Corrosion Prevention and Control (CPC) Program Development – Phase II

Increment 2

Final Report

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for the
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Acronyms and Abbreviations

Term	Definition
AR	Army Regulation
CAM	Corrosion Action Memorandum
CCPE	Corrosion Control and Prevention Executive
CECOM	U.S. Army Communications-Electronics Command
CHP	Controlled Humidity Preservation
CPAT	Corrosion Prevention Advisory Team
CPC	Corrosion Prevention and Control
CTMA	Commercial Technologies for Maintenance Activities
DEVCOM	U.S. Army Combat Capabilities Development Command
DOD	Department of Defense
DOTMLPF-P	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Policy
EMT	Environmental Management Team
ESC	Environmental Severity Classification
FLARNG	Florida Army National Guard
FY	Fiscal Year
GCS	Ground Combat Systems
IDARNG	Idaho Army National Guard
LAR	Logistics Assistance Representative
LCMC	Life Cycle Management Command
MDARNG	Maryland Army National Guard
MEARNG	Maine Army National Guard
MIARNG	Michigan Army National Guard
NCMS	National Center for Manufacturing Sciences
ODASD-MR	Office of the Deputy Assistant Secretary of Defense, Materiel Readiness
PEO	Program Executive Office
POM	Program Objective Memorandum
PM	Preventative Maintenance
PRANRG	Puerto Rico Army National Guard
SMART-T	Secure Mobile Anti-Jam Reliable Tactical Terminal
TACOM	Tank-Automotive and Armaments Command
TM	Technical Manual
TYAD	Tobyhanna Army Depot
U.S.	United States
USVIARNG	United States Virgin Islands Army National Guard

1. Executive Summary

1.1 Results

Army Regulation (AR) 11-42 requires that Life Cycle Management Commands (LCMCs) establish program offices to administer Corrosion Prevention and Control (CPC) as part of the Army-wide CPC program. The CPC program considers CPC in the following areas:

- Collection, distribution, and feedback of system test and equipment maintenance information relating to corrosion
- Army materiel acquisition, recapitalization, remanufacture, overhaul, and/or product improvement, including the evaluation of each proposal for a new system, equipment, or component
- Evaluation of non-developmental items, equipment, and systems
- Care of supplies in storage, including preservation, packaging, and exercising requirements

To meet the requirements set by AR 11-42, the Communications-Electronics Command (CECOM) partnered with the National Center for Manufacturing Sciences (NCMS) and Jensen Hughes to develop a CPC program. The CECOM program serves as a pilot in developing a standard stepwise process and procedure for establishing the key elements of an organization's CPC program. Key elements of the CECOM program include conducting CPC surveys to gather data about CECOM-specific assets and weapon systems, developing a command-wide CPC policy that assigns responsibilities throughout the organization, and establishing a process for planning and executing program funding.

Funding for the collaborative effort was secured through the NCMS Commercial Technologies for Maintenance Activities (CTMA) Program and the Office of the Deputy Assistant Secretary of Defense, Materiel Readiness (ODASD-MR).

1.2 Benefits

The pilot CPC program's development can result in numerous benefits both to the Army and the general public. A template for effective corrosion control is now available for use by standardizing the process. The Army-wide CPC program can utilize this template to improve existing Army command CPC programs and establish new programs, increasing efficiency and consistency throughout the Army. This growth and increased awareness can greatly reduce the impact of corrosion and lead to lower lifecycle costs and improved combat readiness throughout the Army. The mitigating actions should lead to increased safety of equipment operators and a reduction of the burden on United States (U.S.) taxpayers.

1.3 Technology Transition

The new processes developed under the project should be transitioned through Army policy and guidance in accordance with AR 11-42 and its associated Pamphlet. The procedure for developing command CPC programs should also be made publicly available through the Army Publishing Directorate, enabling other LCMCs or anyone involved in sustainment of weapons systems to improve their own CPC programs and procedures.

1.4 Recommendations

Jensen Hughes will work with CECOM to continue establishing the key aspects of the CPC program. The survey process will be refined, and lessons learned over the first year will be applied to improve the process of data collection, reporting procedures, and coordination with other organizations. Jensen Hughes recommends that CECOM focus on

standardizing preferred CPC practices and developing procedures for approving deviations. This should be piloted using the established corrosion survey process and in identifying systemic corrosion issues. Jensen Hughes recommends continued coordination with other Army and Department of Defense (DOD) organizations, as a collaborative approach contributes to the overarching goal to combat corrosion, assist units with addressing environmental-specific issues, and ensure local programs place an emphasis on CPC best practices.

1.5 Invention Disclosure

Invention Disclosure Report(s):

DD882 Sent to NCMS ☐
No Inventions (Negative Report) ☒

1.6 Project Partners

- U.S. Army Tank Automotive and Armaments Command (TACOM)
- U.S. Army Combat Capabilities Development Command (DEVCOM)
- Office of the Corrosion Control and Prevention Executive (CCPE)
- Jensen Hughes
- National Center for Manufacturing Sciences (NCMS)

2. Introduction

2.1 Background

The U.S. Army-wide CPC program specifically requires a series of new or improved processes to enable all Army organizations to satisfy the requirements established by statute and regulation. These regulations include AR 11-42 entitled "Army Corrosion Prevention and Control Program" and its associated Pamphlet. Such processes must account for variations in environmental severity of different locations and their impacts on maintenance and sustainment of Army equipment and infrastructure. This effort is aimed at improving the effectiveness of organization-wide programs in reducing the negative impacts of corrosion of fielded equipment and infrastructure. Specifically, the effort is intended to improve existing processes or introduce new processes for conducting the following types of activities:

- Identifying and managing CPC risk during new design
- Planning, programming, budgeting, and executing the appropriate CPC requirements
- Establishing and operating CPC programs at both headquarters and subordinate levels
- Standardizing preferred CPC practices and approving deviations
- Pursuing cross-cutting CPC technology improvements
- Assessing and improving personnel awareness of relevant CPC topics
- Evaluating the adequacy of available CPC support capabilities
- Monitoring the implementation of recommended CPC improvements

The solution incorporates a phased approach, where each phase involves developing, demonstrating, implementing, assessing, and iterating on process improvements. This report focuses on Phase II of the solution, which is the development of a standard stepwise process and procedure for establishing the key elements of an organization's CPC program based on its missions, responsibilities, and organizational structure. This process is demonstrated by piloting it at CECOM.

2.2 Purpose

The development, demonstration, and validation of improved and standardized processes to implement CPC policy requirements is key to the success of the Army-wide CPC program. Phase II uses a collaborative effort embracing both industry (Jensen Hughes) and government participants (U.S. Army as primary and U.S. Navy, U.S. Air Force, and Office of the Secretary of Defense as observers). Jensen Hughes provides corrosion technical, engineering, and programmatic expertise in creating effective processes. The government, mainly the U.S. Army, provides statutory, regulatory and policy requirements to guide the development process as well as subject matter expertise regarding equipment and infrastructure and current corrosion challenges.

This effort focuses on tasks and deliverables for Phase II, Increment 2. Subsequent phases will pursue improved processes addressing the remaining objectives. Each phase is discrete and will provide value to the sponsoring activity and the public. Phase II, Increment 2 addresses the third objective by pursuing an improved process to establish and operate command CPC programs at the headquarters level that effectively translate to subordinate organizations.

2.3 Scope/Approach

The approach to Phase II of the project is to develop a process and procedure for establishing the core components of a CPC program. This process was piloted by CECOM and includes establishing organization-wide policy and guidance documents, developing funding requirements packages for submission to the Fiscal Year 2025-2028 (FY25-28) Program Objective Memorandum (POM), conducting CPC surveys with formal reports, and generating CECOM-specific corrosion metrics with defined baselines and success criteria.

Together these components, in addition to satisfying any additional AR 11-42 requirements, will aid in reducing the lifecycle maintenance and sustainment burden of weapon systems by ensuring the command is addressing corrosion through a deliberate and effective CPC program. Jensen Hughes, in coordination with CECOM, provides quarterly status updates of CPC program activities and funding execution for received ASLS funding as monthly status reports to CTMA. This report summarizes all activities conducted during the CECOM pilot along with identified gaps, findings, and recommendations.

3. Project Narrative

AR 11-42 calls for the development and continual improvement of command-level CPC programs. The goal of this effort is to develop a standard stepwise process and procedure for establishing the key elements of an organization's CPC program based on its mission, responsibilities, and organizational structure. At the beginning of the process, it was imperative to identify and budget for holistic CPC requirements. Coordination with the Office of the CCPE is necessary to develop funding requirements for submission to the ASLS Management Decision Package as part of the annual POM process. Tasks and deliverables are to be completed with the required funding. Monthly status updates report on the status of tasks, deliverables, and the disbursement of funds.

3.1 Corrosion Surveys

Surveys, per AR 11-42, are any capture of information or data that identifies corrosion on systems, equipment, materiel, facilities, or infrastructure that have the potential for corrosion. Surveys include but are not limited to visual inspections, assessments, reviews, audits, or notes capturing data, photos, or other similar media of exhibited or nonexhibited corrosion. Corrosion surveys are an integral part of developing a CPC program with the purpose of assessing all CPC-related activities located at the surveyed location and provide onsite CPC advice and assistance to command and local personnel.

The focus of CECOM surveys is identifying and reporting on corrosion-related issues that are degrading capabilities, impeding system readiness or safety, or requiring excessive maintenance. The main driver of the surveys is assessing the condition of equipment. An additional but equally important component of the surveys is gauging the adequacy of local CPC policies, procedures, training, knowledge, and skills of organizational leaders, Logistics Assistance Representatives (LARs), operators, and equipment and infrastructure maintainers. The use of a holistic approach allows CECOM to better identify systemic issues and track corrosion trends on Army materiel and infrastructure with particular emphasis on trends attributable to environmental severity or other unique local conditions.

Jensen Hughes used the environmental severity classification (ESC) (ISO 9223, DOD Building Code UFC 1-200-01) to categorize each survey location, because corrosion rates vary depending on regional and local factors. The scale has six categories that range from C1 to CX with increasing severity. Categories C1 and C2 are mildly corrosive while categories C3, C4, C5, and CX require additional corrosion protection.

The condition of CECOM-managed equipment was assessed based on the type and stage of corrosion. Definitions for the stages and common types of corrosion used during surveys can be found in Table 1 and Table 2, respectively.

Table 1. Common Types of Corrosion

Type	Description
General	Also known as uniform corrosion. Refers to the corrosion that proceeds at approximately the same rate over the exposed metal surface.
Crevice	Localized attack on a metal surface at, or immediately adjacent to, the gap or crevices between two joining surfaces. The gap or crevice can be formed between two metals or a metal and non-metallic material.
Pitting	Localized form of corrosion by which cavities or holes are produced in the material.
Galvanic	Electrochemical process in which one metal corrodes preferentially to another when both metals are in electoral contact, in the presence of an electrolyte.

Table 2. Stages of Corrosion

Stage	Description
Stage 0	No visible signs of corrosion or corrosive attack. No presence of white, red, or black corrosion products. No presence of paint film blistering indicating corrosive attack. Discoloration of a coating system, other than caused by corrosion, is permissible.
Stage 1	General surface corrosion is present. White, red and/or black corrosion products are present on the surface of the component being evaluated, but no significant attack is present. Minor blistering of the coating may have also occurred.
Stage 2	Heavy corrosion products are present on the surface of the component. This is the beginning of base metal loss; however, no significant loss has yet occurred. Moderate white, red and/or black corrosion products are present on the component surface. Severe blistering of the paint may have also occurred.
Stage 3	Corrosive attack has resulted in significant base metal loss. Reduction in the cross-section thickness of the component has occurred. Voluminous white, red and/or black corrosion products are present on the component. The structural integrity of the component may or may not be compromised. Pinholes, which may or may not penetrate through the base metal, may have developed.
Stage 4	Perforation of the base metal has occurred. No metal remains at the point of severest corrosive attack. The component has lost structural integrity.

Surveyors assigned an overall corrosion maintenance classification to all equipment assessed. The corrosion maintenance classifications are used to recommend the level of maintenance required to mitigate the corrosion identified as well as delay the onset of future corrosion. Failure to complete the recommended maintenance could result in progression of corrosion which could lead to specialized maintenance, increased downtime, or part failure. Each piece of equipment surveyed was assigned to one of six corrosion maintenance classifications: preventative maintenance (PM) per technical manual (TM), spot paint, part replacement, repainting, metal work, and needs classification. A full description of each maintenance classification can be found in Table 3.

Table 3. Maintenance Classification Ratings

Rating	Definition
PM per TM	No visible corrosion or coating damage. (Unit level)
Spot Repair	Minor cosmetic damage. Nonstructural/does not impact operability or safety. (Unit level)
Part Replacement	Stage 3 or 4 corrosion on easily replaceable parts (don't require allied trades). Parts are likely cheaper to replace than repair. (Unit level IAW Maintenance Allocation Chart)
Repaint	More than 25% of external surface area has corrosion/coating issues. Recommend sending for depot level repaint per AR 750-59. (Intermediate maintenance "paint booth")
Metal Work	Stage 3 or 4 corrosion on non-critical part that requires Allied Trade repair such as cutting and welding. (Allied trades / intermediate maintenance)
Needs Classification	Severe corrosion (Stage 3 or 4) on critical parts affecting safe operability of the asset. (Potential source of repair elevation or disposal)

3.1.1 Survey Briefings

Briefings are typically held at the beginning and end of a survey. Participants include the host command, installation, and key CPC personnel. The in-brief allows CECOM to introduce the survey team, outline the week's itinerary, explain the survey process, and provide an overview of corrosion information. Specific topics include a background on corrosion, benefits of the CPC survey, and post-survey actions. The out-brief reiterates on points from the in-brief while also providing preliminary findings and recommendations. Both briefings provide CECOM an opportunity to open dialogue with personnel responsible for the day-to-day maintenance and provide advice, assistance and additional training opportunities for command leadership and maintainers to address corrosion.

3.1.2 Survey Questionnaire

Jensen Hughes developed a questionnaire to assist surveyors in having conversations with operators, maintainers, supply personnel, Unit Corrosion Monitors, LARs, and others to learn about corrosion issues during surveys. The questionnaire can be found in Appendix A. The questionnaire considers all aspects of the Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Policy (DOTMLPF-P) domains to consider factors that otherwise would not be captured through equipment observations alone. The questions are written to avoid yes or no answers, and prompt personnel to provide details about corrosion-related issues they are experiencing. This includes but is not limited to gauging the adequacy of local CPC policies, procedures, training, knowledge, and skills of organizational leaders, LARs, operators, and equipment and infrastructure maintainers.

3.1.3 Survey Dashboard

At the end of each survey, the team generates a corrosion dashboard with all surveyed equipment data displayed. The dashboard is delivered to unit leadership and any additional maintenance personnel necessary to address CPC concerns and issues. A sample of the dashboard can be found in Figure 1. The dashboard allows a user to sort data by equipment age, equipment type, location, and maintenance classification using slicers located on the lefthand side as shown in Figure 2. The slicers enable quick data analysis and prioritization of the survey data.

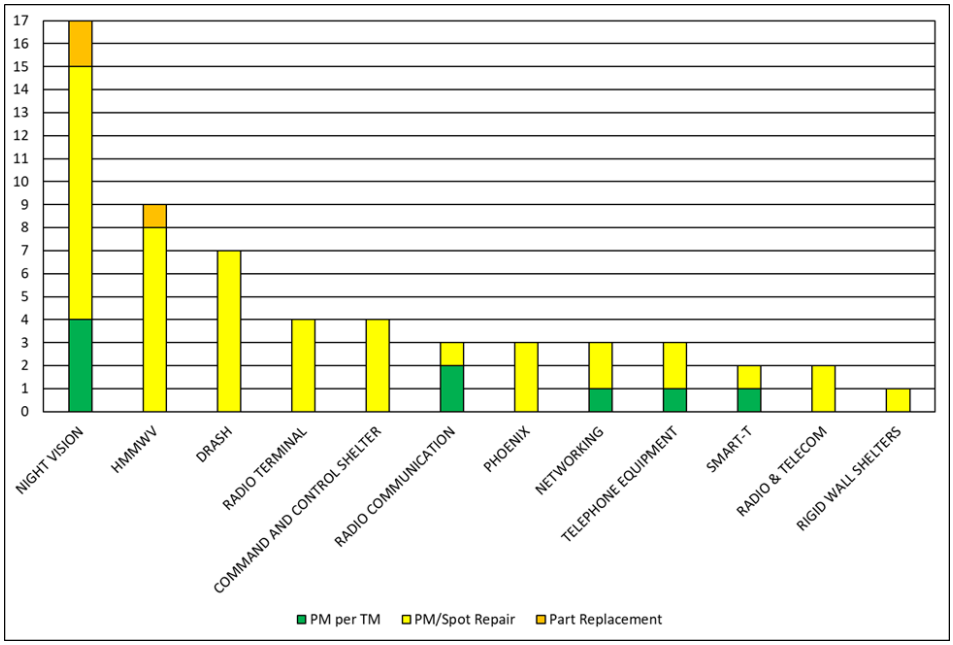
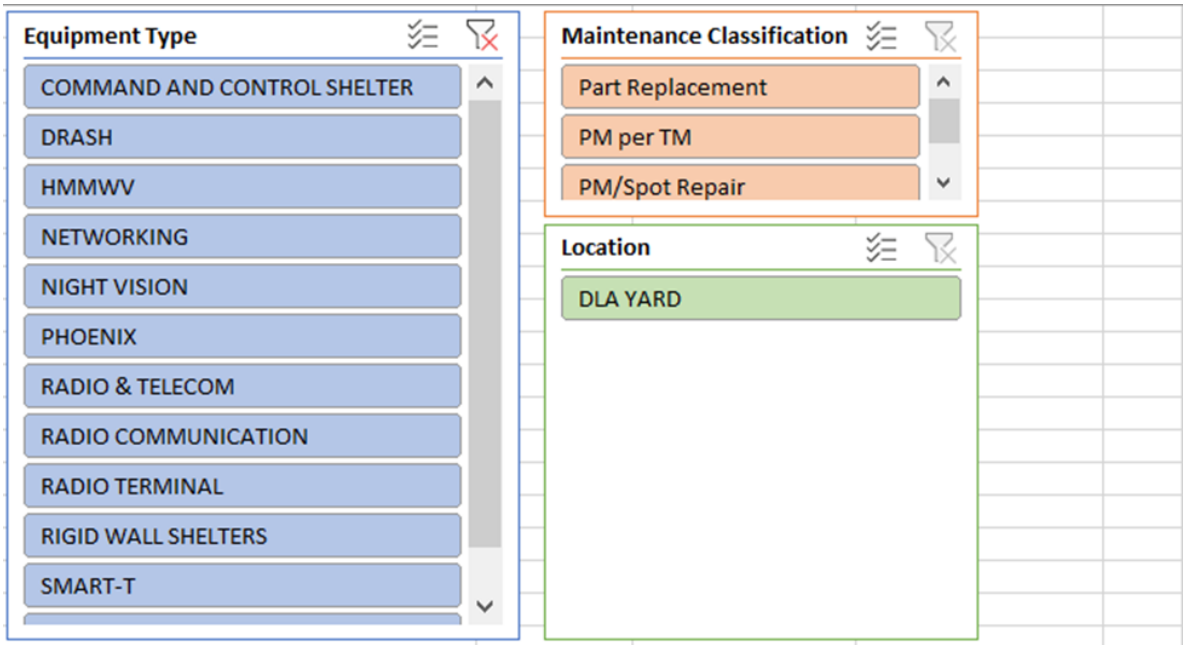


Figure 1. Corrosion Survey Dashboard 1



Equipment	PM per TM	PM/Spot Repair	Part Replacement	Total
NIGHT VISION	4	11	2	17
HMMWV	0	8	1	9
DRASH	0	7	0	7
RADIO TERMINAL	0	4	0	4
COMMAND AND CONTROL SHELTER	0	4	0	4
RADIO COMMUNICATION	2	1	0	3
PHOENIX	0	3	0	3
NETWORKING	1	2	0	3
TELEPHONE EQUIPMENT	1	2	0	3
SMART-T	1	1	0	2
RADIO & TELECOM	0	2	0	2
RIGID WALL SHELTERS	0	1	0	1
Total	**9**	**46**	**3**	**58**

Figure 2. Corrosion Survey Dashboard 2

3.1.4 Final Report

The survey team generates a corrosion survey report with a full analysis of data acquired from the survey, dashboard, field notes, and the corrosion survey questionnaire. All of the collected information is used to identify corrosion trends on Army materiel and infrastructure, develop recommendations to rectify deficiencies, and provide direction for the CECOM CPC program. The conclusions and lessons learned assist in the iterative process of refining survey practices and as well as program guidance and policy.

3.1.5 Summary of Surveys

Jensen Hughes and CECOM performed seven surveys during Phase II of the project. Table 4 provides a list of each survey, the location's ESC rating, equipment density, and breakdown of the maintenance classification ratings.

Table 4. Summary of Survey Data

Location	ESC	Maintenance Classification Ratings Condition						
		Total	PM per TM	Spot Repair	Part Replacement	Repaint	Metal Work	Needs Classification
MIARNG	C2	200	48	148	3	1	0	0
IDARNG	C2	257	0	253	4	0	0	0
MDARNG	C3	74	22	52	0	0	0	0
TYAD	C2	58	9	46	3	0	0	0
USVIARNG	C5	162	44	95	21	0	1	1
PRARNG	C5	191	50	123	17	0	1	0
FLARNG	C5	201	77	108	15	0	1	0

The CECOM CPC program conducted an initial fact-finding mission at the Maine Army National Guard (MEARNG) followed by a full survey at Michigan Army National Guard (MIARNG). CECOM worked jointly with TACOM on these trips to gain insight into the factors involved in scheduling and conducting a CPC survey. These would serve as the baseline from which to conduct future surveys. The second survey was conducted at the Idaho Army National Guard (IDARNG) and built upon lessons learned at MIARNG on how to effectively conduct CPC surveys. CECOM was able to directly engage operators and maintainers of CECOM-managed equipment. Discussions with personnel who have hands-on experience with equipment provided insights that contribute to more than what can be achieved through visual inspection alone. Information gained from such conversations could lead to identification of systemic corrosion issues.

The team conducted a survey at the Maryland Army National Guard (MDARNG) at Aberdeen Proving Ground Edgewood Area. This survey incorporated changes to the survey program based on feedback on the prior two surveys, MIARNG and IDARNG, such as adjusting the Maintenance Classification Ratings to better suit computer-electronic equipment. For example, recommending the use of corrosion inhibiting compounds could damage equipment if not used properly, so this maintenance classification was adjusted to focus on preventive maintenance generally. The changes demonstrate the CPC program's efforts to develop, refine, and improve the survey process.

Jensen Hughes and CECOM held a fact-finding mission at Tobyhanna Army Depot (TYAD), where the primary goal was to speak with personnel at maintenance shops and discuss internal corrosion issues on the Secure Mobile Anti Jam Reliable Tactical Terminal (SMART-T) system. As a result of these discussions, CECOM put additional emphasis on inspecting internal components to weapon systems for corrosion when feasible.

Jensen Hughes and CECOM performed surveys at the United States Virgin Islands Army National Guard (USVIARNG) and Puerto Rico Army National Guard (PRARNG) as the first locations surveyed with a C5 (very high) ESC rating. Local environments are a contributing factor to corrosion, and in general, corrosion increases as ESC ratings increase. Surveyors noted controlled humidity preservation (CHP) facilities on USVIARNG and PRARNG were inoperable which also increased the risk of corrosion. Evidence can be seen in Table 4 where Maintenance Classification Ratings of "part replacement" and above are more frequent compared to prior surveys, highlighting the heightened risk of corrosion. CECOM will work with USVIARNG and PRARNG to address the lack of CHP and related CPC support facilities.

The final survey of Phase II was held at the Florida Army National Guard (FLARNG), which also had a C5 ESC rating. In these locations, mold and mildew were more common compared to other surveyed sites. There was also a shortfall of support facilities such as a wash rack, blast booth and paint booth, which are particularly important in C5 locations.

3.2 Funding

Jensen Hughes developed a process to identify and budget for holistic, command-wide CPC requirements. In coordination with CECOM, Jensen Hughes developed an information paper describing CECOM's funding requirements for submission to the ASLS Management Decision Package as part of the annual POM process. This included a description of the regulatory requirements, tasks to be completed, funding requirements, risks, and benefits. Jensen Hughes also worked with CECOM to provide quarterly updates to the CCPE on current FY funding, to include the status of tasks, deliverables, and obligation and disbursement rates. Jensen Hughes will continue to work with CECOM and the CCPE to ensure command-wide CPC requirements are well understood, justified, and communicated, and that the funding provided is executed and managed effectively.

3.3 Corrosion Policy

Jensen Hughes drafted a CPC policy in collaboration with CECOM to establish command wide policy for developing and implementing the CECOM CPC program as part of the overall Army CPC program in accordance with the requirements of AR 11-42 and AR 750-59. The policy will establish a program office to oversee the CECOM-wide CPC program and assign roles and responsibilities throughout the organization/command. CPC training will be incorporated throughout CECOM and will be tailored to the roles' duties. The policy will highlight how to assist Project Managers, Program Executive Offices (PEOs) and Material Developers by providing CPC support throughout the acquisition and sustainment process and by ensuring CPC is properly addressed in system engineering plans, test and evaluation master plans, lifecycle sustainment plans, and operational sustainment reviews. The policy also outlines survey requirements per AR 11-42 that include survey structure, reporting, and team makeup. Jensen Hughes will continue to support the policy through staffing, and coordinate with CECOM and CCPE to ensure that the policy requirements are clearly defined and communicated throughout the command.

3.4 Metrics

Jensen Hughes is working with CECOM to develop organization-wide metrics to measure CPC effectiveness. Having clearly defined metrics will ensure the scale of corrosion on CECOM-managed equipment is well-understood, as well as provide quantitative data to support any progress resulting from the CECOM CPC program's efforts. These metrics will be reinforced through the CECOM corrosion policy to ensure that corrosion-related information is being captured accurately and that it is communicated to the CPC Program Office. The metrics are in line with Army-wide metrics being tracked by the CCPE. Jensen Hughes and CECOM will develop success criteria for all metrics, establish a baseline, track progress over time, provide data and any relevant documentation to the CCPE as part of annual reporting, and identify areas of improvement where expectations are not being met.

3.5 Other AR 11-42 Requirements

Jensen Hughes is collaborating with CECOM to develop and strengthen partnerships. Participation in Army and DOD sponsored events is an important component to the development of the CECOM CPC program, as a collective and coordinated effort can better address CPC concerns. Jensen Hughes and CECOM attended the DOD Maintenance Symposium in December 2022. CECOM presented an overview of its CPC program and solicited feedback from

maintainers in attendance. The CECOM team had meaningful interactions with other CPC program leads and the Army CCPE. In April 2023, Jensen Hughes and CECOM participated in the PEO Ground Combat Systems (GCS) Environmental Management Team (EMT)/ Corrosion Prevention Advisory Team (CPAT) meeting. There, the CECOM team networked with PEO GCS program manager offices, DEVCOM Ground Vehicle Systems Center, DEVCOM Army Research Laboratory, the Naval Research Laboratory, National Aeronautics and Space Administration, Aberdeen Test Center, and GCS original equipment manufacturers. CECOM will build upon connections made at these events and will use the information gathered to contribute to the development of a robust CPC program.

4. Lessons Learned

Jensen Hughes learned several lessons throughout the course of Phase II that shed light on what works well in establishing a CPC program and what methods to avoid. Other organizations can utilize these lessons learned to build their CPC programs in a way that avoids similar pitfalls while having the greatest chance of success. One lesson is that CPC extends into many organizations and missions. While a CPC program requires a centralized office, subordinate organizational units need to be involved in order to make effective change. Corrosion has broad impacts on Army materiel, and a group effort is necessary to combat it. Jensen Hughes and CECOM applied this lesson in developing its command-wide CPC policy. Assigning responsibilities to subordinate elements will assist the CPC program through actions such as remediating existing corrosion and inhibiting corrosion through design.

Another example of the benefits of collaboration is through communication with operators and maintainers. The CECOM CPC team gained invaluable information about common corrosion issues found on their equipment by engaging directly with operators and maintainers of those systems. Without the assistance of the SMART-T shop at TYAD, surveyors would not have identified water intrusion issues on the SMART-T system. From then on, the team began to survey the equipment internally for water intrusion and corrosion when under supervision of Army personnel trained in disassembly and reassembly of the equipment. Jensen Hughes also developed the corrosion survey questionnaire as a direct result of such interactions to ensure the right questions are being asked of personnel in their areas of expertise.

Communication and collaboration extends beyond CECOM and personnel responsible for communications-electronics equipment. It is beneficial and efficient to network with organizations across the Army, DOD, and industry to collectively pull resources to tackle corrosion. Forums, symposia, and conferences provide unique opportunities where corrosion-related issues can be evaluated and approached from differing angles and viewpoints. CECOM's CPC program has benefited from interactions at events such as the DOD Maintenance Symposium and EMT/CPAT Meeting.

After the first year of conducting corrosion surveys, the team determined several methods for conducting surveys in a more purposeful and effective way. Taking a strategic approach to selecting survey locations helps ensure that meaningful data is collected. CPC surveys should be conducted at multiple locations with varying ESC ratings. Local environments can play a large role in corrosion; in general, corrosion rates increase with ESC ratings. Collecting data from varying locations can assist CECOM in prioritizing mitigating actions as well as demonstrate the effects that environmental factors have on corrosion.

The team learned that it is important to provide survey results to units while the survey is fresh in the minds of unit personnel. This entails providing survey information incrementally to the local units as it is available. The out-brief, provided toward the end of the survey, provides an overview of the equipment surveyed and initial recommendations. The survey dashboard, provided within 30 days of the survey, helps inform leadership and maintainers on the condition of their equipment in a data-driven manner. The final report, provided within 90 days of the survey, includes more detailed descriptions of CPC related concerns, a discussion of findings from unit personnel, and specific recommendations. In order to affect change following a survey, it is important to share survey data and recommendations efficiently, maintain support from unit leadership, and

begin to take action to address the corrosion issues uncovered.

To ensure recommendations are addressed following a survey, it is important that CECOM communicate with the necessary stakeholders through the Corrosion Action Memorandum (CAM) process. AR 11-42 requires that corrosion actions are tracked, and the CCPE established the CAM process to ensure that stakeholders acknowledge CPC-related actions and provide updates quarterly on their progress. Many organizations responsible for addressing survey recommendations may not be aware of the CAM progress, so CECOM can help inform them of the process and work toward a solution. This ensures that surveys result in meaningful action to reduce corrosion.

5. Conclusions

Phase II demonstrated what steps are necessary in establishing the foundation of a CPC program and piloted the process at CECOM. Jensen Hughes drafted a policy document that establishes a CPC Program Office and assigns CPC-related responsibilities to subordinate commands. The policy also outlines procedures for assisting PEOs with CPC planning, conducting surveys, identifying training for CECOM personnel, and tracking program metrics. The continued development and refinement of CECOM's CPC program is necessary to reduce the harmful effects of corrosion on CECOM-managed equipment. Throughout the first year, the survey process has been continually refined and expanded upon with the addition of features such as the survey questionnaire and tailoring the survey tool to CECOM-specific platforms. As the project enters Phase III, Jensen Hughes will continue supporting CECOM to ensure that the command is addressing corrosion through a deliberate and effective CPC program. This will include conducting additional CPC surveys, developing guidance documents, and tracking metrics and funding execution.

6. Project Benefits

The pilot CPC program's development is expected to result in numerous benefits both to the Army and the general public. By standardizing the process, a template for effective corrosion control is now available for use. Other CPC programs can utilize this template to establish new programs and improve existing ones, increasing efficiency and consistency throughout the Army and beyond. Nascent CPC program development time should shorten as the process continues to be refined and improved upon. Standardizing the approach should also allow current and future programs to better sync with each other, allowing for better knowledge-sharing and collaboration for solutions to CPC-related issues and concerns.

Formalizing the process through policy and ensuring that CPC is addressed early in the design phase of weapon systems will ultimately reduce the sustainment burden and reduce lifecycle costs. As the Army-wide CPC program develops further and corrosion is addressed on weapons systems prior to sustainment, the overall impact of corrosion on total lifecycle costs will lessen while their combat readiness increases. The bottom line is weapon systems will be safer and more reliable while also reducing the burden on U.S. taxpayers.

The development of the CPC program has been designed to address Army weapon systems, but the foundational processes could be retooled for other military branches or civilian/commercial endeavors. These potential applications can be adjusted accordingly and potentially result in similar benefits as indicated previously.

Appendix A – Corrosion Survey Questionnaire

U.S. ARMY
COMMUNICATIONS – ELECTRONICS COMMAND

CORROSION SURVEY QUESTIONNAIRE

Unit: _____
Date: _____
Surveyor: _____

Questions for Unit Maintainers	
Unit/Organization	
Contact Name & Rank	
Contact Info	

Question	Reference	Response
1. Are you currently seeing corrosion issues?	AR 11-42	
a. Have you checked equipment both internally and externally for corrosion?	DA PAM 750-1 6-14.c	
i. Is the equipment experiencing water penetration into areas that should be sealed/watertight?	DA PAM 750-1 6-14.c	

Questions for Unit Maintainers			
	Question	Reference	Response
(a)	What effects has water penetration had on the system?	DA PAM 750-1 6-14.c	
b.	Have you noticed any tendencies for corrosion to form in specific patterns or locations? Are you aware that certain designs carry an increased risk of corrosion? Examples: Improper drainage, accumulation of dust or mud, skip welds, sharp edges on coated surfaces, paint failure, joining of dissimilar metals i.e. bolts and washers.	AR 750 2-10.l	
c.	What do you do when you encounter corrosion issues?	AR 11-42 3-3.h	

Questions for Unit Maintainers			
	Question	Reference	Response
i.	What procedures do you follow and where do they come from?	AR 11-42 3-3.h	
d.	Do you have equipment where corrosion is the main cause of failure, what did it cause?		
e.	How do you determine when you cannot fix the corrosion?	AR 750-1 3-10.c(20)	
i.	When you find corrosion that severe, what do you do?	AR 750-1 3-10.c(20)	

Questions for Unit Maintainers			
	Question	Reference	Response
ii.	Is there a local repair facility above your level available to you?		
iii.	How do you prepare the equipment to be turned back in?	AR 750-1 4-8	
iv.	Who do you turn it into and what is their contact info? (Please provide name, rank, and unit)	AR 750-59 2-9.h	
f.	Does the installation have the appropriate repair facilities, such as paint booths, blasting facilities, metal working shops, etc.?	AR 11-42 3-3.l	

Questions for Unit Maintainers			
	Question	Reference	Response
2.	Have you ever received an item from supply that already had corrosion damage on it? If yes, can you tell us about that and what you did about the corroded item?		
3.	What are your preventative maintenance checks and services (PMCS) including for internal electronic components and systems?	DA PAM 750-1 6-14.c	
a.	Are your PMCS in the technical manual (TM)?	AR 11-42 2-3.a(9) AR 750-1 3-10.b(2)	
i.	Do you think your TM's PMCS is adequate? In what ways do you believe that they are lacking in regards to corrosion?	AR 11-42 2-3.a(9)	

Questions for Unit Maintainers			
	Question	Reference	Response
ii.	Do you have any special procedures if/when equipment is exposed to aggressive environments? This could be due to proximity to ocean or fresh water exposure, freeze/thaw cycles, deicing salts, etc.	AR 750-59 2-10.h	
b.	Are there any standardized inspection procedures for full-up systems or individual components?	AR 11-42 3-3.b AR 750-1 3-7b AR 750-59 2-9e	
i.	Can we see a copy or take a copy with us?	AR 11-42 3-3.b AR 750-1 3-7b AR 750-59 2-9e	
c.	Are there any additional PMCS that you are doing that are not in the TM or standard procedure?	DA PAM 750-1 9-2	

Questions for Unit Maintainers			
	Question	Reference	Response
4.	Do you know if you have a unit corrosion monitor (UCM) and if so, who that is? (Please provide name, rank, and unit.)	AR 11-42 1-24.i(1) AR 750-59 2-11.a	
a.	Are corrosion related maintenance actions being documented in deficiency reports? Examples: Standard Form (SF) 368 (Product Quality Deficiency Report (PQDR)), SF 364 (Report of Discrepancy (ROD)), and DD Form 1225 (Storage Quality Control Report)	AR 11-42 1-42.d AR 750-59 2-10.k	
i.	If you encounter corrosion issues, what code do you use on the Global Combat Support System-Army (GCSS-A)? (Should be Failure Code 170 – corroded/rusted.)	AR 750-59 2-12.g	

Questions for Unit Maintainers			
	Question	Reference	Response
ii.	Where do you send them?	AR 11-42 1-42.d AR 750-59 2-10.k DA PAM 750-1 6-13	
iii.	Do you know what happens next?		
iv.	Do you get any feedback, and if so from whom? (Please provide name, rank, and unit.)		
v.	Can you provide examples of such deficiency reports?	AR 750-59 2-12.g	

Questions for Unit Maintainers			
	Question	Reference	Response
5.	Are you able to get the supplies you need for corrosion repair or preventive maintenance through the supply system? Examples: Chemical Agent Resistive Coatings (CARC), CARC spot paint kits (or other coatings in the TM), Corrosion Inhibiting Compounds (CICs), tarps and covers, and PPE	AR 11-42 2-2.j AR 750-59 2-12.e	
a.	How and where do you store these items?		
b.	Are there items you need that are not specified in the TM?	DA PAM 11-42 2-5.g AR 750-59 2-12.h	

Questions for Unit Maintainers		
Question	**Reference**	**Response**
6. Where do you perform activities such as cleaning and touch-up painting?	AR 750-1 3-10	
a. Can you describe your methods for cleaning equipment of debris, dirt, sand, mud, and other contaminants?	AR 750-1 3-10	
7. How do you determine when to use a cover? When covers are deemed necessary, what is the process of applying them to equipment?		
a. Are covers always used on equipment when not in use?		

Questions for Unit Maintainers		
Question	**Reference**	**Response**
b. What are your procedures for applying covers? (e.g., after cleaning equipment, type of fit, etc.)		

Questions for Supply			
	Unit/Organization		
	Contact Name & Rank		
	Contact Info		
	Question	**Reference**	**Response**
8.	Are items in supply checked for corrosion? If yes, what do you do when you encounter corrosion?	AR 11-42 1-24.i(3) AR 750-59 2-9.f(3) AR 750-59 3-4.a(3-4)	
9.	How do you determine which storage facility or method to use for a given part?	AR 750-59 3-4.a(1)	
a.	Do items in storage have scheduled maintenance checks or as needed for corrosion in particular?	AR 750-59 3-4.a(3)	

Questions for Supply			
	Question	**Reference**	**Response**
b.	Are containers being examined for damage, for example, intrusion of water and potential corrosion?	AR750-59 3-4.a(4)	
c.	Is humidity-controlled storage readily available (i.e are there facilities locally)?	AR 750-59 3-4.a(1)	
10.	Please explain your care of supplies in storage (COSIS) procedures.	AR 750-59 2-9.f(3)	
a.	How does the process vary depending on what is inspected?	AR 750-59 3-4.d-e	

Questions for Supply			
	Question	**Reference**	**Response**
b.	How does supply check electronic components and systems for corrosion, including internal electronic components and systems? This includes but is not limited to wire casings, critical components, and electrical connections.	DA PAM 750-1 6-14.c	
c.	Have you noticed any tendencies for corrosion to form in specific patterns or locations? Are you aware that certain designs carry an increased risk of corrosion? Examples: Improper drainage, accumulation of dust or mud, skip welds, sharp edges on coated surfaces, paint failure, joining of dissimilar metals i.e. bolts and washers.	AR 11-42 3-3.h	
d.	What methods are used to clean equipment of debris, dirt, sand, mud, and other contaminants?	AR 750-59 3-4.a(2)	

Questions for Unit Corrosion Monitor			
	Unit/Organization		
	Contact Name & Rank		
	Contact Info		
	Question	**Reference**	**Response**
11.	What are the issues that you would like to bring up as the UCM?	AR 750-59 2-12	
a.	Do you think your training has been sufficient?	AR 11-42 1-24.i(2) AR 750-59 2-9.i AR 750-59 2-10.j	
b.	Do you feel as though you have enough assistance?	AR 750-59 2-11	

Questions for Unit Corrosion Monitor			
	Question	**Reference**	**Response**
c.	Are local logistics assistance representatives (LARs) available to assist you?	AR 11-42 1-42.g(9)	
d.	Are corrosion related maintenance actions being filled out in deficiency reports? Examples: Standard Form (SF) 368 (Product Quality Deficiency Report (PQDR)), SF 364 (Report of Discrepancy (ROD)), and DD Form 1225 (Storage Quality Control Report)	AR 11-42 1-42.d AR 750-59 2-10.k	
i.	If you encounter corrosion issues, what code do you use on the Global Combat Support System-Army (GCSS-A)? (Should be Failure Code 170 – corroded/rusted.)	AR 750-59 2-12.g	

Questions for Unit Corrosion Monitor			
	Question	**Reference**	**Response**
ii.	Where do you send them?	AR 11-42 1-42.d AR 750-59 2-10.k DA PAM 750-1 6-13	
iii.	Do you know what happens next?		
iv.	Do you get any feedback, and if so from whom? (Please provide name, rank, and unit.)		
v.	Can you provide examples of such deficiency reports?	AR 750-59 2-12.g	

Questions for Logistics Assistance Representative			
	Unit/Organization		
	Contact Name & Rank		
	Contact Info		
	Question	**Reference**	**Response**
12.	What are the most common corrosion maintenance issues you face?		
a.	What has been your experience in handling corrosion related issues?		
13.	What do you see as being the needs of the maintainers with respect to corrosion control?		

Questions for Logistics Assistance Representative			
	Question	**Reference**	**Response**
14.	Have there been any issues with receiving supplies related to corrosion (e.g., Chemical Agent Resistive Coatings (CARC), CARC spot paint kits (or other coatings in the TM), Corrosion Inhibiting Compounds (CICs), tarps and covers, and PPE)?		
15.	Do you have reach back to CECOM or to their corrosion office, be it internal/DEVCOM C5ISR?		
16.	Are there areas of your training in regards to corrosion that you think are inadequate?		

Other Questions			
Unit/Organization			
Contact Name & Rank			
Contact Info			
Question		**Reference**	**Response**
17.	If the installation has the appropriate repair facilities, such as paint booths, blasting facilities, metal working shops, etc., describe the condition of all applicable facilities.		
a.	If repair facilities are not available locally, where is the nearest available location?		
18.	What is the sustainment life of the equipment? (Is the sustainment plan past the expected phase out date, with the Army requesting an extension?)		

Other Questions			
Question		**Reference**	**Response**
a.	Has corrosion become more prevalent post phase out date?		