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MG Duane A. Gamble Commanding General U.S. Army Sustainment Command

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Features



COMMANDER'S CORNER WORLDWIDE ASSETS FOR GLOBAL FORCE PROJECTION MG Duane A. Gamble **Commanding General**

U.S. Army Sustainment Command

LEAPING AHEAD OF TOMORROW

U.S. Army Futures Command is bringing capability to address land, air, maritime, space, and cyberspace multi-domain threats.

By Dr. Shawn M. Walsh, **COL Lee Dunlap and** LTC Deidre E. Patterson

Cover: Streamlining modernization of the Army's home station mission command centers requires close coordination among stakeholders, from home station to the battlefield. (Scott Sundsvold, I3MP Strategic Communications)



LEADERSHIP PERSPECTIVE **CAPABILITIES INTEGRATION ACROSS DOMAINS**

LTG Eric J. Wesley

Deputy Commanding General, Futures **Director, Army Capabilities Integration Center** U.S. Army Training and Doctrine Command

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By Justin Eimers



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INSIGHTS

Airlift, sealift and prepositioning make up the three "legs" of strategic mobility. In this month's Commander's Corner, MG Duane A. Gamble, Commanding General, U.S. Army Sustainment Command, answers our questions about Army prepositioned stocks (APS), providing details about the new combat-configured APS, some real-world examples of the new configuration, and the Configured for Combat plan and its benefits.

With a variety of continually evolving threats, it is imperative that the Army maintain its tactical advantage across all domains – land, air, sea, space and cyberspace. The Multi-Domain Operations concept is a way to ensure that we do just that, and LTG Eric J. Wesley, Deputy Commanding General, Futures / Director, Army Capabilities Integration Center, U.S. Army Training and Doctrine Command, discusses its purpose, importance and necessity as well as challenges faced in implementing it.

A major step the Army has taken in this direction recently was the standing up of the Army Futures Command in July. Now in its initial operating capability phase, the new four-star command will strive to achieve overmatch on future battlefields by providing Soldiers with the weapons and equipment they need. Army experts share valuable insights into the new command, including the reasons for the recent choice of location, its strategic partnerships for Army modernization, and its efforts at achieving unity among different elements of the Army future force modernization enterprise.

Increasing speed of acquisition is not limited to the Army Futures Command, though. The U.S. Army Project Manager Mission Command at the Program Executive Office Command, Control, Communications-Tactical (PEO C3T) also has a hand in that process through its Developmental Operations model. Shedding light on this efficient approach, PEO C3T discusses how it speeds development of warfighting capability by not only putting new technology in the hands of Soldiers but also receiving their feedback early in the acquisition process.

Being proactive can have other benefits besides improving acquisition; it can save enormous amounts of money and – more importantly – lives. This is especially true when it comes to preventive maintenance on Abrams tanks. Michael S. Hendrickson, tank maintenance team leader at the U.S. Army Tank-automotive and Armaments Command, Integrated Logistics Support Center, explains the serious risks we take when not being attentive to maintenance and diagnostics.

Last but not least, this year's Annual Warfighters Tactical Gear Guide highlights modernization efforts in both the Army and the Marine Corps, from the Army's updated Soldier Protection System to a variety of gear for Marines, such as the MK13 Mod 7 Long Range Sniper Rifle and the Plate Carrier Generation III body armor.

Your comments and suggestions are welcome. Thank you for your continued readership!

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NEW FOUR-STAR COMMAND CATAPULTING CONCEPT TO CAPABILITY ARMY FUTURES COMMAND: LEAPING AHEAD OF TOMORROW

Both physical and nonphysical threats in the land, air, maritime, space, and cyberspace domains continuously challenge the Army's achievement of future superiority. The Army Futures Command is now on the scene to ensure the Army leaps ahead — and stays ahead — of these multi-domain threats.

By Dr. Shawn M. Walsh, U.S. Army Research, Development, and Engineering Command Fellow and a lead engineer from the Army Research Laboratory; COL Lee Dunlap, Division Chief for ARCIC's Science, Technology, Research and Accelerated Capabilities Division; and LTC Deidre E. Patterson, Army Strategist and ARCIC Chief of Initiatives



A Punisher unmanned ground vehicle follows Soldiers during the Pacific Manned Unmanned-Initiative (PACMAN-I) experiment in Hawaii. (U.S. Army photo)

Tempo and complexity. If there were two single characteristics that illuminate the key technological and strategic challenges that threaten the Army's ability to ensure a superior force in the future, tempo and complexity would make the short list. The Army's Multi-Domain Operations concept explicitly recognizes this complexity by noting that "U.S. supremacy is increasingly contested in the land, air, maritime, space, and cyberspace domains." Global and accelerating advances in science and technology, increasingly accessible by adversaries, are leading to unprecedented tempo in both the physical realm (e.g., highly maneuverable robotics, precision munitions) and the information realm (e.g., rapid pattern recognition, data mining, and decision-making fueled by artificial intelligence and machine learning). How will the Army maintain supremacy in light of accelerating tempo and complexity in multiple domains? Answer: by fundamentally transforming its culture and processes to catapult a concept to a validated warfighting capability. The Army future force modernization enterprise demands cultivating new processes that don't just keep pace with technological change but also are designed to leap ahead and stay ahead of the capabilities of our adversaries.

Historically, the Army has approached new threats, challenges and opportunities by framing the problem as a mission. The Army Futures Command (AFC) was conceived to institutionalize the mission of the Army future force modernization enterprise — to ensure pervasive overmatch. Every mission needs a strategy, and AFC's strategy is to integrate the future operational environment, threat and technologies to develop and deliver future force solutions. AFC seeks to strike a balance between materiel capabilities and operating concepts to deliver complete, validated and effective Warfighter "solutions." This strategy includes ensuring the best talent, practices and capabilities are united to deliver timely and effective force modernization outcomes, offsets and overmatch.

Finding a Home for the Army Futures Command

Officially launched on July 1, 2018, AFC is in its initial operating capability phase. The Army has not undertaken a reorganization on the scale of AFC since 1973. As the fourth and newest Army fourstar command, AFC is tasked with "driving the Army into the future to achieve clear overmatch in future conflicts." The Army recognized, as have numerous DoD board recommendations, the Decker-Wagner report, General Accounting Office reports, and independent public and private studies, that there is a gap between the ever accelerating pace of science and technology and the ability of DoD's "traditional," industrial-age acquisition process to strategically identify, respond and close those gaps. The Army also recognized that attracting and developing talent were critical – especially in innovative science and technology areas where the Army must compete for limited and specialized pools of talent. As such, the Army developed a set of criteria that focused on selecting an urban hub that would attract talent by being close to diverse technology companies, universities and business incubators, and could provide access to a variety of science, technology, Engineering and Math personnel and affordable research and development infrastructure.

Though numerous cities across the U.S. were considered, ultimately Austin, Texas was selected as the location for the AFC. AFC is scheduled to achieve its full operating capability in the summer of 2019. In addition to being located between major military bases in Killeen and San Antonio, Austin also hosts Army Research Laboratory's (ARL) extended campus, which had already established a footprint at the University of Texas at Austin in November 2016. Prior to AFC, the U.S. Army Research, Development and Engineering Command (RDECOM) ARL had created the collaborative hub in Austin to strategically access unique research and development capability in the southwest United States, just as its hubs in Los Angeles, Boston and Chicago enable access to expertise and capabilities unique to those geographical regions.

Creating an Aspirational and Collaborative Culture

As noted by COL Patrick Seiber at the initial announcement, the factors considered in selecting an urban location for AFC headquarters included "talent, high quality of life, innovation hubs, and money spent for research." He shared that "one of the things we determined we've got to be able to do is immerse ourselves in the culture with these innovators and we can't do that if we stay in our walled posts and installations." Though Austin will eventually be home to the AFC headquarters, it is important to recognize that the vast majority of the AFC personnel will remain in their current locations across the U.S. As noted by the Under Secretary of the Army Honorable Ryan D. McCarthy, "This is not about moving lots of people from other commands. ... [The] Army Futures Command can be best characterized as a restructuring and de-layering to maintain the 'best in breed' in all military capabilities."

Thus, perhaps more than ever, creating a new and inclusive AFC culture that inspires and connects the best ideas, talents and processes from its entire workforce and industry/academia is paramount. AFC is designing fundamentally new processes that bring expertise in concepts, requirements, research and development, and testing together earlier and often. Iterative concept generation and prototyping, together with virtual and physical experimentation, will allow foundational research from both Army labs as well as industry and academic partners to be rigorously assessed for their conceptual warfighting potential to defeat a future threat or enable a

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NEW FOUR-STAR COMMAND CATAPULTING CONCEPT TO CAPABILITY



SGT Jairo Arciga tests the Expeditionary Joint Battle Command-Platform (X JBC-P) during the Army Expeditionary Warrior Experiment at the Maneuver Battle Lab, Fort Benning, GA. A man-packable version of the mounted JBC-P system, the X JBC-P provides beyond-line-of-sight capability for situational awareness and mission command. (U.S. Army photo/PEO C3T - RDECOM CERDEC)

new capability. AFC recognizes that the Army alone does not have a monopoly on exploiting advances in science and technology. Hence, with aggressive and strategic collaboration and venturing across multiple innovation networks, AFC will speedily identify where it should invest its resources and where it should leverage efforts to cost-effectively achieve truly unique and needed future Warfighter outcomes.

Unity of Command, Unity of Effort

At the center of the AFC is a sharply focused goal to bring unity across disparate but complementary elements of the Army future force modernization enterprise. Unity of Command, enabled by analytically driven fusion of data and information, will allow senior Army leaders to minimize the time needed to make effective and critical decisions that will enable the future force. In addition, new processes and governance will allow empowered decision-making at appropriate levels across AFC, minimizing delays in executing a wide range of programs and efforts. Unity of Effort is intended to move the Army out of its current "silos and stovepipes" to a highly integrated and prioritized set of outcome-focused processes that provide early feedback, adoption and maturation of promising concepts and technologies.

There are three highly integrated, major focus areas in AFC. The first focus area will lead the careful collection, development and assessment of data, forecasts and concepts to clearly identify and prioritize future needs and opportunities. Based on these prioritized needs, the second focus area begins the process of conceptualizing new and effective solutions that use iterative and integrated experimentation and prototyping to generate knowledge. This knowledge enables innovative "materiel" development and operating concepts to deploy the materiel effectively. Finally, the third focus area refines and engineers the materiel so that it can be scaled for stable, reliable manufacturing and fielding.

AFC will also synchronize efforts across the current Cross Functional Teams (CFTs), ensuring they remain aligned against the Army's modernization priorities to develop requirements informed through experimentation and technical demonstrations. Currently there are eight CFTs: Long-Range Precision Fires; Next Generation Combat Vehicle; Future Vertical Lift; Army Network; Assured Position, Navigation and Timing; Air and Missile Defense; Soldier Lethality; and Synthetic Training Environment.

To ensure rapid management of both issues and opportunities, the AFC Fusion and Integration Center (FIC) will serve as AFC's "nervous system." Composed of representative experts from the diverse elements of AFC, the FIC will monitor, assess, and fuse information vertically between the Department of the Army senior leaders, AFC headquarters and the suborganizations, and horizontally across the suborganizations and external seams within the Army (e.g., the Training and Doctrine Command, Forces Command, and the Army Materiel Command as well as external partners (e.g., industry, academia and other government agency interfacing). AFC is developing metrics, analytics and an integrated information "dashboard" that will allow the FIC and the AFC as a whole to quantitatively and qualitatively assess the modernization enterprise. These metrics will include, but are not limited to, assessing tempo/speed, guality and effective use of resources to ensure timely delivery of strategic and "best of breed" warfighting solutions.

Strategic Partnerships

AFC will provide new and more efficient pathways to connect with both established and emerging strategic partners to better achieve, implement and sustain Army modernization outcomes. These partners include other ACOMs such as U.S. Army Training and Doctrine Command, Army Forces Command, and Army Materiel Command, as well as the Army Special Operations Command, Medical Research and Materiel Command, the Army Engineer Research and Development Center, and the Army Space and Missile Defense Command.

However, AFC will also seek entirely new modes to develop strategic partnerships to identify and accelerate technology development. For example, AFC's Army Applications Laboratory will focus on opportunity-based development that employs novel business methods and authorities to accelerate the discovery and implementation of technology for both known and revolutionary new Army applications. Finally, AFC will seek new and innovative ways to engage and share with other DoD technology communities and accelerators such as the Defense Advanced Research Projects Agency, Defense Innovation Unit Experimental, the Defense Innovation Board, the Army Venture Capital Initiative and the Army Science Board.

The Way Ahead

The Army Futures Command will be a learning command – one that will create and encourage a culture of experimentation not just in its laboratories or testing facilities but also anywhere and everywhere a demonstrable improvement can be made in the Army future force modernization enterprise. Innovations can include not just new robots that can maneuver flawlessly in highly contested and congested operational environments but also the use of new acquisition authorities to speed procurement, new local and national partnerships to attract critical talent, and strategic leveraging of industry, academia and other government agencies to deliver more complex, resilient and integrated warfighting capabilities. The rapid pace of science and technology advances, together with our adversaries' growing ability to exploit such advances, demands that we take action. Thus, the mission of the AFC is to provide our Soldiers the weapons and equipment they need, when they need them, to ensure clear overmatch and success on future battlefields.

HOLISTIC PREVENTION MULTIFACETED PROACTIVE READINESS MAINTENANCE CHECK OR REALITY CHECK: THE CHOICE IS YOURS

Although preventive maintenance checks and services, routine maintenance, and diagnostics may seem trivial and easy to skip, failing to perform them — and to do so correctly — can have dire, costly, and possibly even fatal consequences.

By Michael S. Hendrickson, Abrams Group, Tank Maintenance Team Leader, U.S. Army Tank-automotive and Armaments Command, Integrated Logistics Support Center



SPC Derek Sparks, a 106th Support Battalion track vehicle mechanic, guides an M88 Recovery Vehicle as the track is pulled back onto an M1A1 Abrams tank near Orogrande, NM. The repair work performed by Sparks and his crew is vital for the tank to continue its mission. (U.S. Army National Guard photo by SGT Brittany Johnson)

When preventive maintenance checks and services (PMCS), routine maintenance, and onboard diagnostics are woven together, they provide a holistic approach to maintenance readiness. Each facet is important, and discounting or ignoring them can have very negative and costly results.

What really should be included in the abbreviation PMCS is the word scheduled. All of our equipment is going to need to be serviced and repaired; however, rather than waiting for a failure, we schedule the maintenance action using PMCS. This enables us to dictate the time and the place for the maintenance. How many times have you been forced to perform maintenance in adverse conditions like mud, snow or sand? PMCS is designed to minimize those instances.

High operating tempo and low manning levels make PMCS an ongoing challenge during training and deployments. Harsh environmental conditions spur high demand for repair parts for certain vehicles. Mileage on vehicles driven one month in Iraq may exceed that for a similar vehicle driven one year elsewhere. The extra weight of reactive armor and the high operating tempo in the area of operations will cause frequent failures. All of these factors make PMCS and proper scheduled maintenance highly important. To ensure equipment readiness, maintainers must enforce unit standing operating procedures and be vigilant of developing trends. Too often, leaders treat PMCS and stringent dispatch procedures as a garrison/peacetime endeavor. However, I can personally say that during my Operation Iraqi Freedom

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HOLISTIC PREVENTION MULTIFACETED PROACTIVE READINESS



A Soldier from 1st Battalion, 8th Infantry Regiment, 3rd Armored Brigade Combat Team, 4th Infantry Division, maintains the tracks of an M1A2 Abrams tank as part of routine maintenance. (U.S. Army Photo by SSG Corinna Baltos)



SPC Derek Sparks, a 106th Support Battalion track vehicle mechanic, removes an M1A1 Abrams tank track pad near Orogrande, NM. The tank track had broken en route to conducting live fire. (U.S. Army National Guard photo by SGT Brittany Johnson)

rotation in 2004-05, we maintained a rigorous program that resulted in nearly zero recovery missions due to mechanical failures. We had our share of improvised explosive device battle damage recovery missions, but zero for preventable occurrences.

Small Errors, Big Prices

Now let's imagine an instance involving a failure to correctly perform a crew-level PMCS task for the Abrams tank. The after-operations PMCS check requires adjusting track tension. During this adjustment task, the tank driver moves the tank forward prior to adjustment. The correct procedure when doing this is to coast to a stop. Imagine, however, that your driver has developed a bad habit of using the brakes rather than coasting to a stop. Applying the brakes rather than coasting causes uneven tension in the track, resulting in reduced tension near the front of the track. During the tension adjustment, this slack is removed, but it results in the track actually being too tight, causing stress on all its components. A few weeks pass and you begin to notice that the end connectors are developing a groove pattern and your sprockets begin to show signs of cupping (having a curved ridge instead of a smooth surface).

That minor error just cost the crew hours of backbreaking maintenance. You will now have to replace numerous end connectors and reverse or replace both of the drive sprockets. Additionally, you've quickly reduced the overall life of not only the end connectors and sprockets but also the internal bushings. (Bushings help keep the tracks in alignment, so wearing them down can result in thrown track from tracks becoming too loose or coming off.) That is a quick escalation from a simple five-minute PMCS check to costing thousands of dollars and numerous man-hours in labor to replace the track before its expected life.

The impact doesn't stop there; the effects are potentially more far-reaching than a single Abrams tank. At the national level, the item manager has not forecasted for this premature failure. Similar behavior across the fleet is driving a spike in demand. Now there may not be enough stock on hand when needed.

With regard to monthly PMCS, leaders frequently preach, "Make sure you do your before, during, and after PMCS," but what about those weekly or monthly checks — aren't they important? Once again, let's look at the Abrams tank. Monthly PMCS item #1 is for the engine exhaust seal. That seems simple enough; however, the grill doors are heavy and a pain to open. The crew says, "We can probably skip this" and moves on.

Fast-forward in time. While maneuvering on a miserable, dark, rainy night, suddenly a message alerts you that there is a fire in the engine compartment. The driver is already engaging the 2nd shot fire bottle (a fire extinguisher used manually when the automatic fire suppression system does not extinguish the fire completely),

and you quickly execute a crew evacuation of the vehicle. You're now out of the fight, smoke is smoldering from the engine compartment, and everyone is speculating about the cause and the extent of damage.

The next morning at first light, safety and fire personnel and leadership are also very interested in why the alert came on in your Abrams tank. Opening the rear grill doors, you notice they weren't exactly secure. Swinging the doors open, we see the exhaust gasket is in really bad condition. It shows signs of wear and damage that are well beyond the criteria in the Technical Manual. Maintenance pulls the power pack, and this time you're fortunate: It's only the generator and a wiring harness that have sustained fire damage. Even on the cheap side, neglecting to perform that simple monthly check cost your unit about \$25,000. This time you got lucky, but next time it could also include the loss of the entire power pack in your Abrams. That's a potential cost to your unit of approximately \$750,000.

HOLISTIC PREVENTION MULTIFACETED PROACTIVE READINESS

Routine Maintenance: Anything but Routine

Regarding routine maintenance, this is where we take a holistic approach to maintaining our equipment. It entails field-level mechanics performing the semi-annual, annual, and biennial services as well as after-operations maintenance practices. These maintenance operations demand as much leadership involvement as the crew-level PMCS.

When I was the warrant officer stationed at Fort Riley, KS, back in 2002, our battalion had the oldest fleet of M1A1 tanks. Maintaining them was a challenge, so much so that we frequently missed the Army's standard of 90 percent operational rate. We were scheduled to deploy our Abrams to the National Training Center for an early spring force-onforce rotation. Needless to say, many were concerned about how our fleet would perform, especially since the previous rotation experienced five engine fires.

Undaunted, my battalion executive officer (XO) developed a predeployment service to ensure our success. This entailed pulling 100 percent of the power packs, steam-cleaning the hulls, and inspecting the power pack to ensure all of the wiring harnesses and generator connections were a mirror image of those published in the Technical Manual. Furthermore, prior to installing the power pack, the battalion commander, the battalion XO or I had to conduct a quality assurance inspection.

This was a bit draconian, but it directly resulted in an extremely successful National Training Center rotation. The tank companies all crossed the line of departure for every battle with 90 percent and greater combat power, and we experienced zero engine fires. Was our equipment any better than previous task forces? No, we simply implemented rigorous maintenance standards that enabled us to achieve a tremendous maintenance program when provided the required Class IX repair parts.

Diagnostics: Caring About the Code

We've come a long way in diagnostics since the Abrams was fielded back in the 1980s. Troubleshooting once required the maintainers to carry seven boxes of test equipment that consumed valuable space in their maintenance vans. Today, the same test capability is performed by the vehicle itself. Although the system is automatic, it still requires interaction with the crew. Failure to complete the entire built-in diagnostics and fault isolation process can lead to catastrophic results.

Let's explore the conditions that would eventually result in a main nuclear, biological, chemical (NBC) filter fire, with the driver in the hospital fighting for his very life. Semiannual service had just been completed for the Abrams tank. Shortly after starting field maneuvers, the vehicle self-test triggers a Cable Disconnect Warning message. The crew investigates and believes it is an erroneous message, as all systems appear to be fully operational. Maintenance instructs the tank commander (TC) to perform the built-in Fault Isolation Test (FIT), and the TC reports back that he has a TP(test procedure) 438 code. Maintenance dismisses the code as the connector is underneath the bolt-on armor, well secured inside the main NBC compartment, and they're positive the cable is connected. A function test of the NBC system convinces everyone the TP message is a false positive. In fact, the crew is instructed to ignore future TP438 messages. The crew continues operations, repeatedly dismissing the TP message.

Then one day during gunnery, while operating the main NBC system, the driver notices a sudden rise in the temperature of the NBC air flow. Before he can further communicate, he is quickly overcome by the toxic hot gases from the charcoal filters that are on fire. The TC immediately responds, the crew conducts evacuation, and while outside the vehicle they realize the driver is still inside. The crew is yelling the driver's name, unaware he is unconscious. Smoke has filled the crew compartment. Miraculously, the crew is able to extract the driver; however, the endeavor to rescue the driver results in other crew members sustaining severe burns and carbon monoxide poisoning.

The accident investigation team determines the results of the fire were directly caused by a failed mechanical component of the main NBC system. It is further determined the warning system and auto shutdown failed due to a disconnected cable – the very one that had been reported to the crew and maintenance via TP438. This further illustrates the importance of fully investigating diagnostic results.

In summary, maintaining Army combat equipment is vital and requires direct involvement by leaders at all levels. All aspects of PMCS, routine maintenance and diagnostics combined and executed to standard will provide the maneuver commander maximum combat power to engage and destroy the opposition. Leaders are most effective when they are visible. I would challenge leaders to join me in my effort to get out from behind the desk and spend as much time as possible with the troops that are actively engaged in executing the multi-echelon maintenance requirements. Those young Soldiers and junior officers are the future of our Army. We owe them our active involvement and mentorship.





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ARMY PREPOSITIONED STOCKS: WORLDWIDE ASSETS FOR GLOBAL FORCE PROJECTION

MG Duane A. Gamble assumed the duties as Commanding General of the U.S. Army Sustainment Command, Rock Island Arsenal, Illinois, in July 2017. He previously served as the commanding general of the 21st Theater Sustainment Command headquartered in Kaiserslautern, Germany. Prior to that, he served as the assistant deputy chief of staff for Logistics (G-4) at Army headquarters, Pentagon, Washington, D.C. Before joining the Army staff, Gamble had served as the deputy commanding general of the 1st Sustainment Command (Theater), headquartered at Fort Knox, Kentucky. He also served as commander, 528th Sustainment Brigade (Airborne), supporting Army Special Operations Forces in Iraq, Afghanistan and the Philippines, among numerous other command and staff assignments throughout his 33-year career.

Gamble earned a Bachelor of Arts degree from Western Maryland College and was commissioned as an Ordnance officer in May 1985. He has earned Master of Science degrees from the Florida Institute of Technology and from the Industrial College of the Armed Forces.

A&M: What can you tell us about the Army prepositioned stocks program?

MG Gamble: The Army prepositioned stocks (APS) program constitutes one of the three legs of the strategic mobility triad: airlift, sealift and prepositioning. APS exists to reduce deployment response time and the initial amount of strategic lift required to support continental U.S. (CONUS)-based power projection and to sustain the Warfighter until sea lines of communications with CONUS are established and industrial base surge capacity is achieved. APS is owned by Headquarters Department of the Army and managed by Headquarters Army Material Command, Office of the Surgeon General, and the Defense Logistics Agency.

There are several categories of APS: prepositioned unit sets, operational project stocks, Army war reserve sustainment stocks and war reserve stocks for allies. Prepositioned unit sets are built to reduce deployment response time and support the Army's force projection strategy. Unit sets are comprised of combat equipment (known as major end items) and supplies (also known as war reserve secondary items). Operational project stocks are equipment not found in Army unit authorizations. These are tailored to provide key strategic capabilities required by combatant commanders in support of contingencies, humanitarian assistance and disaster relief. Army war reserve sustainment stocks are assets intended to sustain the fight by replacing combat losses and supplies consumed in battle. War reserve stocks

MG Duane A. Gamble

Commanding General U.S. Army Sustainment Command

for allies are owned and financed by the U.S. but released to the appropriate Army component commander for transfer to supported allied forces under the Foreign Assistance Act.

APS are important components of total Army readiness and global force projection. As the Army becomes increasingly expeditionary, the ability to rapidly deploy troops from home stations to the battlefield with access to ready, modern, combat-configured equipment is paramount. Combat-configured APS serve as a strategic deterrent and, when called upon, APS provide the combat equipment required to respond rapidly and win.

A&M: Where are APS located and what equipment is stored there?

MG Gamble: APS assets are located worldwide in North America, Europe, South Korea, Japan, Kuwait, Qatar, and at Guantanamo Bay, Cuba. The equipment stored at each location is based on the operational needs of the combatant commander in the associated theater of operations. Critical equipment stored at the various locations



COMMANDER'S CORNER



Configured-for-combat equipment is issued to the 155th Armored Brigade Combat Team during their draw from APS-5 in Kuwait during Operation Spartan Shield. (U.S. Army photo by Justin Graff, 401st AFSB public affairs officer)

includes major end items such as tanks and combat vehicles, medical equipment sets, engineering sets, and artillery systems that make up armored and infantry brigade combat teams, sustainment brigades, and other critical unit sets.

A&M: What can you tell me about the transition from combat-capable APS to combat-configured APS?

MG Gamble: The commanding general of Army Materiel Command, GEN Gustave Perna, directed the change in configuration of APS from combat-capable to combat-configured in order to increase combat readiness of APS sets worldwide and enable the rapid employment of units drawing APS. The Configured for Combat (CFC) implementation plan is in progress and runs through fiscal year 2024.

Transitioning to a combat-configured APS program provides Soldiers with critical enabling technologies that provide decisive overmatch to shoot, move, communicate and protect. The ultimate goal is to store and issue equipment in a ready-to-fight configuration with command, control, communications, computers, intelligence, surveillance and reconnaissance enablers to allow for a quick response to any OPLAN [operation plan] or contingency requirement. A vehicle that is combat-configured includes all its corresponding basic issue items, combat enablers and Soldier technologies installed on the vehicle. The vehicle also contains high-performance fluids and receives more frequent routine maintenance. As a result, APS vehicles are maintained at a higher state of readiness and therefore enable deploying units to be employed more rapidly by the combatant commander receiving expeditionary Army force. A&M: Are there any examples of an APS equipment set that has completed or is in the process of transitioning from a combat-capable to combat-configured set?

MG Gamble: The 403rd AFSB [Army Field Support Brigade] transitioned APS-4's ABCT [armored brigade combat team] equipment set to a configured-for-combat posture during the last year. Combat-configured vehicles have all the basic issue items and Soldier technologies colocated, installed and configured within the platform. During the transition, the AFSB also rewarehoused the ABCT equipment, storing it by UIC to enable rapid deployment. APS-4 is managed and maintained by the 403rd AFSB and contains multiple brigade equipment sets, support element sets and a watercraft set.

A&M: What are the benefits of CFC?

MG Gamble: Maintaining and configuring APS equipment in a combatconfigured state increases readiness, enables deploying units to rapidly draw and employ APS, and reduces intratheater distribution requirements, timelines to assemble APS unit sets from storage to issue configuration, and the amount of time the gaining unit spends in the tactical assembly area installing and configuring equipment. This leads to rapid employment of forces once on the ground.

A&M: What are some of the challenges with the transition?

MG Gamble: Implementation timelines for CFC initiatives are aggressive, and modification to the Army Regulations and Technical

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Manuals governing the configuration and use of APS requires updates to reflect the shift from maintaining and configuring APS in a combat-configured versus combat-capable state. It's a significant and lengthy effort to change Army regulations, and it is challenging leaning forward to implement CFC initiatives without supporting regulatory guidance. In addition, equipment authorized in APS unit sets did not historically include CFC enabling equipment; instead, APS unit sets relied, by design, on units deploying some equipment from home station and installing this equipment into APS combat platforms after they arrived in theater. Transition to CFC posture requires an increase in APS equipment authorizations in order to reduce or eliminate requirements of units to deploy. Authorizing new equipment throughout the program is a cumbersome process and forces APS to compete for modernized equipment that is often in short supply throughout the Army. Sourcing CFC enabling equipment also introduces new security requirements and labor skillsets into the program that compete for APS funding.

A&M: Is there an example of an APS set being issued to a unit in the new configuration?

MG Gamble: I have several examples. Most recently, the 401st AFSB completed the largest ever equipment issue from Army Prepositioned Stocks-5 on July 9. The 401st AFSB issued a full armored brigade combat team equipment set to the 155th ABCT in support of Operation Spartan Shield. More than 13,000 fully mission-capable

pieces of equipment were issued to the 155th ABCT during the process. Only five end items were deemed non-mission-capable. These are being repaired and will be issued once they are ready.

The equipment draw with the 155th ABCT was excellent in terms of readiness levels, efficiency and attention to property accountability. CFC equipment sets contribute to all of those things, but most importantly, we want to make sure our capabilities with APS equipment are effective. We had been testing and fine-tuning the assembly and issue process with CFC equipment sets since the beginning of the year in order to maximize effectiveness.

The 401st AFSB issued 257 pieces of equipment from an Army Prepositioned Stocks-5 armored brigade combat team set during an issue exercise in January. The exercise, led by the Army Field Support Battalion-Kuwait, was intended to test the battalion's ability to rapidly issue newly combat-configured equipment and test the overall functionality of combat configuration concepts. Soldiers with the 1st Battalion, 37th Armored Regiment, 2nd ABCT, 1st Armored Division (2/1 AD) acted as the gaining tactical unit for the exercise.

The exercise provided an opportunity for the AFSB-Kuwait to show and teach Soldiers how equipment is supposed to be arranged on a platform. It also provided an opportunity for the gaining tactical unit to give feedback about the equipment based on combat experience. When a fault on a vehicle is identified during the issue process, the 401st AFSB maintenance teams attempt to fix the fault within two hours. If a repair can't be made within two hours, the vehicle is replaced with another of the same platform. The speed at which a





Awaiting forward transport, vehicles are staged at an Army Prepositioned Stocks-5 warehouse during a large-scale equipment issue to the 155th Armored Brigade Combat Team, at Camp Arifjan, Kuwait. (U.S. Army photo by Justin Graff, 401st AFSB public affairs officer)

non-mission-capable vehicle can be replaced with a fully functioning vehicle is greatly improved through combat configuration of APS-5 equipment sets.

The 401st AFSB issued the first combatconfigured equipment set from APS-5 to the 1st Battalion, 37th Armored Regiment, 2/1 AD, in May. It marked the first time a fully combat-configured equipment set was issued from APS-5 since the transition from combat-capable to combat-configured began in 2017. A total of 2,222 pieces of equipment were issued from APS-5 in the form of a combined arms battalion and forward support company.

Issuing that combined arms battalion to 2/1 AD was significant because we were able to truly hone our processes and build confidence in our ability to put this equipment in the hands of the Warfighter both safely and effectively, and it allowed for equipment to move forward ahead of the 155th ABCT's arrival so there would be no gap in coverage for the OSS area of responsibility while those two brigades rotated in and out.

A&M: How confident are you in the readiness of APS assets?

MG Gamble: I am extremely confident in the readiness of global APS assets, and ongoing CFC initiatives continue improving readiness and speed of deployment and employment. In the past, units falling in on APS deployed with their organic enabler equipment and installed and configured after issue. This process could require weeks and months impacting the deploying forces' ability to respond to a crisis. While the CFC initiative is not fully funded for full spectrum operations, the Army begins receiving partial funding in fiscal year 2019. Implementation is prioritized to enable the most critical platforms and sets first, equipping them with command, control, communications, computers, intelligence, surveillance and reconnaissance equipment such as radios and mounts, vision enhancement equipment, and friendly force tracking platforms. Combatconfigured APS equipment improves readiness, saves time and reduces the burden on strategic lift capacity.



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DEVOPS DELIVERS INNOVATION THROUGH SOLDIER FEEDBACK

The opinions of rank-and-file Soldiers may often be unsought, but not so with the DevOps model of developing and fielding new technology. PEO C3T reveals how this approach has been successfully used in improving new technology by putting it in the hands of Soldiers early in the development process. By Justin Eimers, PEO C3T Public Affairs



MAJ Jerry Jones and CPT Monica Holmes demonstrate the Command Post Computing Environment (CP CE) at Aberdeen Proving Ground, Maryland. CP CE will speed up the integration of new capabilities through its common user interface. (U.S. Army photo by Dan Lafontaine, PEO C3T Public Affairs)

"The ear of the leader must ring with the voices of the people." These words from Woodrow Wilson echo loudly across today's Army. As the force faces potential peer adversaries, it searches for solutions to reduce traditionally long acquisition timelines and modernize its tactical network more rapidly. In support of this effort, program offices and cross-functional teams have embraced a Developmental Operations (DevOps) model, incorporating Soldier feedback from the early stages of the acquisition process and driving rapid improvements in critical mission command and tactical network systems.

The Army's Network Modernization strategy focuses on four modernization priorities known as lines of effort (LOEs): creating a unified network transport layer, building a common operating environment for mission command applications, improving Joint Force and coalition interoperability, and improving command posts' mobility and survivability. Each of these LOEs utilizes DevOps to leverage experimentation, place capability in the hands of Soldiers early on in development, and inform design choices for the delivery of future warfighting systems.

DevOps in the Command Post

To meet the needs of improving command posts' mobility and survivability, the U.S. Army Project Manager (PM) Mission Command, assigned to the Program Executive Office Command, Control, Communications-Tactical (PEO C3T), has employed the DevOps model throughout the development of the Army's Command Post Computing Environment (CP CE). CP CE will consolidate current mission command systems and applications into a single user interface and allow commanders to see the same common operational picture. It also supports collaboration using a common picture with Joint and coalition mission partners and can leverage cloud and edge computing capability.

"Everything we've done up to this point with CP CE has been centered on Soldiers and early Soldier feedback," said LTC Shermoan Daiyaan, Product Manager for Tactical Mission Command, assigned to PM Mission Command. "From the day we got the capability, we've constantly been putting it in the hands of Soldiers for them to give us feedback."

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DEVELOPMENTAL OPERATIONS SPEEDING ACQUISITION TIMELINES



Soldiers with the 67th Expeditionary Signal Battalion, 35th Signal Brigade, receive new equipment training on the Terrestrial Transmission Line of Sight radio (TRILOS) at Fort Gordon, Georgia. The TRILOS is significantly smaller than the legacy High Capacity Line Of Sight radio that it replaces. (U.S. Army photo by Amy Walker, PEO C3T Public Affairs)

By extending the framework of CP CE – being able to modify the system and write new capabilities on top of the existing one – PM Mission Command has been able to add features needed to carry out the mission and also ones suggested by Soldiers in the field. Variable Message Format was added to the software to serve as primary data exchange for messaging; three-dimensional maps and a DVR playback-like capability are currently undergoing lab testing at Aberdeen Proving Ground, Md., as a result of feedback from Soldier user juries.

Considering the need for command post mobility and survivability, CP CE has incorporated significant size, weight and power reductions. The hardware-dense information systems that reside in current command posts rob units of mobility because of the labor-intensive processes to transport, set up, initialize, maintain, and dismantle. New Tactical Server Infrastructure version 2 (TSI v2) server stacks will provide increased capacity and capability with three versions – small, medium, and large – depending on the mission need. CP CE infrastructure software will be integrated and automated with the server hardware to eliminate the need for manually loading the software.

"We're fielding a different baseline of hardware with TSI. Currently, the Army has nine server stacks dedicated to mission command that weigh 1,200 pounds, while TSI v2 features one 350-pound stack," said Daiyaan. "When the CP needs to move quickly, a nearly 900-pound reduction is huge."

Program Offices are using prototyping to help inform requirements through early Soldier involvement. Targeted R&D efforts with the Communications-Electronics Research, Development and Engineering Center (CERDEC) are focusing the lens on improving units' expeditionary command post capabilities and provide more mobile, scalable, and survivable platforms. The Command Post Integrated Infrastructure (CPI2) effort ensures communications hardware and mission command application integration across platforms. The first part of the incremental approach, underway now, equips selected units with mobile platforms, secure wireless, and intelligent power solutions. Units then conduct their own integration of systems onto platforms in order to inform future command post designs. The second increment, beginning in fiscal year 2019, involves equipping five Brigade Combat Teams with mobile command post prototypes.

"The outcome of this experimentation will inform both the CPI2 requirements and designs going forward. Together these phases will enable final command post solutions to be designed, integrated and provided to the Army through an established program of record," said Veronica Ewing, Deputy Project Manager for Mission Command.

With its role as the program's central integrator, PM Mission Command is working to meet the necessary acquisition milestone to execute both the directed requirement and the formal CPI2 Program of Record at such time that the Army Requirements Oversight Council approves the CPI2 capability development document. A capability development document captures the information necessary to develop

proposed programs, normally using an evolutionary acquisition strategy.

CPI2's strategy is to bring together existing programs through a system of systems approach to achieve the Army's vision. To keep pace with the rapid pace of technology advancements, the program will also work closely with the Army's organic research community.

"We'll be synchronizing with our S&T and PEO partners to determine when solutions reach a mature technology readiness level," said LTC Antonio Sanchez, Product Director for Strategic Mission Command.

"We'll continue to identify future S&T efforts, and then based on the schedule, see where those transition points can be inserted into production. We'll leverage the expertise of the Army's scientists and engineers in these technical disciplines."

PM Mission Command is also using DevOps to explore potential improvements to the Army's critical friendly force tracking system Joint Battle Command-Platform (JBC-P). Responding to units' requests to take JBC-P features outside their mounted platforms, Army researchers are prototyping options for experimentation. The project, known as Expeditionary JBC-P (X JBC-P), aims to inform future decisions to deliver the vehicle-based Blue Force Tracking system's capabilities to dismounted Soldiers. The goal is to develop a kit that is lighter and smaller, has a longer battery life, and is safe for Soldiers to use while dismounted. The components taken from the currently fielded mounted JBC-P system are too cumbersome and heavy for a Soldier to carry for long distances in a rucksack.

The partnership between CERDEC and the Program Office is yielding significant results for DevOps assessments, said J. Tyler Barton, science and technology demonstration-objective manager

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DEVELOPMENTAL OPERATIONS SPEEDING ACQUISITION TIMELINES



First Lieutenant Michael Austin, platoon leader for Attack Co., 1st Battalion, 503rd Infantry Regiment, 173rd Airborne Brigade, communicates with his company commander through the Integrated Tactical Network during a live-fire exercise in Grafenwoehr, Germany. (U.S. Army photo by SPC Joshua Cofield, 173rd Airborne Brigade)

for expeditionary mission command with CERDEC's Command, Power and Integration Directorate.

"Working on this project with PM Mission Command and tactical units has enabled CERDEC to rapidly provide operational capability to the Warfighter, successively providing improvements over a fourmonth sprint," he said. "It's been incredibly rewarding to see our concepts, analysis, designs, and adaptations go so quickly from the whiteboard into the hands of Soldiers."

Building Tactical Network Transport Through DevOps

In June, Soldiers in the 67th Expeditionary Signal Battalion (ESB), 35th Theater Tactical Signal Brigade (TTSB) at Fort Gordon, Georgia, became the first unit equipped with the expeditionary Terrestrial Transmission Line-of-Sight (TRILOS) radio after new equipment training and fielding from Project Manager Tactical Network and the Communications-Electronics Command (CECOM). To speed development, the PM relied heavily on Soldier feedback from pilot units, enabling the PM to continually improve the new systems prior to formal fielding.

"The importance of Soldier feedback is paramount," said CW2 Randy Smith, network operations technician, 67th ESB, 35th TTSB. "If you give a system to a Soldier they'll show you how to break it, so by allowing them to work on it, troubleshoot and then observing what their needs are with it, you'll be able to fine-tune whatever lesson plans, instructions, tactics, techniques and procedures you are providing."

The TRILOS radio sets up rapidly for robust expeditionary tactical network communications in a small form factor system that provides significant size, weight and power reduction compared with the legacy at-the-halt High Capacity Line of Sight (HCLOS) radio.

"The moment that we got the TRILOS out and we set up the tripod ... we could tell they took a lot of time getting feedback from Soldiers," said SSG Brad Bowen, Bravo Company, 67th ESB network operations. "It's a much more thought out system, from the tripods to the antennas to how it interfaces with our current communication equipment. Soldiers seem to be able to comprehend this system much quicker."

Following the DevOps process, the PM took Soldier feedback from the operational test last July directly to its industry partners. Together they integrated 12 refinements to the TRILOS radio within 45 days of the conclusion of a Network Integration Evaluation (NIE). The PM then demonstrated these enhancements during a full follow-on capability demonstration last September at Fort Hood, Texas, which enabled the 57th Expeditionary Signal Battalion and the 11th TTSB to see firsthand that its feedback had been heard and implemented and to ensure that the capability was ready to be fielded.

"What I thought was most impressive was the follow-up and then the response time in terms of speed to action," said LTC Patrick Lane, Commander of the 57th ESB.

The Integrated Tactical Network and the Next Step

The Army Network Cross-Functional Team (CFT) is conducting experimentation to provide a portable, medium-to-high bandwidth beyond-line-of-sight communications and networking capability to allow Brigade and below formations to network locally and access mission command voice and data. Known as the Integrated Tactical Network, or ITN, the effort will enable commanders to lead and fight their formations from anywhere they choose.

"As new threats emerge, as new conditions emerge that commanders will have to operate in, the network is going to have to adapt," said CW5 Brian Wimmer, senior technical advisor to the Network CFT. "It won't be a snap-to-chalk line network where we're going to field you all this kit and everyone's going to have the same radio."

The ITN began as a company-level DevOps experiment using a secure but unclassified network capability focused on the tactical edge by the 1st Battalion, 508th Parachute Infantry Regiment (1-508 PIR) of the 82nd Airborne Division. Success of the company event led to the equipping of the battalion for a Joint Readiness Training Center rotation last November, followed by platoon-level training exercises at Fort A.P. Hill-held this March-that expanded to include mission command capabilities. Program Offices are working closely with the Network CFT on the experimentation and proof-of-concept efforts underway with U.S. Army Forces Command units, including the 1-508 PIR and 1st and 2nd Security Force Assistance Brigades.

The outcomes of this process will inform technology selection and product development for future tactical radios products. Reaching out to industry partners and leveraging Soldier feedback from in theater, NIEs, and Soldier user juries and pilots will help the Army get needed capability into the hands of Soldiers at an accelerated pace, keeping them one step ahead as technology continues to evolve.

"The Army is working on quick-win solutions for the network while also looking for potential future capabilities," said Maj. Gen. Peter Gallagher, director of the Network CFT. "We're going to experiment, we're going to demonstrate, we're going to adapt and buy solutions that are already proven."



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ENSURING THE ARMY IS READY TO FIGHT TONIGHT

By Kim Ernzen

Kim Ernzen is vice president of the Land Warfare Systems product line at Raytheon Missile Systems in Tucson, Arizona. Before this appointment, Ernzen served as vice president of operations for RMS. Previously, she was director of Raytheon's Advanced Products Center in Dallas. Ernzen worked for the former Raytheon Aircraft division in Wichita, Kansas, for more than 10 years. She holds a bachelor's degree and Master of Science in aeronautical engineering and an executive MBA from Wichita State University.

The U.S. Army is undergoing a major transformation. To achieve balance between readiness and modernization, the Army has established a Futures Command and implemented cross-functional teams (CFTs) to address key gaps and accelerate modernization. The CFTs include Future Vertical Lift; Soldier Lethality; Next-Generation Combat Vehicle; Long-Range Precision Fires; Air and Missile Defense Capabilities; Army Network; Assured Positioning, Navigation and Timing; and Synthetic Training Environment.

Raytheon not only understands this new structure but also has an extensive portfolio of products and solutions, many of which align perfectly with the CFTs. Our existing technology can help the Army achieve its goals, and we are developing new capabilities to ensure that our ground troops can maintain an overmatch advantage.

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Command to accomplish its modernization mission.

As Vice President of the Land Warfare Systems product line at Raytheon Missile Systems, I am responsible for a wide array of weapons and other systems that help give our men and women in uniform an unfair advantage in the fight. Weapon systems such as Excalibur, TOW and Stinger align with the Army's CFTs like LRPF, NGCV and IAMD. These weapons have been proven countless times in combat. We are partnering with the Army to evolve these already advanced systems and make them even better. We are also constantly upgrading other Land Warfare Systems products such as Javelin and our targeting and reconnaissance systems.

Raytheon is working on new effector solutions. One example is our long-range precision strike missile called DeepStrike[™]. This new missile is designed to meet the Army's Precision Strike Missile, or PrSM, requirement as part of the Long-Range Precision Fires CFT. Our advanced solution features an innovative, two-in-the-pod design and an advanced guidance system. Raytheon's new long-range precision strike missile will fly farther and faster and pack more punch than the current weapon, which is rapidly approaching the end of its service life.

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Raytheon is also developing an advanced 3rd Generation Forward Looking Infrared system. This new, dual-band 3rd Gen FLIR sensor package is a leap-ahead capability that will enable Soldiers to see more than twice as far on the battlefield as with existing single band sensors. 3rd Gen FLIR is the premier sensor development program for the Army's vehicle modernization programs.

As a global company, Raytheon has solidified strong partnerships around the world. By leveraging those alliances with America's allies, our company can partner to deliver rapid, low-risk and affordable solutions.

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INTERDEPENDENT, NOT INDEPENDENT: CAPABILITIES INTEGRATION ACROSS DOMAINS

Although the U.S. military has successfully dominated operational domains in the past, adversaries' advances in technology and other capabilities make any further future control uncertain. The Multi-Domain Operations concept provides a way forward to ensure that we continue to deter aggressors across the battlespace.



Expected to be the foundation of the Multi-Domain Task Force, Soldiers with the 17th Field Artillery Brigade fire a High Mobility Artillery Rocket System at Yakima Training Center, Washington. The Multi-Domain Task Force will work with other services to be able to fight in all domains. (U.S. Army photo by SGT Jacob Kohrs)



LTG Eric J. Wesley

LTG Eric J. Wesley is currently serving as Deputy Commanding General, Futures/Director, Army Capabilities Integration Center, U.S. Army Training and Doctrine Command. Most recently, he served as the Commanding General, U.S. Army Maneuver Center of Excellence and Fort Benning, Georgia.

LTG Wesley was commissioned as an armor officer from the U.S. Military Academy in 1986. He began his career as a tank platoon leader, scout

platoon leader and battalion logistics officer in 2nd Battalion, 70th Armor Regiment, 1st Armored Division in Germany.

Some of LTG Wesley's previous service includes deploying with 2nd Brigade, 3rd Infantry Division, to Operation Desert Spring in Kuwait, followed by Operation Iraqi Freedom, where 2nd Brigade led the 3rd Infantry Division's attack into Baghdad. In addition, he deployed to Kabul, Afghanistan, serving as Chief of Current Plans for the International Security Assistance Force (ISAF) in support of Operation Enduring Freedom, and later he was the Director for Future Plans for ISAF Joint Command in Afghanistan. He then served as the Deputy Commanding General (Support) for the 1st Infantry Division followed by duty on the Army Staff as the Deputy Director for Program Analysis and Evaluation (PAE) for the Army G8.

Multi-Domain Operations (MDO) describes how the Army contributes to the joint force's principal task as defined in the unclassified Summary of the 2018 National Defense Strategy of the United States of America: deter and defeat Russian and Chinese aggression in both competition and conflict. To do either, the Army must have a viable warfighting concept. The MDO concept is designed to defeat our potential adversaries' ability to build layers of stand-off that generate political separation among the United States and its allies, physical separation of the joint force in time and space, and functional separation of the joint force and partners.

Furthermore, the U.S. has generally enjoyed domain dominance in operations over the last 15 years. That advantage will not be guaranteed in the future. To improve and increase their layered stand-off, Russia and China have increased military and technological investments in all domains challenging both our dominance and our ability to achieve a tactical advantage. Thus, the Army needs an expanded battlefield perspective that allows commanders and staffs to think through and visualize the evolving nature of warfare in all domains, in conflict and competition, in order to retain dominance and flexibility.

In the future, the Army will have to penetrate the multiple layers of stand-off. To do so, the Army must optimize domains at decisive spaces. Currently, the Army overmatches its enemies

LEADERSHIP PERSPECTIVE MULTI-DOMAIN OPERATIONS



A High Mobility Artillery Rocket System is fired aboard the USS *ANCHORAGE* (LPD 23) during Dawn Blitz 2017, a Pacific exercise that integrated Navy and Marine Corps capabilities. (U.S. Navy photo by MC2 Matthew Dickinson)

through the episodic synchronization of domains during an operation. Future conflict against a near-peer adversary capable of challenging our domain dominance negates this limited approach. Optimizing the employment of MDO offers a solution to the challenges our near peers pose. In MDO, Army forces, as an element of the joint force, compete in all domains below the threshold of armed conflict; when necessary, engage in armed conflict to penetrate and dis-integrate enemy antiaccess and area denial systems; and exploit the resultant freedom of maneuver to achieve strategic objectives (win) and force a return to competition on favorable terms.

A&M: Why is MDO so important and necessary today?

LTG Wesley: As we assessed our future ability to address the adversary's impact, we identified a potential problem: adversary stand-off. Multi-Domain Operations provides a fundamentally different way of looking at the problem of stand-off. Our adversaries have spent the last 15 years investing in tactical, operational, and strategic standoff capabilities. That investment is a direct result of our adversary's determination that engaging the United States Army in close combat results in an undesired outcome. With the stand-off problem, the question becomes: how do we prevent adversaries from creating stand-off prior to armed conflict during the competition periods - and how might we penetrate that stand-off during conflict? The essence of the Multi-Domain Operations concept allows us to reduce the stand-off challenge in competition left of conflict, to penetrate the adversary's remaining stand-off, to dis-integrate the enemy systems that enable it, to exploit the penetration, and then to return to competition. Therefore, the operating logic of MDO is compete, penetrate, dis-integrate, exploit, and re-compete. When dealing with a stand-off challenge, one must understand that we require reach - the distance and duration a unit can successfully employ military capabilities. Therefore, the primary challenge is to get inside and dismantle the adversary's standoff capability to increase reach unhindered.

A&M: Please speak to some specific ways in which the various domains (land, sea, air, space and cyberspace) will be integrated.

LTG Wesley: MDO requires practitioners to understand the interdependencies of the domains. While the degree to which each domain is involved depends on the specific challenge posed based on our adversary's capabilities, all domains will be in play. Cyberspace capabilities may be employed offensively to destroy or disrupt an adversary's integrated air-defense network in one operation, when in another operation cyberspace capabilities may be used for reconnaissance to identify types of adversary systems.

The principal idea behind MDO, however, is focusing on how capabilities in each domain enable actions in other domains and how the alignment of multiple domains creates overmatch; it is not a singular capability focus idea. What we are trying to achieve is the idea that the net effect of capabilities employed across all domains is greater than the sum of the parts. Dominance in each domain cannot be ensured; therefore, it is important to align our capabilities within each domain within a decisive space. This allows us to leverage advantages we must create in order to penetrate and dis-integrate adversary stand-off, allowing us to exploit the decisive space. The advantage of the MDO approach to warfare is an expanded perspective of competition and conflict periods in all domains.

A&M: What would you say are the greatest current challenges to achieving the goals of MDO?

LTG Wesley: The greatest challenge in MDO is command and control (C2). If you think through implications, you realize multi-domain C2 is the preeminent challenge due to the difference in the way the domains are controlled and influenced. Each domain is stewarded by various echelons and different services. This often results in difficulty when attempting to integrate domains due to the authorities granted or not granted. Cyber is one example where the authorities have historically been retained at very high levels. Joint strike fighters are managed or operated by different services, and if someone is trying to line up all five domains in an acute manner - as a target of opportunity - one can imagine that it is very difficult to do that. We execute MDO today; however, we do it episodically because of the challenge of lining up resources in the various domains. Attempting to align all of the actions from air to ground in order to have a consolidated effect can sometimes take extended periods to ensure you have a synchronized effort. This shows why the biggest challenge of MDO is multi-domain C2.

A&M: Are there any plans to get all the services collaborating in a joint effort in MDO? What are the challenges in bringing that about?

LTG Wesley: The U.S. Army Training and Doctrine Command has been collaborating on this particular topic for at least three years or so, particularly between the U.S. Air Force and the Marine Corps. Most recently, over the course of the last year, we conducted four wargames that were intended to solve specific problems that faced the joint force in a multi-domain operational environment. The Army plans to roll out MDO 1.5 for the Association of the United States Army's national event in October 2018. MDO 1.5 is a follow-on concept to a multiservice white paper titled Multi-Domain Battle: Evolution of Combined Arms for the 21st Century, 2025-2040 (Version 1.0). MDO 1.5 expands on MDB 1.0 and serves as the Army's effort to describe how we think we fit in to the joint force and what we think we can provide to the joint force. The next step in developing this concept is MDO 2.0. We have talked to the Marine Corps and the Air Force about pursuing MDO 2.0 over the course of the next year. Future operations will require us to integrate all services and all domains. MDO 2.0 can be an effort to create either a multiservice document or potentially the preliminary aspects of a joint document.

LEADERSHIP PERSPECTIVE MULTI-DOMAIN OPERATIONS

A&M: What domains do you think present the greatest challenge for the military at this time?

LTG Wesley: The challenge is not a particular domain; aligning capabilities and authorities to the appropriate echelon is. Some of these domains transcend not only tactical areas but also regions resulting in effects worldwide. Authorities that are often retained at varying levels cause immense challenges. Attempting to change that paradigm and ensure that authorities are pushed down to the right level will ensure that we achieve the correct tactical, operational and strategic effect.

A&M: What impact do you think the implementation of MDO might have on existing military units or constructs? How likely is it that MDO will make any units obsolete?

LTG Wesley: The implementation of MDO will be determined by continued experimentation, which will drive concept refinement. Based on the current concept, there is very little that may become obsolete. Roles don't decrease; they expand. While this evolution may change some aspects of warfare, many will stay the same. The land component – the land domain – will always be relevant. "Shoot, move, communicate" will always be relevant. The aspects that may change involve the expansion of roles in terms of operations in all domains. We could see units take on different forms by resizing, reorganizing, shrinking or expanding. Combat arms forces will

remain, but their organization and capabilities will change. We are going to continue to see the U.S. Army migrate capabilities downward to tactical units. That has happened for centuries. The capabilities will continue to migrate down to tactical units as the concept evolves to domain integration at the lowest realistic level. This migration is not to say that tactical units are getting overwhelmed with more requirements, but it is providing the tactical units enough capabilities to maneuver semi-independently during the fog and friction of combat operations.

Additionally, we will likely be restoring the echelons above brigade (EAB) ability to conduct integrated campaigns. In many ways over the last 20 years, EABs have been reduced to headquarters elements, whereas in the past, EABs would have conducted campaigns or campaigning operations as a formation. The intent is to work toward improving campaigning capability. Every echelon will have roles and responsibilities in a Multi-Domain Operational environment, and they will integrate domains that extend well beyond the Army while touching all aspects of the joint force.

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A DETRIMENT TO OPERATIONAL READINESS

With obsolescence and shortages in parts, the DoD is facing a demand for material perhaps like never before. What we need are industry partners that can successfully and affordably find the needed items for aircraft and other equipment. By Rick Bowver



COL (Ret) Rick Bowyer serves as the Executive Vice President for Strategic Business Development for Crestwood Technology Group. He previously served as the Fires Division Chief in Army G-8, managing the Army's Air and Missile Defense and Field Artillery portfolios.

"We cannot expect success fighting tomorrow's conflicts with yesterday's weapons or equipment. ... Our backlog of deferred readiness, procurement, and modernization requirements has grown in the last decade and a half and can no longer be ignored." –Secretary of Defense James N. Mattis, "Summary of the 2018 National Defense Strategy of the United States of America"

We are not ignoring you, Mr. Secretary! Mission-capable rates, unit deadline reports. service chief testimonies and Government Accountability Office reports all point to the same conclusion. Readiness degradation, material shortages and obsolescence challenges continue to confound the DoD. However, the demand for increased readiness is challenging for several reasons. First, increased operational tempo and training requirements have placed huge demands on fielded equipment. Second, the decrease in DoD's Modernization and Research and Development accounts has necessitated the extended use of existing equipment. Vehicles, aircraft and equipment are now well beyond their projected life expectancy. The result is an unplanned demand for repair parts that in many cases have become hard to find or obsolete.

The Defense Logistics Agency (DLA), service acquisition program offices, operational maintenance activities, and depots are all in crisis mode to find the demanded material. Additionally, changes in maintenance practices have compounded the problem due to disruptions in demand, frequency and forecastability of repair parts. When DoD acquisition centers within DLA cannot find a part, they "decertify" the National Stock Number. The number of decertifications is increasing, thus leaving the Services to find more parts on their own. Essentially, DLA's response to the Services is: "You're on your own."

To meet these new demand patterns, industry is introducing innovative engineering solutions aimed at accelerating the regeneration of parts. However, these solutions are often more costly in terms of time and money. "SD-22 - Diminishing Manufacturing Sources and Material Shortages: A Guidebook of Best Practices for Implementing a Robust DMSMS Management Program" supports this finding. Department of Commerce data indicate these types of innovative engineering solutions are up to 1,000 times more expensive than searching and finding the part first. Likewise, original equipment manufacturers offer very expensive engineering change proposals as the preferred solution. Many of these solutions are 10,000 times more expensive.

Thus, procuring the right material at the right time in the correct quantities is essential to building long-term sustainability at a more affordable cost. That is the crux of the issue. DoD is in a reactive obsolescence frenzy. Many program offices lack the predictive analytics to make prudent lifetime or safety stock buys because they didn't expect their systems to remain in service so long. The program offices that have the analytics just can't seem to find the material.

But what if there was an existing industry capability with a verifiable ability to locate, source, inspect and deliver material that is often impossible to find within the standard DoD supply chains? These components may include but are not limited to the following manufacturing/stock categories: obsolescence, end of life, and Diminishing Manufacturing Sources and Material Shortages.

What if a capable industry partner didn't ignore the problem and recognized the importance of finding material to improve readiness and could do so at a greater than 50 percent success rate? Readiness is not only critical for our Services but our Allies abroad as well. This industry partner would use proven sourcing techniques and capture lessons learned from previous successful efforts to improve the overall readiness for the Services. The result would improve cost and schedule concerns for Service programs. Additionally, a partner with obsolescence expertise would improve the short- and longterm sustainment and affordability of many legacy platforms.

Finally, it's safe to say the current reactive approach to increase readiness and material availability is ineffective. Just read the headlines. ECPs and additive manufacturing are expensive and time-consuming. But there is an alternative. For an immediate solution there are industry-capable partners that aren't ignoring the problem and are actively seeking and finding material to assist our Warfighters with great success.



Modernizing Nett Warrior

The Nett Warrior Future Initiative (NWFI) is a component of the Nett Warrior program focused on new technology. The primary role of NWFI is to recommend upgrades to the existing Nett Warrior systems that improve performance and enhance mission capability. One example of NWFI is moving from dismount-only software to that which is more common throughout various user communities. This common look and feel enhance Soldier awareness and reduce complexity of use.

The NWFI helps the program seek new technology that provides commanders with improved situational awareness, allows leaders the ability to prepare tactical orders quickly and react to the situation on the ground, and makes the unit more flexible, agile and resilient. These capabilities can also improve interoperability with coalition partners.

By employing the NWFI and communication networks, Soldiers are able to share data more effectively between NWFI users ("where am I?" or "where are my Soldiers?") and leverage external data (sensors) to enhance the Soldier's knowledge of the battlefield ("where is the enemy?").

Wearable computing faces two significant challenges, though. The first is difficulty getting a computing system integrated into the body armor and fighting load. Any wearable computer has to be positioned and sized in a manner that it does not present any interference with the primary mission and movements of the Soldier. Secondly, there are continuous challenges involved in providing power to the system. As Soldiers are provided more technology, they require more portable power. Trying to identify and incorporate these power sources into a wearable configuration continues to add to the body integration challenges and added weight.

The Nett Warrior program is encouraged by recent development and innovation by government and industry and looks forward to partnering with industry, academia, etc. to continue to provide the best capability to Soldiers.

More info: peosoldier.army.mil/



ANNUAL WARFIGHTERS TACTICAL GEAR GUIDE



The safety of Soldiers is a top priority of the Army's modernization strategy, and the updated Soldier Protection System, or SPS, exemplifies that effort. Overseen by PEO Soldier's Product Manager Soldier Protective Equipment (PM SPE), the new SPS improves survivability rates and mobility while reducing weight and stress on Soldiers' bodies. It is the result of years of collaboration that leverages science, innovation, Warfighter feedback and commercial innovation.

In fact, the Soldier Protection System is the Army's first integrated personal protective system to begin implementing the Army's goal of reducing the Soldier's load, said LTC Ginger Whitehead, Product Manager Soldier Protective Equipment. "We are trying to secure the weight reduction on the SPS program through the use of new ballistic materials and an innovative, integrated, modular design."

The SPS is composed of five subsystems that have been designed to work in harmony with one another: Vital Torso Protection (VTP), Torso and Extremity Protection (TEP), Integrated Head Protection System, (IHPS), Transition Combat Eye Protection (TCEP) and Integrated Soldier Sensor System (ISSS). By employing a modular approach, future-



Army SPS

proofing the SPS is easier as various components can be updated or altered.

VTP achieves an 8 to 14 percent weight reduction over existing plates, and TEP is now approximately 26 percent lighter. Such weight reductions would have been unthinkable only a few years ago, but the Army's investment in developing more effective armor has yielded impressive results without sacrificing safety.



Army SPS

In addition, threshold weights for the standard dismounted configuration of IHPS are now 5 percent lighter while providing superior mitigation to hearing loss.

These advancements are not created in a vacuum, though. Human factor evaluation is vital in helping determine the strengths

and weaknesses of future equipment to the force. Soldiers from various units across the country regularly participate in the feedback process as they are fitted with equipment and tested through different field trials to offer their opinions on possible improvements. With the Soldiers' feedback, engineers are able to determine if a system needs more extensive reworking, requires just a few adjustments before final production, or is ready for scaled production and deployment.

One such feedback session occurred recently at Joint Base Lewis-McChord, where Soldiers had the opportunity to evaluate the new SPS. SGT Megan Rodriguez, the unit's Evacuation Noncommissioned Officer in Charge, praised the way new uniform





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components can be scaled up or down depending on the mission. "Soldiers appreciate when a uniform fits them, is comfortable and doesn't drag them down," she said. "When a uniform doesn't fit, Soldiers start to remove their gear because it's not comfortable or it gets in the way, and then they don't have any protection, so having equipment that you can utilize based on your job and mission helps out significantly."



SSG John Perez, Non-commissioned Officer in Charge of one of the platoons, also explained how the new equipment is better for Soldiers. "The new system increases training efficiency because it is lighter, which allows us to move quicker, therefore increasing mobility compared to the previous system, IOTV [Improved Outer Tactical Vest], which was more constricting. It also has different tiers that you are able to scale to, which helps a leader decide what level protection is needed based on the mission, so for a driver he can scale down to a lower protection because he's driving, but a Soldier on foot patrol would need the full protection system for added protection," he said.

Fitting the Whole Force

Weight is not the only consideration when designing the new SPS. The Army has listened to Soldier feedback and designed components that are specific to male and female body types, a move lauded by female Soldiers.

SPC Robin Sarkisian, a logistics specialist, used the opportunity to offer her insights on the importance of female soldiers having equipment that fits them. "Speaking for the majority of female Soldiers, having equipment that fits is huge because we have other things going on, so we need to ensure that we are moving just as quickly as the males. As females we are built differently than males, so we need certain things to fit correctly because if we don't, that's going to contribute to more problems that we are already struggling to get through," Sarkisian stated.

"So to have gear that fits is going to make that much of a difference for females in the future to get to where males are in the Army now and on the battlefield. The old system was not as good because it was very heavy, especially on your head and neck, so you tend to wear out faster, get tired faster and your skills are tarnished," she said.

Back at PM SPE, LTC Whitehead elaborated further on innovations related to women. She noted that aside from being heavier and bulkier, previous versions of the SPS used helmets that had an X-formation retention strap mechanism, but this proved to be uncomfortable for female Soldiers with their hair in a bun. The new SPS has an H-back strap that fits around the bun, increasing comfort.

With an overall 10 percent weight reduction, improved mobility, better technology and considerations for the physical differences between genders, the new SPS provides the Soldier with multiple levels of ballistic protection tailorable to a broad range of missions. This modular, scalable approach increases Soldier survivability and mobility and contributes to increased force protection, bringing Soldiers home after ensuring victory abroad.



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GEAR FOR THE MARINE RIFLEMAN

"Every Marine a Rifleman." That has been the proud motto of the U.S. Marine Corps for a long time, but it takes more than words to be Marine riflemen. Equipment that boosts survivability and lethality is vital to meet the challenges that confront them on the battlefield. Accordingly, this year's Gear Guide takes a look at some of the Marine Corps' efforts to modernize gear and boost lethality for Marines right in the field, where it matters most. Whether it is increased weapon lethality, such as that of the MK13 Mod 7 Long Range Sniper Rifle; enhanced body armor protection with lighter weight, such as the benefits of the Plate Carrier Generation III; or advances in nonlethal deterrence such as the "Dazzling Laser" Ocular Interruption System, the Corps' purpose is unmistakable: Give the USMC riflemen what they need, where they need it.

Plate Carrier Generation III



Prototype of the Plate Carrier Generation III (U.S. Marine Corps photo)

Part of the Marine Corps' Ballistic Protection Systems, the Plate Carrier Generation III (PC Gen III) will be an update of the current PC fielded in 2011. Featuring a weight reduction of about 25 percent, reduced bulk, a removable soft armor vest, and an integrated load bearing

panel, the PC Gen III will increase Marine lethality while improving mobility and will provide the same form, function, and soft armor coverage as the legacy plate carrier. The PC Gen III will feature new sizes — including small short and x-small short — that can accommodate Marines of smaller stature.

MK13 MOD 7 LONG RANGE SNIPER RIFLE



The Mk13 Mod 7 Sniper Rifle (U.S. Marine Corps photo by Kristen Murphy)

The first new sniper rifle for Marines since the Vietnam War and the replacement for the M40, the bolt-action MK13 Mod 7 Long Range Sniper Rifle is chambered for the .300 Winchester Magnum caliber and provides accurate, precise sniper fire to a distance of 1,250 meters. Features include an enhanced day optic, adjustable buttstock, and bipod. The MK13 Mod 7 is the primary sniper rifle for the Marine Corps Special Operations Command and will also be the primary sniper rifle for Marine scout sniper and reconnaissance platoons.

M38 SQUAD DESIGNATED MARKSMAN RIFLE (SDMR)



The M38 Squad Designated Marksman Rifle (U.S. Marine Corps photo by Lance Cpl. Taylor W. Cooper)

A lightweight, air-cooled, and gas-operated weapon designated for squad marksman use, the M38 Squad Designated Marksman Rifle (SDMR) is magazine-fed, shoulder-fired, and equipped with an improved optic that enables precise, lethal fire up to 600 meters. Essentially an M27 Infantry Automatic Rifle with a scope, the M38 fires 5.56mm rounds — the same as the M16A4 rifle. The Marine Corps is supplying one SDMR to a marksman in each of its infantry squads.

SNIPER SQUAD RANGE FINDER (SRF)



The Sniper Squad Range Finder (Courtesy photo)

Being able to quickly determine the distance of targets can boost lethality, especially when calling in artillery and air strikes. The SRF helps snipers and squad leaders with its ability to detect targets at a distance up to 1,500 meters. Since the SRF is mounted on a rifle, a Marine can use it without having to let go of the weapon, and its Infra-Red (IR) aiming laser and IR illuminator capabilities enable Marines to illuminate or point to targets during both day and night.

SQUAD THERMAL SYSTEM (STS)

The STS will be a lightweight, monocular thermal imager that can be handheld or attached to a weapon (M16A4 rifle or M4 carbine). When used in conjunction with the AN/PVQ-31 Rifle Combat Optic (RCO), it will enable recognition of man-sized targets at a distance of at least 300 meters and possibly as far as 700 meters under atmospheric conditions providing 4.35 miles of visibility.

OCULAR INTERRUPTION (OI) SYSTEM



The Ocular Interruption System (Photo by B.E. Meyers Advanced Photonics)

Also known as a "Dazzling Laser," the OI is a nonlethal hailing and warning device intended to stop the advance of personnel who are potential threats. Featuring an eye-safe laser, it produces visual obstruction of targets by means of a glare effect that can be intensified if the need arises. The system provides various benefits, including increased safety for non-enemy personnel, reduced need for lethal force, and deterrence against unauthorized vehicles and personnel. It can be used as a handheld device or mounted on weapon systems equipped with a Military Standard-1913 rail attachment bracket.

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INDUSTRY PERSPECTIVE THE VALUE OF GUARANTEED OUTCOMES

Perspective of an Aerospace Services Provider on the Future of U.S. Armed Forces Sustainment By Ed Dolanski

Ed Dolanski is President of U.S. Government Services for Boeing Global Services. As the largest performance-based logistics contractor for the U.S. Department of Defense, Government Services is an industry leader in sustainment solutions for Boeing and non-Boeing platforms.

As the U.S. military reprioritizes readiness and U.S. policy leaders grapple with enduring challenges around the globe and competing needs at home, it's natural to ask whether resources are being allocated as efficiently as possible. In the area of defense spending, the Pentagon needs flexibility to meet emerging challenges, and that means taking a hard look at resources across the entire budget, including those allocated for operation and maintenance. The fundamental question is: How can the U.S. military improve its readiness rates without breaking the bank?

The answer may be a fresh look at a long-standing contracting vehicle known as Performance-Based Logistics. For the better part of two decades, the DoD has used this type of contract to guarantee performance and protect the defense budget from sustainment-cost uncertainty. While generally viewed as a net positive to the U.S. government, it's fair for the Pentagon's procurement experts to scrutinize these contracts to see whether they remain the best bet – and best value – for maintaining mission readiness.

Think of performance-based life-cycle support as a public-private partnership. Sustainment providers bring their expertise and



economies of scale to take on the elements of life-cycle support that could otherwise drain resources and manpower from military partners. This frees up resources for emerging needs, because the cost of sustainment is locked in.

The C-17 Globemaster III Integrated Sustainment Program (GISP) is an example of a holistic public-private partnership that is highly effective on long-established fleets. The contract includes field services, engine management, supply chain management, modifications and maintenance, and sustaining engineering – all integrated for maximum efficiency. Since 2004, this partnership has resulted in a 40 percent reduction in support dollars per aircraft while maintaining a bestin-class mission capability rate of 84 percent or better.

Take another example: a partnership to guarantee cost and availability of blades for

the U.S. Army's Chinook fleet. The agreement guaranteed cost savings of up to 19 percent over its life, but perhaps of even greater value is what the contract offered in terms of readiness and flexibility. Consider what happened when aircraft deployed in theater sustained significant hail damage. Under the terms of the agreement, the sustainment provider -Boeing - was able to transfer domestic assets to backfill depleted stock in theater, place orders for new spares, and increase industrial base build and overhaul rates within 48 hours of the event. Under a typical transactional approach, contracting for analysis, evaluating the blades, and executing the repair could have been a multi-year surge effort. Instead, it was addressed in real time, and all backlog was mitigated within 12 months.

To be sure, there are cases when individual elements of sustainment may be best handled under more traditional contracting structures or divided among services providers. A platform that is just reaching a critical mass of in-service aircraft, for example, doesn't carry decades of lessons learned like the C-17 with the aggregated GISP. Inviting multiple sustainment providers to compete for and bring innovative solutions to product life-cycle support could drive up performance and drive down cost at this stage of a platform's maturity.

As the U.S. government continues driving increased readiness levels at the best value, a contract that guarantees results and keeps budgets flexible by preventing sustainment cost surges is a winning approach.



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