Any Clime and Place

Corrosion prevention and control support for multi-domain distributed operations

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Recognizing the paradigm shift in global logistics presented by Force Design experiments, the Marine Corps Corrosion Prevention and Control (CPAC) Program implemented a solution to support units in remote locations worldwide: the Mobile Service Container. This modular, scalable, deployable, self-sustaining CPAC support package affords prepositioning nodes and stand-in forces the capability to sustain readiness for extended periods while detached from traditional logistics support networks. This capability is in lockstep with the Marine Corps intent to integrate logistics across multiple distributed domains in contested environments.[1]

A Primer on Marine Corps CPAC

The maritime and littoral terrains where MEFs operate represent the most corrosive environments on the planet. The combination of high salt content and humidity accelerates material degradation compared with inland climates. Since 2004, Marine Corps Systems Command (MCSC) has executed a comprehensive CPAC program designed to extend the useful life of military equipment while reducing maintenance requirements and associated costs.[2] As a resident of the Product Manager, Maintenance Support Systems portfolio, CPAC does not perform the functions of a traditional acquisition program that develops and delivers capability sets to the operating forces. Instead, it directly integrates engineering solutions and maintenance support services to MEF commanders, MCSC Program Managers, and the Marine Corps Organic Industrial Base.

One of the most successful readiness enablers employed by the CPAC Program has been its Corrosion Service Teams (CST). These contracted mobile teams serve as the first line of defense, providing organizational CPAC services to all Marine Corps units. The CSTs perform preventive and corrective field-level maintenance services, including: application of various corrosion prevention compounds; surface preparation to remove corrosion; touch-up painting; tactical, registration, and safety markings; and corrosion assessments and assignment of Corrosion Category Codes. All work is performed using units' spaces with minimal external support required, freeing operator and maintenance personnel to prioritize other mission-critical tasks.

The CPAC Mobile Service Container provides a forward-based equipment sustainment capability to support deployed forces. *(Photo by NSWCCD.)*

The CPAC Program currently provides five CSTs strategically positioned throughout the enterprise: Camp Pendleton, CA (I MEF, Marine Forces Reserve [MFR], and Training and Education Command); Camp Lejeune, NC (II MEF, MFR, Training and Education Command, and Marine Forces Special Operations

Command [MARSOC]); Okinawa, Japan (III MEF and U.S. Army/U.S. Navy joint partners based in Japan); MCB Hawaii (III MEF); and Fort Worth, TX (MFR and Training and Education Command). Each team is manned, trained, and equipped based on unit equipment density, operational tempo, and environmental conditions.

All Marine Corps units receive cyclical service visits, the frequency of which increases in more corrosive environments. The CST service visits increase equipment operational availability and reduce premature failure and higher-level maintenance requirements, greatly enhancing equipment readiness.

Problem Summary: Supporting Distributed Operations

In 2019, the 38th Commandant of the Marine Corps, Gen David Berger, indicated an eventual shift in priorities to U.S. Indo-Pacific Command.[3] The maturing of Force Design and increased requirements for the forward positioning of sustainment capabilities accelerated this timeline.[4] Responding to the realignment of priorities, the CPAC team lead cited preventing corrosion as a critical factor in maintaining equipment in forward-based operations while noting that current corrosion control strategies may not meet the demands of advanced base operations in contested environments.[5] He stressed the significance and prioritization of expeditionary CST support as one of the program's goals.[6]

The CPAC Program was already experienced in deploying CSTs to support operations; I, II, and III MEF CSTs routinely travel to geographically dispersed bases and stations, and the MFR CST continuously moves throughout the lower 48 to service units. These missions typically occur on military installations with the infrastructure to support operations efficiently.

The CSTs have also performed service visits at remote locations such as Australia, the Republic of the Philippines, South Korea, Norway, Italy, Spain, and Romania. Service at these locations has presented significant logistical challenges. For instance, CST service vehicles cannot be shipped or operated at foreign locations (except from Okinawa to mainland Japan); therefore, all tools, service equipment, and materials must be palletized and shipped to and from the destination. This adds significant cost, making the volume of trips necessary to meet the expanding demand signal unfeasible in a fiscally constrained environment. Additionally, each location's unique regulations require extensive coordination with supporting units and host-nation officials.

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Other logistics dilemmas include accountability, security, and shelf life of CST supplies. Once pallets are broken down, service items can be lost, misplaced, damaged, or even used for other purposes. When the CST arrives, they often have to spend several days searching for equipment and materials and, in many cases, repairing or replacing mission-essential items.

Solution: The CPAC Mobile Service Container

The CPAC program pursued a standalone, turnkey solution to mitigate the challenges and risks associated with supporting forward-deployed units and to reduce overall cost, allowing the program to increase support of rapidly expanding requirements. The CPAC's Research, Development, Testing, and Evaluation partner, Naval Surface Warfare Center, Carderock Division (NSWCCD), and its engineering support contractor, Vision Point Systems, Inc., initiated an Office of the Secretary of Defense-funded project to develop an Expeditionary Corrosion Service Container Procurement Package.[7] Using a standard quadruple container (QUADCON) as the overall form factor, the team designed and built a conceptual prototype.

The CPAC engineers observed CST operations and interviewed team members to develop baseline tools, supplies, and materials solutions. A major need included the capability to apply corrosion prevention compounds (CPCs) to Marine Corps equipment at various locations throughout the day without relying on shore power. Using commercial off-the-shelf components, CPAC engineers constructed a mobile CPC service cart with a gas-powered air compressor, a five-gallon pressure pot, a fluid pump system, and CPC application equipment to support four technicians working simultaneously. This ruggedized system can easily be maneuvered around unit lots and across most terrains, allowing technicians to service equipment in place without burdening units for movement support.

In addition, the prototype container design included securely mounted storage cabinets, a hazardous materials locker, the mobile CPC service cart, and all the tools, supplies, and materials required for a specific CST mission. The engineering team moved the prototype to Camp Lejeune, NC, for a field demonstration and testing with CST technicians. The engineering team incorporated design and inventory changes based on CST feedback from field testing. The CPAC team lead approved the final design, dubbing the system the *CPAC Mobile Service Container (MSC)* and directing production of the first units.

CPAC MSC Proof of Concept: Marine Rotational Force-Darwin

In early fiscal year (FY) 2024, the CPAC Program and I MEF coordinated the delivery of the first CPAC MSC production unit to Robertson Barracks, Darwin, Australia, to support the Marine Rotational Force-Darwin (MRF-D) Ground Equipment Staging Program 24.1. The I MEF CST deployed to Darwin from March to April 2024 and, using the MSC, performed organizational corrosion prevention services

CST Technicians deployed to Darwin, Australia, to conduct intermediate level corrosion repairs using the CPAC MSC. *(Photo by NSWCCD.)*

on 687 assets.[8] Upon completion, the MRF-D Ground Equipment Staging Program secured the MSC and staged it for future operations.

Overall, the mission was a success; however, it was not without challenges. The CST identified several internal issues including configuration, damaged equipment, unnecessary supplies, additional parts requirements, and confirming the container delivery before the team executes travel.[9] Exercising the MSC in a deployed environment was successful because of teamwork and coordination between MRF-D Marines and the CPAC team; this evolution provided valuable lessons for future operations. The CPAC program incorporated field user feedback into the follow-on MSC design and standard operating procedures to improve functionality.

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Current Operations and the Way Forward

In FY2025, the CPAC program shipped a second MSC to Darwin, Australia. This variant is equipped to provide a mobile corrosion repair capability. It consists of additional equipment and materials required to perform intermediate corrosion repair and recoating at a forward location. In February 2025, the I MEF CST again deployed to Darwin; this mission focused on maximizing field-level corrosion repairs. During this six-week service visit, the team completed intermediate-level corrosion repair on 42 assets. Each repair action represents a considerable transportation cost avoidance, as this equipment would normally require evacuation to a regional corrosion repair facility, the closest being Okinawa, Japan, for repair and recoating.

To date, the CPAC program has delivered five MSCs. Two are positioned in Darwin, with two more pre-staged in Camp Pendleton and Okinawa for follow-on shipment to Palau and the Republic of the Philippines, respectively, to support Marine Forces Pacific operations and distributed prepositioning networks in the U.S. Indo-Pacific Command area of responsibility. A fifth MSC is staged at Third Assault Amphibian Battalion, Camp Pendleton, CA, to maximize corrosion prevention actions on the newly fielded Amphibious Combat Vehicle family of vehicles.

Six more MSCs are on the production schedule and will be delivered between FY2025 and FY2026. Like Marine Corps units experimenting with *Force Design 2030*, the CPAC program will consider operational strategies to employ this capability. Concepts of operations include a combination of remain-in-place with fly-in CST support like the MRF-D model and prepositioning MSCs at major regional installations for rapid deployment when required. Beyond the first eleven units, the CPAC program may increase MSC production as forward-based sustainment requirements increase.

Conclusion

The MSC presents several key benefits, the most obvious being enhancing sustainment efforts in multi-domain distributed operational environments. The CPAC program can provide the same preventive and corrective corrosion control services that units enjoy at their home bases and stations for a relatively low cost. By pushing sustainment capability forward, MEFs can avoid prohibitively high transportation costs. MGySgt Delroy Wade, the I MEF Maintenance Management Chief, discussed the explicit benefits of the MSC as it relates to MRF-D specifically:

> The implementation of the Mobile Service Container (MSC) is an absolute force multiplier. Across the [USMC] operating environments where "normal" work conditions are limited, our Enhanced Corrosion Service Team (ECST) is equipped with the correct tools for ensuring safety, productivity, performance, and efficiency with the MSC. The MSC is multi-purpose, deployable, and packed with tools to overcome the logistical and strategic challenges that arise from the tyranny of distance that our Corps is presented with, especially with the remoteness of Marine Rotational Force-Darwin (MRF-D).[10]

The MSC is the result of the combined efforts of the CPAC team, NSWCCD, and industry partners to maximize the sustainment of Marine Corps equipment. It represents the innovation

professionals can achieve when they do not allow action to be paralyzed by standard operating procedures. Lauren Paladino, Marine Corps CPAC Senior Engineer, describes this collective accomplishment as:

> CPAC is constantly working to support the fleet in meeting USMC priorities, such as Force Design 2030 and improvements in contested logistics. The MSC is one example of how the CPAC program works towards supporting the fleet in forward-enabled, distributed, and littoral operations. CPAC will continue to resolve field-level corrosion issues and implement solutions, working together with the operator and acquisition community to promote the useful life of USMC assets.[11]

The vision and ingenuity displayed by the team demonstrate Marine Corps Systems Command's commitment to acquisition excellence and building a broader logistics web, capable of supporting multi-domain and distributed operations in contested environments.

Notes

1. Gen David H. Berger, *Installations and Logistics 2030–February 2023,* (Washington, DC: 2023).

2. Headquarters Marine Corps, *MCO 4790.18C, Corrosion Prevention and Control Program,* (Washington, DC: 2014).

3. Gen David H. Berger, *38th Commandant's Planning Guidance,* (Washington, DC: 2019).

4. Gen David H. Berger, *Force Design 2030 Annual Update–June 2023,* (Washington, DC: 2023).

5. Eric Brown and Lauren Paladino, "The Marine Corps War on Corrosion," *Marine Corps Gazette* 106, No. 5 (2022).

6. Product Manager, Corrosion Prevention and Control, *CPAC Program Operations Strategy 2023*, (Quantico: 2023).

7. Naval Surface Warfare Center Carderock Division (Code 613), *Expeditionary Corrosion Service Quadcon Procurement Package*, (West Bethesda: 2023).

8. Robert Pedrosa, "Trip Report for Marine Rotational Force–Darwin," Naval Correspondence Letter to Eric Brown, April 25, 2024.

9. Robert Ballinger, "Trip Report I MEF Camp Pendleton, CPAC Quality Assurance Representative (QAR) to Marine Rotational Forces–Darwin 06 Mar–15 Apr 2024," Naval Correspondence Letter to Eric Brown, April 23, 2024.

10. Master Gunnery Sergeant Delroy Wade, email message to MCSC CPAC Team Lead, March 18, 2025.

11. Lauren Paladino (NSWCCD Senior CPAC Engineer) in discussion with the MCSC CPAC Team Lead (March 2025).