types, and application methods, along with the associated quality assurance processes, makes it imperative that individuals selecting and applying

[1] Eric F. Herzberg, et al, *Estimated Impact of Corrosion on Cost and Availability of DoD Weapon Systems–FY18 Update*, 11393.000.00T1 (Tysons, VA: LMI, March 2018).

coatings are experienced and properly trained. The involvement of military, civilian, and contractor personnel increases the difficulty of offering a unified response to this issue.

The Director, Corrosion Policy and Oversight (D,CPO) responded to a similar request focused on qualification and certification of painters in a report to the congressional defense committees in May 2014.[2] DoD has reviewed the conclusions from that report (excerpted below) and finds that they remain valid.

> *"The Military Departments currently have requirements for certification and qualification of civilian and military personnel, and for inclusion in contracts with respect to contractor personnel, to ensure that protective coatings and paints are applied to DoD weapon systems, military equipment, and infrastructure properly. Across the DoD, industry-accepted certification and qualification programs are utilized when they are applicable. Internal training courses and on-the-job training also are used to meet specific DoD needs. Based on an analysis of the input provided by the Military Departments to the D,CPO the following conclusions are made:*
>
> - *Each of the Military Departments clearly understands the importance of training, qualification, and certification with respect to the application of protective coatings and paints that are applied to DoD weapon systems, military equipment, and infrastructure. This is reflected by the training, qualification, and certification requirements currently in place;*
> - *The Military Departments tailor their training, qualification, and certification standards for application of protective coatings and paints based on the type of paints and coatings used, the specific application, and the job function of individuals involved. Training, qualification, and certification are obtained from multiple providers or developed internally based on the specific application;*
> - *The Military Departments monitor training, qualification, and certification standards for application of protective coatings and paints and revise, improve, and expand them on an as-needed basis.*
>
> *D,CPO finds that the training, qualification, and certification standards for application of paints and coatings being used by the Military Departments are adequate and appropriate to meet the needs of the DoD and the individual Military Departments. Further, the Military Departments need the flexibility to establish and revise their training, qualification, and certification standards to meet their specific needs. Broader application of qualification standards for application of protective coatings and paints that are applied to DoD weapon systems, military equipment, and infrastructure is not in the best interest of DoD at this time."*

Challenges across the DoD sustainment enterprise and the need for improved training are well documented. A multi-agency report issued in 2018 concluded in part that:[3]

> *"The DoD Maintenance Enterprise faces workforce skill gaps across the board. The emergence of new weapon technologies coupled with retirements has caused a significant mismatch between skill requirements and workforce capabilities. Recruitment and retention of critical skill sets are*

[2] *Broader Application of Qualification Standards for Coatings and Paint Applicators*, Reference: F-16D58D1, May 2014.

[3] Office of the Under Secretary of Defense for Acquisition and Sustainment and Office of the Deputy Assistant Secretary of Defense for Industrial Policy, *Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States*, Report to President Donald J. Trump by the Interagency Task Force in Fulfillment of Executive Order 13806, September 2018.

concerns, partially because of sharp competition for labor with the private sector and due to a lack of defense specific skills. Training the new workforce is essential, and improving the organic industrial base's opportunity to recruit already trained artisans would have significant and immediate impacts on productivity and readiness."

The Government Accountability Office (GAO) has conducted several studies on the sustainment workforce at DoD maintenance depots of which two recent ones are pertinent. One study, concluded in December 2018, focused on the effectiveness of the services' initiatives to maintain the critical skills of the workforce at their respective depots.[4] During the study, several depots categorized painters, along with machinists, mechanics, technicians, welders, and engineers, as critical occupations for the depots' repair, sustainment, and maintenance of weapon systems and equipment. The study documented maintenance delays for major weapon systems due to workforce challenges, including:

- Hiring personnel in a timely manner;
- Supplying inexperienced personnel with the training necessary to become proficient in skilled occupations;
- Ensuring that enough skilled workers are trained properly to replace an aging skilled depot workforce; and
- Diminishing science, technology, engineering, and mathematics and trade skills of the domestic workforce.

One of the major findings of the study, with which DoD concurred, supports the need for improved training for the depot workforce and states:

"Since 2008, all four military services have developed strategic plans that identify and address workforce challenges at the depots. However, some of these strategies are either outdated or have not been implemented. The service components told GAO that they plan to revise, update, and utilize them by the end of fiscal year 2019 at the latest. In the interim, the depots maintain their own planning processes and have taken a variety of actions to help maintain critical skills in their workforces, such as offering recruiting and hiring incentives to skilled workers, implementing training and apprenticeship programs and partnering with local vocational schools."

The second study, concluded in January 2020, examined how well the depots share best practices and lessons learned, including those related to painting.[5] The study found that broader implementation of best practices and sharing lessons learned would result in time and cost savings at the depots. Two actions were identified as key:

- Improving awareness of venues for sharing best practices, and
- Supporting materiel lessons learned organizations, such as the Navy's Fleet Readiness Center *Naval Sustainment System* and the Air Force's *Art of the Possible*.

This suggests that greater coordination of painter training in particular and corrosion prevention and control training in general would benefit DoD.

[4] GAO, *DoD Depot Workforce: Services Need to Assess the Effectiveness of Their Initiatives to Maintain Critical Skills*, GAO-19-51, December 2018.
[5] GAO, *Military Depots: DoD Can Benefit from Further Sharing of Best Practices and Lessons Learned*, GAO-20-116, January 2020.

Weapon Systems and Equipment

CPC is implemented through a combination of corrosion-resistant design, materials selection, maintenance philosophy (e.g., dehumidified storage, fresh water washdown, etc.), and application of protective coatings during the life-cycle of systems and equipment. The specific mix of CPC measures implemented may be imposed on original equipment manufacturers (OEMs) by the program office through government or non-government specifications and standards or performance-based requirements, such as reliability and operational availability. When performance-based requirements are used, the OEM selects the mix of CPC measures. DoD policy does not require acquisition personnel and system designers to have CPC-specific training; however, they are able to consult with corrosion engineers in the DoD laboratories during system design and development to ensure CPC is appropriately considered in accordance with DoD Instruction 5000.02, *Operation of the Adaptive Acquisition Framework*.[6]

During sustainment, CPC is performed on DoD weapon systems and equipment at the field and depot levels. Field level maintenance comprises shop-type work as well as on-equipment maintenance activities at maintenance levels other than depot. Intermediate or shop-type work includes limited repair of commodity-oriented assemblies and end items (e.g., electronic "black boxes" and mechanical components); job shop, bay, and production line operations for special requirements; repair of subassemblies, such as circuit boards; software maintenance; and fabrication or manufacture of repair parts, assemblies, and components. On-equipment or organizational maintenance is normally performed by an operating unit on a day-to-day basis to support operations of its assigned weapon systems and equipment. Organizational maintenance encompasses several categories, such as inspections, servicing, handling, preventive maintenance, and corrective maintenance. At the field level, CPC is performed by uniformed military personnel, government civilians, or contractors supporting operational systems. CPC at the field level typically includes corrosion-focused inspections, application of corrosion preventative compounds, localized surface preparation and touch up of coating systems (i.e., spot painting), small component removal and replacement, and other minor repairs not requiring significant disassembly. Training of uniformed military personnel involved in field level CPC activities occurs during military occupation training via both computer-based training (CBT) and OJT. They do not receive extensive CPC training since they are not performing large or complex tasks in this area and CPC is performed in conjunction with other maintenance activities. Government civilians may have more extensive training, such as that provided by *NACE International* (NACE) or *The Society for Protective Coatings* (SSPC). Training for contractors is specified in applicable contracts.

Depot-level maintenance entails materiel maintenance requiring the major repair, overhaul, or complete rebuilding of weapon systems, end items, parts, assemblies, and subassemblies; manufacture of parts; technical assistance; and testing. Each military service manages and operates its own organic depot level maintenance infrastructure. Depot level CPC is primarily performed by government civilians or contractors and includes the most extensive and complex CPC activities, which may require specialized facilities or tooling to accomplish their mission. For instance, complete removal and reapplication of protective coatings is typically done at depots. Depot maintenance may be performed at government-owned organic depots or by commercial entities. Training for organic depot personnel is more extensive than for field level personnel and is accomplished via internal training programs, OJT, and through non-government sources, such as NACE, SSPC, or *Spray Technique Analysis and Research for Defense* (STAR4D). Training for contractor personnel at commercial depots and for contractors working at

[6] DoD Instruction 5000.02, *Operation of the Adaptive Acquisition Framework*, January 23, 2020

organic depots is prescribed in contracts and may require coating applicators to have specialized training or hold certifications.

DoD Facilities and Infrastructure

Coating application during new construction and major repair projects is performed by private sector contractors. Military personnel and government civilians do not typically apply paints and coatings. The manufacturer applies the vast majority of building and infrastructure system paints and coatings in the shop or during onsite assembly. Construction contract personnel perform onsite painting based on requirements delineated in construction criteria. The project *Unified Facilities Criteria* (UFC) and *Unified Facilities Guide Specifications* (UFGS) documents define performance, training, certification, testing, and oversight requirements. Appendix B provides a list of UFCs and UFGSs requiring coatings-related training.

DoD facilities and infrastructure generally use the same paints, coatings, and application methods as the private sector and other federal agencies and state governments. Therefore, contract painters are familiar with industry practices, standards, and application methods as well as DoD criteria. For high-performance and complex coating applications, the UFC and UFGS require a higher level of experience, training, and quality control (QC). In some cases, a manufacturer's representative is required to be onsite to ensure proper coating application. The contractor QC representative is also responsible to government contracting officials for ensuring coatings are applied in accordance with contractual requirements. The *Whole Building Design Guide* hosts D,CPO-sponsored CPC content, including "Corrosion Fundamentals", a one-hour distance learning course supporting facilities design, construction, and sustainment.[7] Three additional paint and coatings courses are in the queue for posting. These courses are available to government and contractor personnel.

For existing facilities, most in-house maintenance and painting functions are commercially outsourced. Military or government civilian maintenance personnel are only engaged in small, less complex touch-up and repainting activities. Facilities-related military painters can be found in Naval Construction Battalions, Marine Corps Facilities Support, the Air Force Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer, and Army Corps of Engineers Combat Engineers. To accommodate assignment rotation needs, some military personnel are in billets supporting facilities maintenance where they may perform paint or coatings work. These military personnel complete painting and coating tasks not as a specific duty but as an adjunct task to their primary project work.

Government employee roles related to DoD facilities include request for proposal (RFP) development and contract administration duties, such as quality assurance, contract oversight, and public works sustainment functions. Design engineers and architects retained by design-build contractors are not government employees and not considered paint and coating specialists. Instead, they rely on UFC and UFGS criteria to identify what levels of expertise, experience, certifications, and types of coatings are required to meet RFP requirements.

[7] https://www.wbdg.org/ffc/dod/cpc-source/training.

Capabilities of the DoD CPC Workforce

DoD has extensive CPC capabilities, including basic research, applied research, maintenance, and sustainment. One of the functions of the D,CPO, under 10 U.S.C. 2228, is to coordinate research across DoD to minimize duplication of efforts and increase efficiency and application of research being performed. Brief summaries of CPC capabilities follow.

Basic Corrosion Prevention and Control Research for the Department of Defense

The primary DoD organizations performing basic research related to CPC are the Army Combat Capability Development Command–Army Research Laboratory (CCDC ARL), the U.S. Naval Research Laboratory (NRL), and the Air Force Research Laboratory (AFRL). Research topics include, but are not limited to, new materials development, surface treatments, coatings, accelerated corrosion test methods, predictive analytical modeling, and cathodic protection. In addition, investments in external CPC and related research at universities or other research institutions is made by the Army Research Office (ARO), the Office of Naval Research (ONR), and the Air Force Office of Scientific Research (AFOSR) through Multi-University Research Initiatives, the Small Business Innovative Research program, the Small Business Technology Transfer program, and other research grants and agreements.

Applied Corrosion Prevention and Control Research for the Department of Defense

Applied CPC research is performed primarily at, or in conjunction with, various DoD laboratories and engineering organizations since they understand DoD needs as well as technology transition requirements and processes. The DoD laboratories partner with academia, the defense industrial base, and coatings manufacturers to meet the applied research needs of the DoD acquisition community and operational forces.

Applied CPC research topic areas are similar to those in research and development (R&D) but with materials, systems, and processes at a higher level of technical maturity. Applied research related to the development of paints and coatings focuses on developing and improving coating performance requirements, novel applications of commercially available coatings, qualification of coatings for DoD applications, and failure analysis. DoD laboratories and engineering organizations also perform research related to coatings when DoD-specific requirements are classified or economically insufficient to drive the commercial market to develop coatings meeting DoD's needs. Table 1 shows a summary of the various DoD laboratories and engineering organizations engaged in applied coating research with more detailed descriptions following.

Table 1. Summary of DoD Laboratories and Engineering Organizations Engaged in Applied Research Related to Corrosion Prevention and Control

	Organization	R&D	Systems Engineering and Design	Acquisition Support	Materials Testing	Standards/ Specifications	Training
Army	CCDC ARL	X		X	X	X	
	CCDC GVSC	X	X	X	X	X	X
	CCDC AvMC	X	X	X	X	X	X
	CERL	X	X		X	X	X
Navy	NRL	X	X	X	X	X	
	NSWC	X	X	X	X	X	X
	NAWCAD	X	X	X	X	X	X
	NUWC		X	X	X	X	
	NAVFAC EXWC	X	X	X	X	X	X
	NIWC	X	X	X	X		X
Air Force	AFRL	X		X	X	X	
	AFCPCO		X	X		X	X
	CAStLE	X	X	X	X	X	X

- **CCDC ARL**—ARL, Aberdeen, MD, is home to the commodity manager for Chemical Agent Resistant Coatings and has an active program researching and testing materials to this end.
- **CCDC Ground Vehicle Systems Center (GVSC)**—In Warren, MI, GVSC is the nation's laboratory for advanced military automotive technology. The Ground System Performance Fluid team operates and maintains the Fuels and Lubricants Labs which includes evaluations and improvements to ensure corrosion protection is provided from vehicle lubricants and coolants. GVSC supplies engineering services to the Tank-Automotive and Armaments Command Integrated Logistics Support Center for ground system corrosion sustainment, including command CPC surveys, and conducts corrosion and coatings research and development.
- **CCDC Aviation and Missile Center (AvMC)**—Headquartered in Redstone Arsenal, AL, AvMC addresses effects of corrosion to Army aviation and missile systems and works to realize goals of the Army Aviation and Missile Command's Corrosion Program Office.
- **Army Construction Engineering Research Laboratory (CERL)**—The Army's CERL in Champaign, IL, hosts the Paint Technology Center (PTC). It is the U.S. Army Corps of Engineers Center of Expertise for paints and coatings. PTC field and lab tests can measure performance of paints and coatings under mild to extreme conditions for many types of infrastructure programs. On average, PTC receives 600 inquiries a year from the public and private sectors regarding paint system selection, testing, training, research, inspection, and management.
- **NRL**—NRL operates the Center for Corrosion Science and Engineering, which has facilities in Washington, DC, and Key West, FL, and is active in researching coatings and other corrosion control technologies, primarily for ships and submarines as well as ground vehicles and facilities located at or near salt water. Related parameters for effective coatings, such as methods to measure and improve surface preparation, are also investigated.
- **Naval Surface Warfare Center (NSWC)**—NSWC comprises eight locations focused on research and engineering supporting the Navy's ships and submarine force. The two primary locations performing applied CPC research are NSWC Carderock and NSWC Philadelphia.

The Corrosion and Coatings Engineering Branch at NSWC Carderock addresses several CPC issues for Navy ships and submarines, and U.S. Marine Corps (USMC) ground vehicles, including studying and developing paint application methods for maintainers of naval craft and USMC ground vehicles. Facilities include mixing and spray booths as well as a variety of support equipment that corresponds to what maintainers have available. The Corrosion and Coatings Branch at NSWC Philadelphia performs applied research and engineering for coatings, cathodic protection, and fasteners, among others.

- **Naval Air Warfare Center–Aircraft Division (NAWCAD)**—The NAWCAD Materials Engineering Division in Patuxent River, MD, is involved in coatings development, testing, and qualification as well as specifying protective coatings for naval aviation weapon systems (Navy and USMC). NAWCAD also develops and maintains aerospace coating specifications and standards including paint application specifications for naval aircraft.
- **Naval Undersea Warfare Center (NUWC)**—In Newport, RI, NUWC researches and delivers solutions to corrosion issues for submarines and underwater structures.
- **Naval Information Warfare Center (NIWC)**—NIWC, located in San Diego, CA, supplies the Navy and DoD with essential capabilities for command and control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR), cyber, and space. Systems development and support includes basic research and prototype development through systems engineering and integration to lifecycle support of fielded systems. NIWC performs CPC research primarily on shipboard and ground-based communications systems.
- **Naval Facilities Engineering and Expeditionary Warfare Center (NAVFAC EXWC)**—The NAVFAC EXWC in Port Hueneme, CA, furnishes specialized facilities engineering, technology solutions, and lifecycle management of expeditionary equipment to the Navy, USMC, federal agencies, and other DoD-supported commands. CPC is addressed in several of its service offerings, including ocean facilities, environmental security, capital improvements, and energy and public works. In addition to its engineering expertise, the EXWC develops engineering concepts, practices, programs, and advanced technologies for improvement of design, construction, and facilities management activities as well as policies, guidance, and criteria to enable delivery of products and services.
- **AFRL**—The AFRL's Coatings Team, at Wright Patterson Air Force Base Dayton, OH, performs research, development, and coatings testing for Air Force aircraft. Its facilities include coating testing and chemical analysis laboratories.
- **Air Force Corrosion Prevention and Control Office (AFCPCO)**—AFCPCO maintains offices and capabilities at Warner Robbins Air Force Base, GA. It offers direct technical and engineering assistance throughout the Air Force, including guidance and training for operations. AFCPCO authored a Corrosion Control Facility Design Guide to assist field level aircraft maintenance personnel with establishing effective regulatory-compliant facilities.
- **Center for Aircraft Structural Life Extension (CAStLE)**—CAStLE, in Colorado Springs, CO, in the U.S. Air Force Academy, supplies sustainment support for DoD weapon systems, including material degradation due to operational use or aging. CAStLE addresses the science and technology needs of DoD clients by delivering data, products, and tools via quick-response basic and applied research projects. CAStLE employs an experienced staff with diverse expertise in science and engineering at multiple sites throughout the U.S. Facilities include material characterization and mechanical testing from coupon-size to full-scale with the capability to test in relevant environments in combination with realistic load spectrums.

Funding for applied CPC research comes from many sources, including acquisition program offices, sustainment program offices, ARO, ONR, and AFOSR as well as MilDep research, development, test, and evaluation (RDT&E) and operation and maintenance (O&M) budgets originating from the Army Materiel Command (AMC), the Chief of Naval Operations (OPNAV), and the Air Force Materiel

Command (AFMC). Additional applied research funding comes from the Office of the Secretary of Defense (OSD) Strategic Environmental Research and Development Program (SERDP), the Environmental Security Technology Certification Program (ESTCP), and D,CPO. Table 2 summarizes funding sources for the major DoD laboratories and engineering organizations involved in applied CPC research.

Table 2. Funding for Applied CPC Research

Organization	Funding Source								
	ARO	ONR	AFOSR	Program Offices	SERDP/ESTCP	CPO	AMC	OPNAV	AFMC
ARL	X			X	X	X	X		
CCDC GVSC	X			X	X	X	X		
CCDC AvMC	X			X	X	X	X		
CERL	X			X		X			
NRL		X		X	X	X		X	
NSWC		X		X	X	X		X	
NAWCAD		X		X	X	X		X	
NUWC		X		X				X	
NAVFAC EXWC		X		X		X			
AFRL			X	X	X	X			X
AFCPCO				X	X	X			X
CAStLE		X	X	X		X			X

Corrosion Prevention and Control Maintenance and Sustainment for the Department of Defense

Maintenance of weapon systems and equipment is performed at the field or depot levels depending on the complexity and scope of work. The work can be classified as preventive (e.g., inspection, application of corrosion preventive compounds, cleaning, and touch-up painting) or corrective (e.g., weld repair, component replacement, major coating removal, and replacement). CPC maintenance at the field level is primarily preventive with the corresponding tools, instruments, and materials. CPC maintenance at the depot level is a mix of preventive and corrective. Depots are large-scale industrial complexes with the capability to perform major CPC maintenance tasks including, but not limited to:

- Detailed non-destructive testing and inspections;
- Structural and electronics repair;
- Full system coatings removal and replacement;
- Electroplating and other surface treatments;
- Application of corrosion preventative compounds and
- Component removal and replacement (including repair of damaged components).

Figures 1 and 2 depict the locations, civilian workforce numbers, and activities of the major DoD organic depots.[8] Each of the depots performs CPC activities in support of the systems they maintain.

[8] *DoD 2018 Maintenance Factbook.*

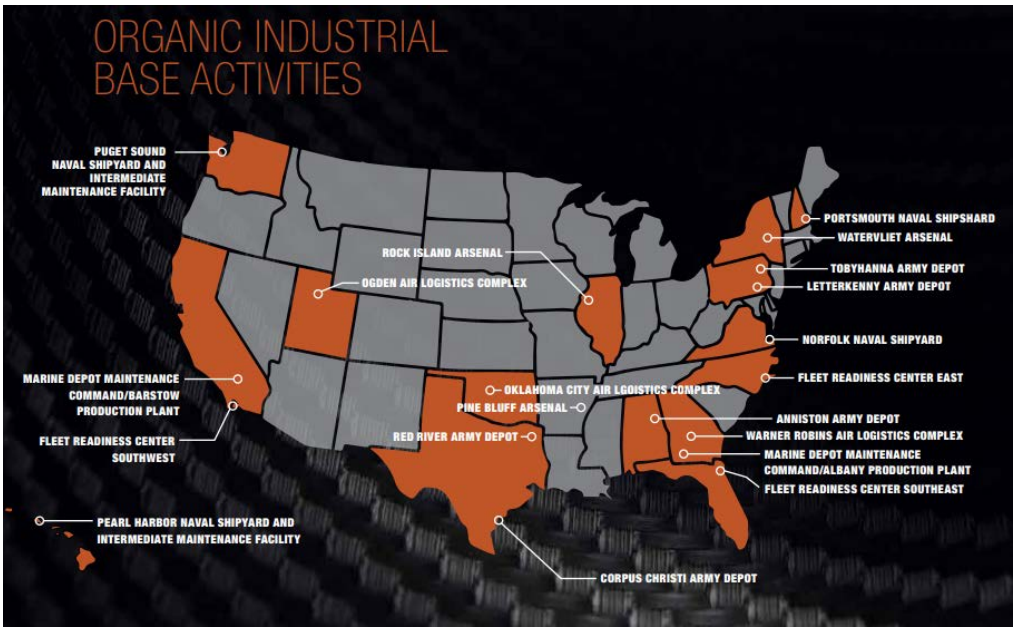


Figure 1. Locations of Major DoD Depots

Corpus Christi Army Depot—
2,945 CIVILIANS
– Helicopters
– Aviation Engines
– Transmissions
– Hydraulic Systems

Anniston Army Depot—
2,643 CIVILIANS
– Combat Vehicles
– Artillery
– Small Arms

Red River Army Depot—
2,395 CIVILIANS
– Tactical Wheeled Vehicles
– Multiple Launch Rocket System Chassis

Ogden Air Logistics Complex—
7,495 CIVILIANS
– Fighter and Attack Aircraft
– Landing Gear
– Software

Air Warner Robins Logistics Complex—
6,483 CIVILIANS
– Cargo Aircraft
– Aviation Electronics
– Software

Letterkenny Army Depot—
1,370 CIVILIANS
– Missile Ground Support Equipment
– Power Generation Equipment

Tobyhanna Army Depot—
2,499 CIVILIANS
– C4ISR Electronics

Oklahoma City Air Logistics Complex—
9,102 CIVILIANS
– Bombers
– Tankers
– Engines
– Software

Marine Depot Maintenance Command—
1,376 CIVILIANS
– Marine Corps Ground Vehicles
– Small Arms

Fleet Readiness Center East—
3,650 CIVILIANS
– Helicopters
– Sea Based and Maritime Aircraft

Fleet Readiness Center Southwest—
2,847 CIVILIANS
– Naval Aviation Fixed Wing Aircraft
– Helicopters
– Engines
– Components

Norfolk Naval Shipyard—
10,535 CIVILIANS
– Nuclear Aircraft Carriers
– Submarines
– Surface Combatants

Pearl Harbor Naval Shipyard and Intermediate Maintenance Activity—
5,081 CIVILIANS
– Nuclear Submarines
– Surface Combatants

Portsmouth Naval Shipyard—
5,476 CIVILIANS
– Nuclear Submarines

Puget Sound Naval Shipyard and Intermediate Maintenance Facility—
13,548 CIVILIANS
– Nuclear Aircraft Carriers
– Submarines
– Surface Combatants

Figure 2. Civilian Workforce Levels and Activities Performed at DoD Depots

Capacity of the DoD Sustainment Workforce Performing CPC Functions

The capacity of the DoD sustainment workforce performing CPC functions is difficult to quantify for two reasons. First, most personnel performing CPC sustainment tasks due so as a part of other job functions. Neither the civilian nor the military workforce have positions dedicated solely to CPC. For the federal civilian workforce, the word "corrosion" appears in only four of the hundreds of civilian occupational series descriptions defined by the Office of Personnel Management in the *Handbook of Occupational Groups and Families*.[9] These occupational series are Nondestructive Testing, Packing, Preservation Servicing, and Equipment Cleaning. However, other occupational groups and series, such as Engineering and Architecture, Quality Assurance, Inspection and Grading, Metal Work, Painting and Paperhanging, General Maintenance and Operations Work, Transportation/Mobile Equipment Maintenance, and Aircraft Overhaul to name only a few, perform CPC tasks as a part of their work functions. Appendix C lists military career fields involved in CPC sustainment tasks across the MilDeps. These career fields are associated with maintenance of weapon systems, equipment, and facilities. While this list is extensive, it does not capture all career fields tangentially involved in CPC sustainment tasks, such as nondestructive testing, contracting, and supply.

Second, maintenance records kept by the MilDeps do not typically separate CPC-related maintenance efforts from other forms of maintenance, so the amount of CPC work performed by DoD can only be estimated. For example, an aircraft inspection may be conducted for a variety of reasons, such as structural integrity and fluid leakage, as well as corrosion. DoD studies have estimated the cost of corrosion from available maintenance data since 2004.[10] The studies parse the corrosion-related portions of maintenance tasks from the non-corrosion-related portions using a corrosion search algorithm.[11] The algorithm searches for predefined corrosion keywords or codes in maintenance records and attributes a percentage of the maintenance action as a corrosion prevention activity. The corrosion percentage varies from 1 to 100 based on the type of work. For example, one of the corrosion keywords is "welding." Welding is primarily used to join two metals together but is sometimes used to repair corrosion damage. Therefore, it has a corrosion cost percentage of 10. Another example is a maintenance database entry for code 170. Code 170 is the Army ground vehicle fault code specifically for corrosion-related maintenance faults; therefore, 100 percent of the maintenance task is attributed to CPC.

Results of corrosion cost studies show that DoD spends on the order of $10 billion annually on CPC-related labor for government and contractor personnel. While this expenditure level does not define the total capacity of the workforce, it offers an idea of the magnitude of the CPC work that DoD performs. The studies also show that government personnel perform 55 percent of the CPC work at the depot level and approximately 85 percent of the CPC work at the field level.

Training for the DoD Corrosion Prevention and Control Workforce

In general, DoD's major commands set training needs and make training available to personnel. Training may occur in a variety of forms, including military occupation training, CBT, classroom training by in-house experts, OJT, and through non-government training providers. Funding for training comes from MilDep O&M appropriations.

DoD civilian personnel training gaps (shortfalls) and requirements are addressed through the Civilian Strategic Human Capital Planning (SHCP) process defined in DoD Instruction 1400.25, Volume

[9] Office of Personnel Management, *Handbook of Occupational Groups and Families*, December 2018.
[10] https://www.dau.edu/cop/cpc/Pages/Documents.aspx.
[11] Eric F. Herzberg, *Determining Corrosion's Effect on the Cost and Availability of DoD Weapon Systems and Equipment: Methodology*, SAL41T1 (Tysons, VA: LMI, November 2015).

250.[12] The SHCP process identifies critical skill gaps and is used to develop strategies to manage the civilian workforce to address those gaps. It uses a competency-based approach to develop employee training and development plans. This policy assigns OSD Functional Community Managers (OFCM) the responsibility to develop and implement strategies to mitigate workforce and competency gaps, including training for their assigned occupational series. The policy also assigns responsibility to DoD Component Functional Community Managers (CFCM) to ensure their respective communities are resourced and staffed with a competent and proficient workforce at the levels required to support the mission. In addition, DoD maintenance policy requires maintenance programs to supply the organic workforce with "…adequate technical and managerial training."[13]

Major Non-Government Corrosion Prevention and Control Training Providers for DoD

DoD is not the industry driver for coating application training. Limited non-government entities develop and provide coating application training such as SSPC-The Society for Protective Coatings, NACE International, the Finishing Trades Institute of the International Union of Painters and Allied Trades, and Spray Technique Analysis and Research for Defense (STAR4D). The three major non-government CPC training providers used by the DoD are summarized below:

- **NACE International**—NACE International, formerly the National Association of Corrosion Engineers, is the primary trade association addressing corrosion concerns throughout the world. The association serves nearly 36,000 members in over 130 countries in industry, academia, and government. Development of the premier industry standards related to CPC is the highlight of the organization. In addition, NACE offers technical training and certification programs, conferences, reports, publications, technical journals, and government relations activities. NACE International is headquartered in Houston, Texas, with multiple offices in North and South America and Asia. To execute these training programs, NACE International established the NACE Institute.
  The NACE Institute provides training and certification in several corrosion related fields, including general coatings, industrial coating application, and coating inspector. Coursework ranges from fundamentals to industry-specific topics disseminated through classroom training, discussion, CBT, and hands-on fieldwork. Training typically leads to workforce certification meeting the NACE No. 13/SSPC-ACS-1 standard.
- **SSPC-The Society for Protective Coatings**—SSPC is the leading source of information on surface preparation, coating selection, coating application, environmental regulations, and health and safety issues that affect the protective coatings industry. SSPC develops industry standards and supplies training and certification to professionals around the world. Certification specialties include surface preparation and coating application, coatings technology, coating concrete, Marine and Navy coatings, lead, health and safety, and coating inspection. SSPC offers classroom training, CBT, and onsite courses, including a mobile training unit to enable on-demand blaster and sprayer training in places where such training isn't normally possible because of a lack of facilities.
- **Spray Technique Analysis and Research for Defense (STAR4D)**—STAR4D Military Painter Training and Certification is an element of the Iowa Waste Reduction Center located at the University of Northern Iowa. The certification program trains painters with the skills to prepare and apply coatings properly. Training includes:
  - customized training to meet facility needs,

[12] DoD Instruction 1400.25, Volume 250, *DoD Civilian Personnel Management System: Civilian Strategic Human Capital Planning (SHCP)*, June 7, 2016.
[13] DoD Directive 4151.18, *Maintenance of Military Materiel*, August 31, 2018.

- comprehensive hands-on and classroom training, and
- virtual reality–based training.

STAR4D focuses on comprehensive knowledge of the entire painting process and improving spray techniques. Benefits include material savings, fewer defects, less rework, corrosion protection, reduced volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions, and a high-quality finished product. STAR4D recently added painting of military assets to its portfolio to help DoD and its contractors address corrosion problems.

Various organizations in the MilDeps send personnel to these non-government training providers for training each year. The total number of personnel trained annually is not tracked at the MilDep level since each lower level organization manages its own training budget and approval processes. However, data made available by SSPC shows that it trained 485 military personnel and government civilians from 2017–2019. The D,CPO has augmented that by coordinating and providing additional training opportunities through competitively bid contracts with NACE and SSPC for nearly 15 years. This training has been well received, and, from 2017–2019, has trained over 1,700 military personnel and government civilians as shown in Figure 3.

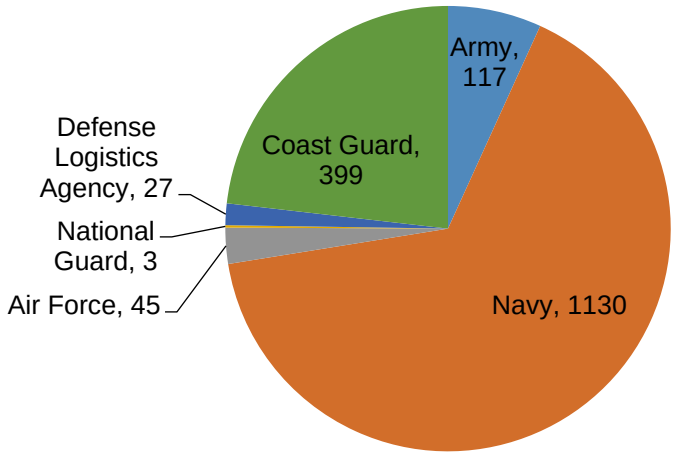


Figure 3. Military Personnel and Government Personnel Trained by NACE and SSPC through CPO Contracts from 2017–2019

Training Shortfalls

The data call issued to the MilDep CCPEs in preparation for this report (Appendix A) specifically requested identification of any training shortfalls. Responses are summarized below.

Army—The Army responses to the data call included a training shortfall and a training recommendation. Responses included the following:

- Army Forces Command—noted personnel are not getting corrosion training every two years as required in Army Regulation 750-59
- CCDC AvMC—cited the need for a centralized approach to painter certification across the services
- Other Army Commands — either reported no shortfalls or did not respond

Navy—The Navy did not identify any shortfalls in its response to the data call. They stated, "*The DON [Department of Navy] empowers Systems Commands and home activities the ability to address training needs as required. These activities analyze current fleet/force needs with workforce requirements yearly and provide training, certification, and education as needed to close gaps.*"

Air Force—The Air Force identified two training shortfalls. The first was lack of specific training for *Wing Corrosion Managers* (WCMs) and made the following recommendations to mitigate the shortfall:

- Create a WCM CBT course;[14]
- Add an extra day of training to the Air Force Corrosion Technical Interchange Meeting (TIM) and Corrosion Prevention Advisory Board meetings with video teleconferencing or webinars for WCMs unable to attend;
- Add specific Corrosion Manager tasks to AF Specialty Code 2A7X3/2A7X5 training records; and
- Update Major Command publications to make the WCM position descriptions more comprehensive (e.g., WCM shall complete CBT, attend AF Corrosion TIM, etc.) until Air Force Instructions can be updated.[15]

The second shortfall identified by the Air Force was that civilian depot artisans are primarily trained via OJT. The Air Force noted "*Organic, base-supplied training is outdated, taught at too high of a level and not hands on. Due to the specificity of paints and equipment, the training needs to be equally specific and hands on. This type of training is best suited for the production bay environment, which is difficult to do without hindering production*."

National Military Painter Training Center Assessment

Assessment Process and Considerations

DoD assessed the need for a center focused on training and research related to the development and application of paint and coatings, considering the following factors:

- Applied research capabilities—
  - Are the existing DoD CPC applied research capabilities sufficient?
  - Do existing capabilities support the requirements of the MilDeps?
- Training requirements—Can the approach address all DoD training requirements?
- Number of personnel requiring training—
  - How many personnel need training?
  - With what frequency is the training required (e.g. new hires, refresher training, recertifications)?
- Training shortfalls—Are there any training shortfalls? If so, what are they?

[14] Following submission of the response to the data call, the Office of the Air Force CCPE informed CPO that a standardized computer based training (CBT) course for the WCM position is in its infancy but will be produced by 367 TRSS (Training Support Squadron) and available on the Griffin Training Website.

[15] Following submission of the response to the data call, the Office of the Air Force CCPE informed CPO that The Corrosion Manager Position was added to AFI 21-101, Aircraft and Equipment Maintenance Management, in FY20.

- Capital investment—How much capital investment is needed to establish a painter training center?
- Sustainment costs—
  - Are there additional recurring costs? If so, how will they be funded?
  - How will training be paid for?
- Training delivery methods—What type of training delivery methods (e.g., classroom, hands-on, CBT, etc.) are the most efficient and effective?
- Training sources—Does the approach leverage existing internal DoD training sources as well as those of non-government training providers?
- Process required to establish a painter training center—What actions need to occur to establish a painter training center?
- What risks are associated with the establishment of a painter training center?

Based on these considerations, three possible approaches to establishing a painter training center have been identified. Approach 1 seeks to eliminate or reduce the limitations of DoD's existing approach to painter training. Approach 2 would establish a single office in OSD or one office in each of the MilDeps to coordinate painter training including performing contracting, identifying new curricula to meet training shortfalls or DoD-specific training needs, and facilitating training scheduling. Approach 3 would establish a center housing equipment and instructors for training and certification of military members and civilian employees. The approaches are summarized in Table 3 and described in more detail in subsequent sections of this report.

Table 3. Comparison of Approaches to Establishment of a Painter Training Center

Assessment Consideration	Approach		
	1. Enhance the Current Approach to Training	2. Establish an Office to Coordinate a Painter Training Center	3. Establish a Centralized Painter Training Center
Applied Research Capability	DoD has a robust applied research capability for CPC. No additional capability is required.	DoD has a robust applied research capability for CPC. No additional capability is required.	DoD has a robust applied research capability for CPC. No additional capability is required.
Training Requirements Definition	Approach includes defining training requirements and curriculum development.	Approach includes defining training requirements and curriculum development.	Approach includes defining training requirements and curriculum development.
Number of People Requiring Training and Training Frequency	Requires additional information from the MilDeps.	Requires additional information from the MilDeps.	Requires additional information from the MilDeps.
Training Shortfalls	Approach includes addressing shortfalls.	Approach includes addressing shortfalls.	Approach includes addressing shortfalls.
Capital Investment	None required.	None required.	Estimated at $20–30 million.
Sustainment Costs	Training funded through existing MilDep training budgets.	Recurring costs associated with maintaining training coordination office(s). Training funded through existing MilDep training budgets.	Recurring costs associated with maintaining training coordination office(s). Training funded through existing MilDep training budgets. Additional costs associated with personnel travel to the training facility.
Training Delivery Methods	Classroom, hands-on, CBT, and OJT. Training delivered by internal and non-government providers.	Classroom, hands-on, CBT, and OJT. Training delivered by internal and non-government providers.	Mostly classroom at the central facility. Can include hands-on and CBT. Training delivered by non-government providers.
Training Sources	Leverages existing training from internal and non-government providers.	Leverages existing training from internal and non-government providers.	Primarily uses one or more non-government providers.
Process Required to Establish a Center	Coordinate sustainment organization training requirements with internal and non-government training providers.	Coordination Office(s) perform contracting and training scheduling functions.	Contract awarded to one or more non-government training providers.
Risks of Establishing Center	Low—Implemented within the current 10 U.S.C 2228 statutory authorities and responsibilities of the D,CPO and the MilDep CCPEs.	Medium—Possible disruption of DoD sustainment organization processes since it involves changing the current way that training is planned, funded, and conducted.	High—Disruption of DoD sustainment organization processes since it involves changing the current way that training is planned, funded, and conducted.

Current Approach to Military Painter Training

The MilDeps currently use multiple training methods and sources to maintain the required workforce skill levels. Training methods include OJT, CBT, classroom training developed by the command or organization, and training provided by non-government sources. The benefits of this approach include the following:

- Training methods and sources are selected to meet the specific workforce skill requirement of the sustainment organization;
- Training schedules are based on the production schedule to minimize impact;
- Training schedules optimized to address demand such as new hire frequency, refresher training periodicity, and recertification requirements;
- Leverages the training curricula and resources of internal and non-government training providers to DoD advantage efficiently and effectively; and
- Minimal overhead and reoccurring costs.

The limitations of this approach include the following:

- Need for multiple contracts to support sustainment organizations' requirements;
- Training obtained from non-government providers is not necessarily focused on DoD-specific requirements; and
- Limited coordination among multiple DoD sustainment facilities. Greater coordination could result in reduced costs due to economies of scale and more uniform training for personnel working on similar assets.

Approach 1. Enhance the Current Approach to Training

Approach 1 seeks to eliminate or reduce the limitations of DoD's existing approach to painter training. At a minimum, specific actions include the following:

- Work with each non-government training provider to list their services through a single government source, such as a General Services Administration (GSA) contract, to enable DoD sustainment organizations to fund training through a government-qualified source. For example, SSPC recently added its corrosion prevention and training courses to the GSA schedule.
- Work with DoD sustainment organizations and non-government training providers to identify any DoD-specific training requirements not currently addressed by industry-developed training. Create curricula to address these needs.
- For onsite training, establish improved coordination between the training provider and DoD sustainment organizations to leverage scheduled training in a geographic area for common equipment and painting methods.

This approach is low cost and low risk. The approach can be implemented within the current 10 U.S.C. 2228 statutory authorities and responsibilities of the D,CPO and the MilDep CCPEs with no additional facilities, staff, or equipment. It is low risk to implement and sustain, requiring no capital investment and using existing training funding and mechanisms. In addition, the contracting burden for obtaining training from non-government sources is relieved and sustainment organizations can schedule training to minimize disruption to the production schedule.

Approach 2. Establish an Office to Coordinate a Painter Training Center

Under this approach, a single office in OSD or one office in each of the MilDeps would coordinate painter training, including performing contracting, identifying new curricula to meet training shortfalls or DoD-specific training needs, and facilitating training scheduling. An advantage of this option is that the coordinating office(s) could develop and maintain comprehensive metrics that could be used to develop budgets and inform future decisions related to training. A disadvantage of this option is that it reduces the flexibility and agility of DoD sustainment organizations with respect to addressing their specific training needs and requirements.

Costs for this approach depend on the structure of the office(s) and the exact duties assigned. While no capital investment is required, additional staffing for the coordinating office(s) may be required and other reoccurring costs would be incurred for contracting, coordination, and metrics gathering and analysis. The option has a medium risk to implement due to sustainment costs and disruption of DoD sustainment organization processes since it changes the current way that training is planned, funded, and conducted.

Approach 3. Establish a Centralized Painter Training Center

This approach establishes a center housing equipment and instructors for training and certification of military members and civilian employees. Under this concept, most of the training would occur in a centralized location but instructors could be sent to DoD sustainment organizations to hold classroom training or OJT. Training delivery via CBT is also possible under this approach. Like Approach 2, an advantage of this approach is that the coordinating office(s) could develop and maintain comprehensive metrics that could be used to develop budgets and inform future decisions related to training. A disadvantage of this approach is that it significantly reduces the flexibility and agility of DoD sustainment organizations with respect to addressing their specific training needs and requirements. The following actions would be needed prior to establishing such a center:

- Identify all painter training requirements for all DoD equipment and systems, i.e., naval systems, aviation systems, ground systems, space systems, and facilities.
- Evaluate the practicality of a single facility to offer the range of training to meet all DoD requirements.
- Assess whether an existing facility meets the requirements or if new facility construction is required.
- Decide whether single or multiple contracts are required to supply all training types.

Initial capital investment in facilities, equipment, and staff are anticipated to be high compared to the other approaches provided herein. Using the cost to establish the National Center for Education and Research on Corrosion and Materials Performance at the University of Akron for reference, DoD estimates initial investment for this option at $20–30 million. This option has a high risk for implementation due to the high initial and reoccurring costs (facilities and equipment maintenance, staff salaries, and student and staff travel expenses) and potential disruption to DoD sustainment organization processes since it significantly changes the current way that training is planned, funded, and conducted. Loss of work time for students traveling to the center is also anticipated. A centralized approach also risks reducing competition among limited sources and excluding industry best practices and technologies as they are developed.

Conclusions and Recommendations

Using the information on painter training and applied corrosion prevention and control (CPC) research within DoD, as well as the analysis described in this report, DoD concludes the following:

- DoD has extensive CPC capabilities, including basic research, applied research, maintenance, and sustainment, focused on improving system readiness and reducing the $20 billion annual cost of corrosion. The capacity of the DoD workforce engaged in CPC is difficult to measure since many personnel perform CPC activities at all levels of maintenance. However, DoD estimates that government (military and civilian) personnel and contractors expend on the order of $10 billion in labor costs on CPC tasks in sustainment of assets.
- It is DoD policy (DoD Instruction 1400.25, Volume 250, DoD Instruction 4151.18) to invest in training and professional development activities for civilian employees and military personnel to enhance the mission performance of functional communities and DoD Components. The DoD CPC workforce currently receives training from internal and non-government providers.
- Improved CPC training would benefit DoD. However, other factors related to maintenance delays, such as personnel retention, the aging workforce, and diminishing sources of supply, would not be affected by improving painter training.
- This report supplies three conceptual approaches for implementing a painter training center.
  - Establishing a physical painter training center (Approach 3) would incur high establishment and sustainment costs as well as high implementation risks.
  - Additional information regarding the specific training requirements at depot and field maintenance levels, the training demand signal in terms of the number of personnel and frequency of training, the specific training requirements for each Military Department, the optimum training delivery method, and the most efficient way to meet the requirement is needed to decide whether enhancing the current approach to training (Approach 1) or establishing a training coordination offices (Approach 2) would offer the greatest benefit at the lowest cost and risk.
- Any changes to the approach to military painter training needs to be implemented in accordance with OSD policy, coordinated with the MilDeps, and integrated with existing training processes.

The following recommendations are made:

- The DoD recommends incorporating the military services' assessments resulting from the recommendations of GAO Report 19-51 on the effectiveness of depot hiring, training, and retention programs into the painter training approaches, as applicable.
- DoD recommends utilizing the DoD Civilian Strategic Human Capital Planning process defined in DoDI 1400.25 vol250 to evaluate and determine the most effective painter training approach to meet the painter workforce training gaps.

However,

- DoD does not recommend including research capabilities in a painter training center.
- DoD does not recommend establishing a centralized painter training center (Approach 3) due to the high establishment and sustainment costs as well as risks associated with implementing such a center.

Abbreviations

AFCPCO	Air Force Corrosion Prevention and Control Office
AFRL	Air Force Research Laboratory
AFOSR	Air Force Office of Scientific Research
AFMC	Air Force Materiel Command
AMC	Army Materiel Command
ARL	Army Research Laboratory
ARO	Army Research Office
AvMC	Army Aviation and Missile Center
CAStLE	Center for Aircraft Structural Life Extension
C4ISR	Command and Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CBT	Computer-Based Training
CCDC	Army Combat Capabilities Development Command
CCPE	Military Department Corrosion Control and Prevention Executive
CFCM	Component Functional Community Manager
CERL	Construction Engineering Research Laboratory (U.S. Army)
CPC	Corrosion Prevention and Control
CPO	Corrosion Policy and Oversight Office
D,CPO	Director, Corrosion Policy and Oversight Office
DoD	Department of Defense
DON	Department of the Navy
ESC	Environmental Severity Classification
ESTCP	Environmental Security Technology Certification Program
FY	Fiscal Year
GAO	Government Accountability Office
GSA	General Services Administration
GVSC	Ground Vehicle Systems Center
HAP	Hazardous Air Pollutant
MilDep	Military Department
NAVFAC EXWC	Naval Facilities Engineering and Expeditionary Warfare Center
NAWCAD	Naval Air Warfare Center–Aircraft Division
NDAA	National Defense Authorization Act
NIWC	Naval Information Warfare Center
NMPTC	National Military Painter Training Center

NRL	Naval Research Laboratory
NSWC	Naval Surface Warfare Center
NUWC	Naval Undersea Warfare Center
OEM	Original Equipment Manufacturer
OFCM	OSD Functional Community Manager
OJT	On-the-Job Training
ONR	Office of Naval Research
O&M	Operations and Maintenance
OPNAV	Chief of Naval Operations
OSD	Office of the Secretary of Defense
PTC	Construction Engineering Research Laboratory Paint Technology Center
QC	Quality Control
R&D	Research and Development
RFP	Request for Proposal
ROI	Return on Investment
SHCP	Strategic Human Capital Planning Process
SERDP	Strategic Environmental Research and Development Program
SSPC	Society for Protective Coatings
STAR4D	Spray Technique Analysis and Research for Defense
TIM	Technical Interchange Meeting
UFC	Unified Facilities Criteria
UFGS	Unified Facilities Guide Specification
USAF	U.S. Air Force
USMC	U.S. Marine Corps
VOC	Volatile Organic Compound
WCM	Wing Corrosion Manager

Appendix A. Data Call Issued to the Military Departments

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
3500 DEFENSE PENTAGON
WASHINGTON, DC 20301-3500

SUSTAINMENT

OCT 17 2019

MEMORANDUM FOR DEPARTMENT OF THE ARMY CORROSION CONTROL AND PREVENTION EXECUTIVE
DEPARTMENT OF THE NAVY CORROSION CONTROL AND PREVENTION EXECUTIVE
DEPARTMENT OF THE AIR FORCE CORROSION CONTROL AND PREVENTION EXECUTIVE

Subject: Assessment of Department of Defense (DoD) Corrosion Prevention and Control (CPC) Workforce Capability and Research and Development Investments

This memorandum requests information from the Military Departments to support a report of the House Armed Services Committee from the attached National Defense Authorization Act for Fiscal Year 2020 (NDAA FY2020) Report 116-120 as shown in Attachment 1. This information will also support the Senate Armed Service Committee requirement for a briefing to the congressional defense committees as required on Attachment 2 NDAA FY2020 Report 116-48. Both the report and briefing are due November 1, 2019. An extension has been requested to allow sufficient time to gather data.

The report to the House Armed Services Committee requires an assessment of current DoD capability and capacity of its military and civilian workforce to perform CPC, to include the application of preventative coatings, and identify any training shortfalls. The report also requires the Department to determine a position on the need to establish a National Center for Military Painter Training and Applied Research.

The briefing to the Senate Armed Service Committee requires a list of:

- Facilities, laboratories, and universities focused on corrosion prevention to include description of work for each location;
- Current funding sources for each location;
- Return on investment if applicable for each location;
- Determination by the Department if a National Center for Military Painter Training and Applied Research could benefit the Department and if so the cost, steps, and process required to create and establish such a center.

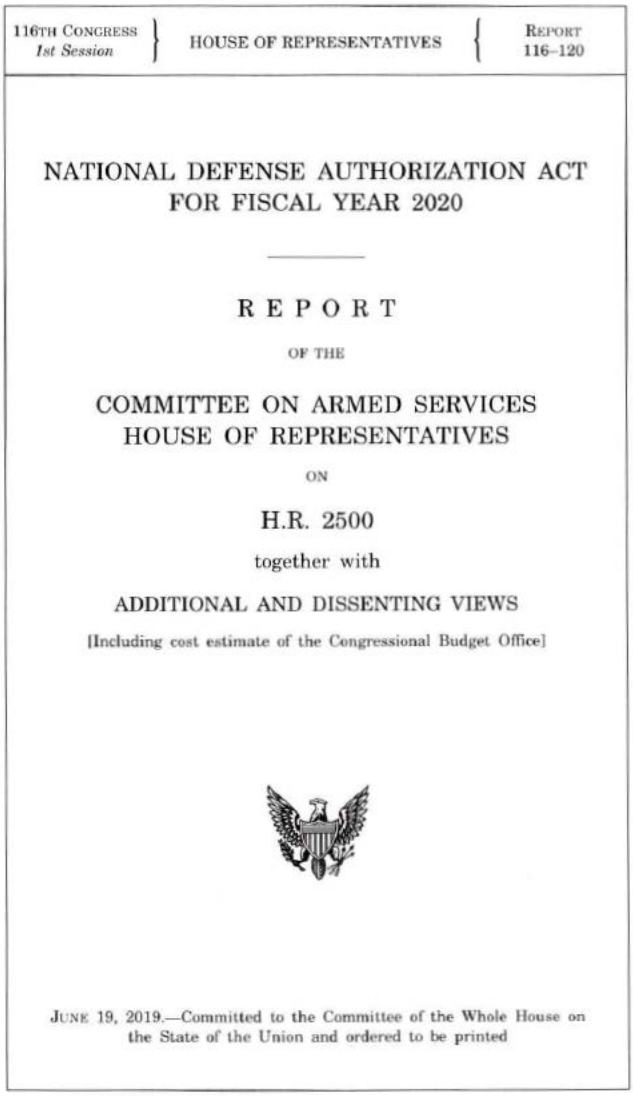
The Corrosion Policy and Oversight office is requesting support in obtaining the data as shown in Data Tables (Attachment 3). The input is requested by December 6, 2019 to support the report and briefing.

My point of contact is Mr. Robert A. Herron at robert.a.herron.civ@mail.mil or (703) 697-3919.

Curtis R. Hafer, Colonel, USAF
Acting, Deputy Assistant Secretary of Defense
Materiel Readiness

Attachments:
As stated

Attachment (1)



116TH CONGRESS *1st Session* | HOUSE OF REPRESENTATIVES | REPORT 116–120

NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2020

REPORT

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ON

H.R. 2500

together with

ADDITIONAL AND DISSENTING VIEWS

[Including cost estimate of the Congressional Budget Office]

JUNE 19, 2019.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

Corrosion Control and Prevention

The committee recognizes that corrosion negatively affects military equipment and infrastructure, can lead to the reduced availability or capability of weapon systems, and creates safety hazards for military personnel. According to a study conducted for the Department of Defense, the estimated annual cost of the impact of corrosion is $20.6 billion on the Department of Defense. To help prevent corrosion, the military services have invested in the research and development of innovative coatings that can be applied to weapon systems to increase the durability and operational capability of the weapon system while reducing the cost and amount of time required to maintain these weapon systems. In addition to developing and utilizing innovative coatings, the committee believes the military services should ensure that sufficient training on the application of such coatings is available for military and civilian personnel involved in weapon systems sustainment at the installation and depot level. Therefore, the committee directs the Assistant Secretary of Defense for Sustainment to provide a report to the House Committee on Armed Services not later than November 1, 2019 that assesses the current capability and capacity of its workforce to perform corrosion prevention and control, to include the application of preventative coatings. The report should address any identified training shortfalls, to include whether there is a need to establish a center focused on training and research related to the development and application of paint and coatings.

Optimized Fleet Response Plan

The committee notes that the Navy began a multi-year process of implementing the Optimized Fleet Response Plan (OFRP) in November 2014. The stated goal of OFRP was to maximize the availability of Navy ships for operations while ensuring adequate time for maintenance and training while providing an appropriate and predictable operational tempo for Navy personnel. As directed in the committee report accompanying the National Defense Authorization Act for Fiscal Year 2016 (H. Rept. 114–102), the Comptroller General reviewed matters related to OFRP and, while noting it was too early to assess the overall effectiveness, did note that there were signs of challenges with implementation and execution of OFRP. Since the Comptroller General's report in 2016, the committee notes the Navy has experienced delays in the schedule of ship maintenance availabilities, implemented a number of changes following the release of the Navy's Comprehensive Review of Surface Force Incidents and the Navy's Strategic Readiness Review, and is responding to the Dynamic Force Employment requirements of the 2018 National Defense Strategy. Therefore, the committee directs the Comptroller General of the United States to conduct an updated assessment of the Navy's Optimized Fleet Response Plan (OFRP), to include:

(1) an analysis of the extent to which the Navy has been successful in achieving the goals it established under OFRP in terms of maintenance completion and timeliness, training certifications, personnel fit/fill rates, operational availability, and others;

Attachment (2)

Calendar No. 114

116TH CONGRESS *1st Session*	SENATE	REPORT 116–48

NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2020

REPORT

[TO ACCOMPANY S. 1790]

ON

TO AUTHORIZE APPROPRIATIONS FOR FISCAL YEAR 2020 FOR MILITARY ACTIVITIES OF THE DEPARTMENT OF DEFENSE, FOR MILITARY CONSTRUCTION, AND FOR DEFENSE ACTIVITIES OF THE DEPARTMENT OF ENERGY, TO PRESCRIBE MILITARY PERSONNEL STRENGTHS FOR SUCH FISCAL YEAR, AND FOR OTHER PURPOSES

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

JUNE 11, 2019.—Ordered to be printed

Corrosion prevention briefing

The committee is aware of the significant problem caused by corrosion, which can lead to costly repairs and decreased readiness of military forces. The committee notes that according to a 2016 Department of Defense report, corrosion costs in 2016 alone were $20.6 billion, and the Government Accountability Office has produced numerous report citing the direct correlation between corrosion and readiness. The committee believes that, to most effectively meet mission-critical demands for military painter training at bases across the United States, which directly impacts corrosion, the Department could establish a competitive bidding process for a National Center for Military Painter Training and Applied Research. The committee believes that such a program could enable the Department to maximize readiness, safety, and cost savings through corrosion prevention and control by meeting the demand for trained military painters, growing partnerships in the military paint industry, and expanding the role of technology in painter training and certification.

Accordingly, the committee directs the Department to provide a briefing, no later than November 1, 2019, to the congressional defense committees on the following: (1) A list of facilities, labs, and universities focused on corrosion prevention, to include a description of work for each location; (2) Current funding sources for each

location; (3) Return on investment, if applicable, for each location; and (4) A determination by the Department if a National Center for Military Painter Training and Applied Research could benefit the Department, and, if so, the cost, steps, and process required to create and establish such a center.

Attachment (3) Data Tables

The following information will be used for the report and briefing:

Annual CPC Training at Installation and Depot Locations

1. Fill out the following tables with the relevant information on the specific training offered and/or taken for each Installation and Depot location.
2. For each Installation and Depot location provide a summary of any training shortfalls and/or needs that are not met by the current training capabilities.
3. Provide an approximation, for each location, of the percentage of personnel that is organic personnel and the percentage that is contract support.
4. For each location, provide a list of any management system certifications such as ISO 9001.

Military personnel:

Installation/ Depot	Type of training (list all that apply)*	Duration of Training	Is training performed in a classroom, hands-on, or on-the-job?	Occupation designation and number that are trained annually

**Type of training may include the following: coating selection, coating application, surface preparation, application of corrosion preventative compounds, and/or coating inspection/quality assurance.*

Government Civilian personnel:

Installation/ Depot	Type of training (list all that apply)*	Duration of Training	Is training performed in a classroom, hands-on, or on-the-job?	Occupation designation and number that are trained annually

Applied Research and Development for CPC

Facility Type (Depot/Field/Lab/ Univ)	Capability*	Capacity (FTE)	Description of work being done*	Funding Source	Estimated ROI (if applicable)

**Capability refers to all CPC methods and processes a location has while the description of work being done refers to a description of the actual CPC efforts being completed at the location.*

Appendix B. Unified Facilities Criteria (UFC) and Unified Facilities Guide Specifications (UFGS) Requiring Coatings-Related Training

Document	Subcategory	Contractor	Individual
UFC 1-200-01 DoD Building Code	All	Requires usage and clear guidance for all Environmental Severity Classification (ESC) Zones in Chapter 4 and Tables A-1 and A-2, which translates to paints and coatings in all UFC and UFGS	N/A
UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard	All	Requires ESC factors to specify "materials, coatings, and other design elements" in the editing of UFGS documents; this translates to the level of qualifications and training for paints and coatings specialists	See "Contractor" cell on this row
UFC 03-190-06 Protective Coatings and Paints	All	N/A	N/A
UFGS 09 90 00 Paints and Coatings	Architectural	None	Specific key personnel experience (three projects in the past 2 years)
	Significant Industrial Component	SSPC QP-1	As required by SSPC QP-1
UFGS 09 96 00 High-Performance Coatings	All	None	None
UFGS 09 67 23.15 Fuel Resistive Resinous Flooring, 3-Coat System	All	None	Three jobs with the same system, totaling over 200,000 sq. ft. in the past 2 years
UFGS 09 67 23.16 Fuel Resistive Resinous Flooring, 5-Coat System	All	None	Three jobs with the same system, totaling over 200,000 sq. ft. in the past 2 years
UFGS 09 96 59 High-Build Glaze Coatings	All	None	None
UFGS 09 97 02 Painting: Hydraulic Structures	Small Jobs (less than 100,000 sq. ft.)	None	None

Document	Subcategory	Contractor	Individual
	Large Jobs (greater than 100,000 sq. ft.)	SSPC QP-1, SSPC QP-2, or SSPC QP-3 as appropriate	Test records for each qualified coating applicator per ASTM D4228
UFGS 09 97 13.00 40 Steel Coatings	All	None	None
UFGS 09 97 13.15 Low VOC Polysulfide Interior Coating of Welded Steel Petroleum Fuel Tanks	All	SSPC QP-1 contractor (SSPC QP-2, if appropriate) SSPC QP-5 coating inspection company Testing laboratory qualifications	Requires certified industrial hygienist, protective coating specialist, QC specialist, and coating application specialists
UFGS 09 97 13.16 Interior Coating of Welded Steel Water Tanks	All	SSPC QP-1 contractor (SSPC QP-2, if appropriate) SSPC QP-5 coating inspection company Testing laboratory qualifications	Requires certified industrial hygienist, protective coating specialist, QC specialist, and coating application specialists
UFGS 09 97 13.17 Three Coat Epoxy Interior Coating of Welded Steel Petroleum Fuel Tanks	All	SSPC QP-1 contractor (SSPC QP-2, if appropriate) SSPC QP-5 coating inspection company Testing laboratory qualifications	Requires certified industrial hygienist, protective coating specialist, QC specialist, and coating application specialists
UFGS 09 97 13.25 Maintenance, Repair, and Coating of Tall Antenna Towers	All	SSPC QP-1 contractor (SSPC QP-2, if appropriate) continental U.S., AK, HI, and PR, optional elsewhere “Consider” SSPC QP-3, where shop coating is feasible	Requires certified industrial hygienist
UFGS 09 97 13.26 Coating of Steel Waterfront Structures, Zero VOC, (SZC) Splash Zone Coating	All	SSPC QP-1 contractor (SSPC QP-2, if appropriate) SSPC QP-3 for shop work SSPC QP-5 coating inspection company Testing laboratory qualifications	Requires certified industrial hygienist, protective coating specialist, QC specialist, and coating application specialists
UFGS 09 97 13.27 Exterior Coating of Steel Structures	All	SSPC QP-1 contractor (SSPC QP-2, if appropriate) SSPC QP-5 coating inspection company Testing laboratory qualifications	Requires certified industrial hygienist, protective coating specialist, QC specialist, and coating application specialists

Appendix C. Military Career Fields for Sustainment Personnel Performing Corrosion Prevention and Control Functions

Army Sustainment—Officers

Air

MOS*	Title
151A	Aviation Maintenance Technician
15D	Aviation Logistics

*Military Occupational Specialty

Ground

MOS	Title
91A	Maintenance & Munitions Materiel
91B*	Maintenance Management
915A	Unit Maintenance Warrant Officer
915E	Senior Automotive Maintenance Officer
919A	Engineer Equipment Repair Technician
91D*	Munitions Materiel Management
913A	Armament Repair Technician

** Indicates some legacy MOSs to be converted to 91A.*

Army Sustainment—Enlisted

Air

MOS	Title
15Y	A-64D Armament Electrical Avionics System Repairer
15G	Aircraft Structural Repairer
15D	Aircraft Powertrain Repairer
15Z	Aircraft Maintenance Senior Sergeant
15K	Aircraft Components Repair Supervisor

Ground

MOS	Title
63B	Wheeled Vehicle Mechanic
63X	Vehicle Maintenance Supervisor
63Z	Mechanical Maintenance Supervisor
44B	Metal Worker
63W*	Wheel Vehicle Repairer
63S*	Heavy-Wheel Vehicle Mechanic

***** *Indicates some legacy MOSs to be converted to 63B.*

Navy Sustainment—Officers

Air

Category	Designator	Title
RL	151x	Aerospace Engineering Duty Officer
LDO	633x	Aviation Maintenance Officer
LDO	638x	Avionics
LDO	636x	Aviation Ordnance
CWO	734x	Aviation Maintenance Technician

Sea

Category	Designator	Title
RL	144x	Engineering Duty Officer
LDO	613x	Engineering/Repair, Surface
LDO	618x	Electronics, Surface
LDO	616x	Ordnance, Surface
CWO	713x	Engineering Technician, Surface

Navy Sustainment—Enlisted

Air

Rating	NEC*	Title
AM		Aviation Structural Mechanic
AM	7232	Advanced Composite Structural Repair IMA Technician
AM	8800	Aviation Maintenance/Production Chief
AS		Aviation Support Equipment Technician
AE		Aviation Electrician's Mate

*Navy Enlisted Classification Code

Sea

Rating	Title
ET	Electronics Technician
MM	Machinists Mate
HT	Hull Maintenance Technician
IC	Interior Communications Electrician
GSE	Gas Turbine System Technician (Electrical)
GSM	Gas Turbine System Technician (Mechanical)

Air Force Sustainment—Officer

Equipment

AFSC*	Title
21Rx	Logistics Readiness
21Ax	Aircraft Maintenance
21Mx	Munitions & Missile Maintenance
20Cx	Logistics Commander
21Bx	Maintenance

*Air Force Specialty Code

Infrastructure

AFSC	Title
32Ex	Engineer
34Mx	Services
30Cx	Support Commander
13Mx	Airfield Operations
10Cx	Operations Commander

Air Force Sustainment—Enlisted

Equipment

AFSC	Title
2A5x1	Aerospace Maintenance
2A3x3	Tactical Aircraft Maintenance
2W1x1	Aircraft Armament Systems
2A6x2	Aerospace Ground Equipment
2A7x3	Aircraft Structural Maintenance

Infrastructure

AFSC	Title
3E0x2	Electrical Power Production
3E4x1	Utilities Systems
2T3x1	Vehicle & Vehicular Equipment Maintenance
2E6x2	Communications Cable & Antenna Systems
2E0x1	Ground Radar Systems

USMC Sustainment—Officers

Air

MOS	Title
6002	Aircraft Maintenance Officer
6004W	Aircraft Maintenance Engineer
6502W	Aviation Ordnance Officer
6004	Aircraft Maintenance Engineer
6502	Aviation Ordnance Officer

Ground

MOS	Title
3510W	Motor Transport Maintenance
1310	Engineer Equipment Officer
2102	Ordnance Officer
2110	Ordnance Vehicle Maintenance

Note: "W" behind the MOS indicates warrant officer incumbents.

USMC Sustainment—Enlisted

Air

MOS	Title
6531	Aircraft Ordnance Technician
6541	Aviation Ordnance Systems Technician
6092	Aircraft Intermediate Level Structure Mechanic
6019	Aircraft Maintenance Chief
6132	Helicopter/Tiltrotor Dynamic Components Mechanic

Ground

MOS	Title
3521	Automotive Organizational Mechanic
3529	Motor Transport Maintenance Chief
2141	Assault Amphibious Vehicle Repairer/Technician
2147	Light Armored Vehicle Repairer/Technician
2149	Ordnance Vehicle Maintenance Chief