THE ARMY'S OFFICIAL PROFESSIONAL BULLETIN ON SUSTAINMENT

OCTOBER-DECEMBER 2021

ARMY SUSTAINMENT

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DEMAND REDUCTION

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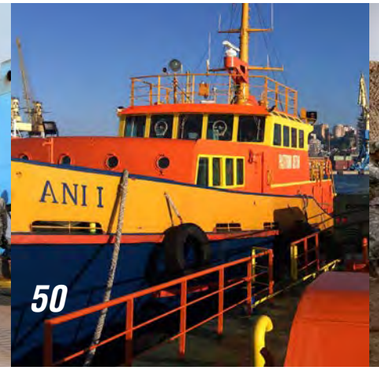

CONTENTS

"Our Army is in the midst of its greatest transformation in four decades while maintaining strategic readiness that will allow us overmatch in competition, crisis, and conflict."

Gen. Ed Daly

U.S. Army Soldiers with 2nd Battalion, 35 Infantry Regiment, 3rd Brigade Combat Team, 25th Infantry Division, are counted onto United States Army Vessel General Brehon B. Somervell (LSV-3) before setting sail on Oct. 17 at Waipio Point, Hawaii. Mission Tropic Voyage is the first time the 8th Theater Sustainment Command and LSV-3 have served as transport for maneuver elements; this training serves to increase the operational reach of the U.S. Army. (Photo by Spc. Rachel Christensen)

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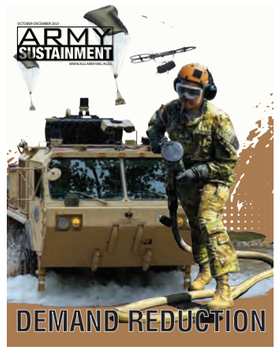

ON THE COVER

This issue's cover focuses on water, fuel and ammunition operations and shows some of the ways the Army is working toward Demand Reduction through various programs. Those three sustainment issues have the highest demand signatures and reducing their footprint is instrumental to reaching the Army's goal of operating for up to seven days without resupply. (Graphic by Sarah Lancia with U.S. Army photos)

This medium is approved for the official dissemination of material designed to keep individuals within the Army knowledgeable of current and emerging developments within their areas of expertise for the purpose of enhancing their professional development.

By Order of the Secretary of the Army:

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Mission: *Army Sustainment* is the Department of the Army's official professional bulletin on sustainment. Its mission is to publish timely, authoritative information on Army and Defense sustainment plans, programs, policies, operations, procedures, and doctrine for the benefit of all sustainment personnel. Its purpose is to provide a forum for the exchange of information and expression of original, creative, and innovative thought on sustainment functions.

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Army Sustainment is seeking articles on techniques, tactics, and procedures; emerging trends; lessons learned; and other experiences.

The editorial staff from *Army Sustainment* is seeking submissions from the community. As with all content submitted to *Army Sustainment*, it should be sustainment focused, provide professional development information, and should not contain any classified or sensitive information.

Submissions should be well-developed narrative articles and can be opinions, techniques, tactics, and procedures (TTPs), lessons learned, exploration of new technologies or emerging trends, or other similar content of a valuable nature to fellow sustainers.

General public affairs style coverage or content on units, exercises, initiatives and events that do not otherwise hold additional professional development value are typically not as strong as those submissions that offer real, actionable sustainment information.

While the editorial staff here at *Army Sustainment* do conduct our own review and editorial process and have authority to approve content submitted to us for public release, we recommend at least some basic professional coordination between the submitting author and their organization's public affairs or public information office, especially for U.S. personnel working in NATO or other multinational organizations.

Army Sustainment chooses new topics for each bulletin and accepts contributions from the sustainment field. Check out our social media, including our page on Facebook, to learn about upcoming topics.

Find more information: *www.alu.army.mil/alog/submissions.html*

Sustainers Close a Memorable Year

■ *By Gen. Ed Daly*

We are approaching the end of the calendar year 2021, and our Army senior leader priorities remain crystal clear: People, Readiness, and Modernization. As the Army's senior sustainer, I could not be prouder of the incredible work and accomplishments of the materiel enterprise these past 12 months nested with, and in support of, Army priorities.

This year left us with no shortage of demanding missions and tasks, from the COVID-19 pandemic response to ongoing contingency operations and multinational, joint exercises in theaters across the globe. Without fail, time and again, you demonstrated the resolve, determination, and innovation that has been the hallmark of logisticians throughout our history. You validated those effective operations rely on sustainment, and most importantly, the support you provided allowed our Army to successfully answer our nation's call.

While the end of the year provides a time to reflect on all that has been achieved, it's also a time to look forward. Our Army is in the midst of its greatest transformation in four decades while maintaining strategic readiness that will allow us overmatch in competition, crisis, and conflict. Sustainment transformation must keep pace to ensure freedom of action, operational reach, and prolonged endurance in support of Aimpoint 2035 and a multi-domain operation-ready force in a contested environment. This requires us to think, operate, execute, and assess differently, and it starts with envisioning the battlefield of the future, particularly from a sustainment perspective.

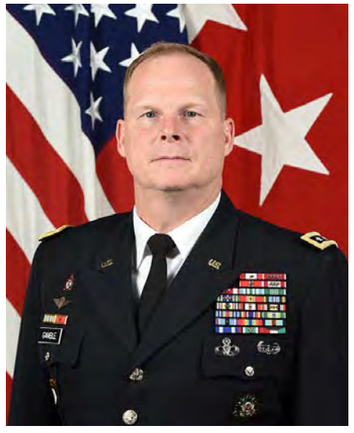
Over the next few editions of *Army Sustainment*, your fellow sustainment leaders and I will explore how we set conditions today to modernize the sustainment warfighting function from the fort to the factory to the foxhole. We know intelligence drives operations, and that operations can only be achieved with sustainment as a key enabler. Through the military decision making process, we will assess the current environment, identify facts and assumptions, visualize the end state, and determine the actions required to operate on a 21st century battlefield in an MDO environment.

As Gen. Dwight Eisenhower said, "You will not find it difficult to prove that battles, campaigns, and even wars have been won or lost primarily because of logistics." While sustainers play an integral and essential role in our Army, you operate primarily behind the scenes and out of the spotlight. This holiday season, know that our Army senior leaders see you. They—we—appreciate you, and we are proud of you. Enjoy some downtime with your families and loved ones and recharge because we need every sustainer energized and ready to approach 2022 with enthusiasm and drive.

People First. Winning Matters. Army Strong!

Gen. Ed Daly serves as the commanding general of the U.S. Army Materiel Command. He served three years as the deputy commanding general of AMC in his previous assignment. He managed the day-to-day operations of the Army's logistics enterprise, and also served as the senior commander of Redstone Arsenal, Alabama. He served as the commanding general of Army Sustainment Command at Rock Island Arsenal, Illinois, and as AMC's deputy chief of staff, overseeing the roles and functions of the headquarters staff.

Disciplined In Demand to Sustain the Future Force



■ *By Lt. Gen. Duane A. Gamble*

During Operation Iraqi Freedom's (OIF) initial combat operations, our sustainment support enabled mission execution even as the on-hand supply of several commodities tended to be lower than expected. National supply shortages and limited theater transportation capacity were challenges units adapted to by carrying what they needed until a more stable supply flow was made available. Despite the friction they caused, these supply and transportation shortages pale in comparison to the challenges we will face sustaining large-scale combat operations (LSCO) against a near-peer adversary.

At the start of OIF, our logistics system was distribution-based and operated with the luxury of near-constant connectivity between its nodes and segments. At the end of OIF's first year, we began reducing our uniformed sustainment footprint in the theater and purposefully replaced it with contracted capabilities. Year over year, this tactical logistics support enabled our operations and ensured we could minimize those challenges unique to OIF's warfighting context without necessitating exponential growth in sustainment units. Our brigade-centric structure met the needs of counterinsurgency and stability operations. Still, our transition to division and corps operations is essential to best posture ourselves for a future conflict marked by distributed, contested, and extended operations across multiple domains. Assured lines of communication and other luxuries will require disciplined and precise logistic demand to employ our sustainment force structure for greatest effect.

More doesn't always mean better and adjusting our perception of demand to this notion will be a key enabler in continually compressing that logistical tail. The goal of distribution-based logistics wasn't simply inventory reduction as a means to an end; rather, we sought to improve support efficacy and agility. The same purpose holds true for our focus on reducing logistics demand across echelons as a means of reaching our readiness objectives—such a reduction is not just austerity for austerity's sake. It is no great secret that what worked in OIF may not carry over to future conflicts, so our Army and the joint force are recalibrating our doctrine and execution toward LSCO in a multi-domain operational environment. From increased precision during the requirements determination process to added agility in the tactical space, demand reduction efforts will ensure our sustainment readiness for the next fight.

As a means of progressing from idea to concept to a guiding framework for action, Training and Doctrine Command published a white paper, Demand Reduction: Setting Conditions to Enable Multi-Domain Battle, in 2018, which outlines that in order for units to effectively conduct semi-independent operations in newly challenging environments for an extended period of time, the Army must concurrently reduce demand while improving its ability to support brigade combat teams on an evolving battlefield. Former Chief of Staff of the Army and current Chairman of the Joint Chiefs of Staff Gen. Mark Milley amplified this hypothesis in his assertion that a "massive amount

From increased precision during the requirements determination process to added agility in the tactical space, demand reduction efforts will ensure our sustainment readiness for the next fight.

of logistics" won't necessarily be as readily available in future conflicts. A unit's operational requirements that support mission readiness are derived from a commander's intent. In future operations, the evolving nature of warfare will almost certainly make our demand drivers more variable and harder to predict. Our solutions to best posture for these operations are both tangible and intangible. For example, we've already made great strides reducing battlefield demand of critical supplies like fuel by reconfiguring how we deliver this in the tactical space. Our bulk fuel distribution systems now transport over 30% more fuel with the same number of trucks, reducing fuel demand and removing vehicles from that tactical space by positively changing how we conduct organic fuel distribution to a given brigade. However, taking full advantage of updated capabilities or enabling technologies is best supported by a commitment to logistics discipline that permeates our culture. From leader education to tactics, techniques, and procedures adjustments, we are framing demand reduction as a tactical readiness enabler as agile and adaptive as the commanders it has been developed to support.

As with any initiative we undertake as an Army, leadership and culture serve as critical linchpins equally as important and foundational to success across the force as any other investment. This dynamic is no different in advancing capabilities supporting an Army fully prepared for multi-domain operations (MDO). One of those is our complete, systematic approach to demand reduction. In this edition of *Army Sustainment*, you will learn more about how the Army has already made great strides operationalizing this concept and what the path forward entails in our drive to an MDO-Ready force in 2035. From meeting demand at its tactical point of need through our support of advanced manufacturing capabilities to making best use of our enterprise sustainment data to eliminate reactive maintenance, our efforts to reduce demand all revolve around providing our commanders in the field with the materiel and decision space they need to decisively accomplish their mission.

At its core, demand reduction is neither a seismic shift toward materiel austerity nor a singular focus on using less gas on the battlefield. The effort cuts across echelons, from the organic industrial base to the close tactical area and has been built into the way we will modernize in the context of MDO. Executed properly through a clear understanding of its scope, demand reduction will effectively serve as our new status quo, driven by its cultural adoption. Our sustainment capabilities have proven to be a distinct competitive advantage over our adversaries time and again. Maintaining this edge will remain an imperative in the future.

Lt. Gen. Duane A. Gamble, Deputy Chief of Staff, Headquarters, Department of the Army, G-4, oversees policies and procedures used by U.S. Army Logisticians. He has masters' of science degrees from the Florida Institute of Technology and Industrial College of the Armed Forces.

Maintaining the Operational Reach and Technological Edge

■ *By Maj. Gen. Mark T. Simerly*

American military forces currently possess a significant advantage over peer competitors thanks to our global operational reach, the distance over which a joint force can successfully employ military capabilities. For Army formations, that distance depends largely on the ability to sustain mobile, dispersed combat formations in a contested, rapidly changing environment. Army sustainment provides the foundation of the Army's operational reach. Combat formations that lack adequate sustainment risk early culmination and, ultimately, mission failure.

The risk of failure increases as we calculate sustainment demands in the near future, especially the demand for energy. Next-generation weapons systems will enhance Soldiers' mobility, survivability, and lethality, but many, such as the recently upgraded M1A1 battle tank, are larger and heavier than systems currently in use. Other enhancements, such as the integrated visual augmentation system, require a phalanx of batteries borne by the Soldier and re-charged in the forward area. The Army's sustainment enterprise is making limited progress on its ability to support developing systems, but future energy demands easily outpace capability. In short, the Army must reverse this trend before our combat formations run out of energy.

The Plan

Army leadership has not ignored this challenge. Various agencies—including the Board on Army Science and Technology, the Army Capabilities and Integration Command, and Army Futures Command (AFC)—have published findings and recommendations intended to limit demand growth. Training and Doctrine Command (TRADOC) and AFC are teaming with universities and other external agencies to develop solutions and are focused on five priorities.

Improve Effectiveness and Efficiency

As the Army develops the ability to fight and win multi-domain operations, program managers, researchers, and corporate partners must continue pursuing increased energy efficiency and alternative energy sources. For example, most command-and-control systems now use electrical power provided by generators that run on fuel. Delivering that fuel requires a distribution network of trucks, drivers, rail cars, storage facilities, movement control teams, contractors, commanders, and staff officers at multiple echelons.

To reduce this burden, the Sustainment Center of Excellence has teamed with AFC and the Mission Command Center of Excellence to modernize command posts. One solution is the advanced medium mobile power source (AMMPS). When operated as a microgrid, this network of generators combines fuel, batteries, and intelligent power

We need to modernize our sustainment capability in step with the rest of our combat power, ensuring we maintain the operational reach and technological edge necessary to fight and win the next war.

electronics to provide electrical power at the point of need. The AMMPS microgrid may reduce fuel demand by 20-30% across the Army's tactical generator fleet. The Army began fielding this capability in 2018.

Battery research offers another viable path towards demand reduction. AFC is partnering with multiple agencies to build a better battery. Initiatives include closing the gap between civilian batteries and the need for military batteries with more energy density, better performance in extreme weather, and faster discharge and charge rates. The Energy Storage Team, part of the Ground Vehicle Systems Center in Warren, Michigan, just developed a powerful lithium-ion battery that is significantly lighter and safer than the Army's current inventory of lead-acid batteries.

Hybrid and electric vehicles offer an additional opportunity to improve efficiency and effectiveness. The Maneuver Center of Excellence currently is developing a prototype electric light reconnaissance vehicle (eLRV) that will be purpose-built as a hybrid or run entirely on battery power. Equipped with either an electric or hybrid engine, the eLRV would replace High Mobility Multipurpose Wheeled Vehicles (HMMWVs) in every scout platoon. If successful, the new vehicle will provide increased operational duration, silent mobility and silent watch capability, enabling scouts to go longer and farther with less risk of detection. Other Army organizations are also working on converting existing HMMWV fleets to run on battery power.

Despite these efforts, the Army still has much work to do. Current battery technology can power a scout vehicle or a brigade command post, but not major weapon systems, such as battle tanks and self-propelled howitzers. We also need batteries that weigh less and store more, to prevent individual Soldiers from carrying a rucksack full of batteries. In addition to battery power, the Army should continue to research fuel cells that create electricity from varied fuel sources, replacing thousands of internal combustion engines with a cleaner, far more efficient power source.

Improve Situational Awareness

We can't reduce the Army's demand if we can't see what we are consuming. As the complexity of combat operations increases, commanders will need to visualize and project various energy sources' status to anticipate challenges, set priorities, and make informed decisions. Over the past two decades, the Army has fielded enterprise business systems, such as Global Combat Support System–Army, to provide commanders with real-time information regarding the status of their sustainment efforts. Future commanders will also need to see and conserve the energy resources that extend their operational reach.

Fortunately, we are not starting from zero. Commercial energy companies have been developing these types of systems for decades. "Peak shaving," for example, enables power companies to incorporate fast-responding generators or store energy anywhere on the grid until the need spikes (picture southern Virginia in July). In conjunction with other systems, grid storage technology can reduce a brigade combat team's need for fuel, generators, and resupply convoys.

AFC is already developing requirements for secure tactical advanced mobile power, a series of components that create a smart power grid that provides real-time feedback on consumption and capacity. This information will help commanders make better and faster decisions and forecast more accurate consumption rates during planning.

Decision-making at the speed of 21st-century warfare will require systems that anticipate, measure, and report consumption. The Army, in coordination with its joint partners, must develop systems that collect, consolidate, and analyze energy production, storage and usage at every point within the supply chain, from factory (or power plant) to foxhole.

Employ Robotics and Autonomous Systems

Using artificial intelligence and machine learning to reduce commanders' cognitive load can improve decision-making by providing real-time feedback on the status of weapons systems. AFC's artificial intelligence task force is adapting commercial capabilities towards this goal, and the Army's Combat Capabilities Development Command has been teaming with universities to explore ways to rapidly consolidate thousands of data points to provide commanders with timely and actionable intelligence. The Marine Corps, meanwhile, is researching artificial intelligence applications to set "rules of thumb" that commanders can use to predict the weather, enemy activity, supply consumption, and unit readiness if and when units lose connectivity.

Separately, the Army is developing automated solutions that reduce or eliminate Soldiers' physical tasks. For example, the automated switching gear being developed by the Maneuver Support Center of Excellence will automatically shift the power supply between a network's transmission lines without requiring a Soldier to monitor and make those decisions.

Meanwhile, AFC is developing applications that will convert new and existing equipment into optionally manned vehicles. These systems will reduce both Soldier workload and combat risk. The Leader-Follower system, championed by CASCOM, applies this technology to cargo trucks, enabling units to conduct more convoys with fewer drivers within a 24-hour cycle, reducing risk to Soldiers.

Most initiatives to adapt this technology remain in the developmental stages. The speed with which the Army develops, manufactures, and fields these capabilities depends largely on the level of investment that senior leaders are willing to allocate towards building smarter, faster, more energy-efficient combat formations.

Meet Demand at the Point of Need

The Army expends enormous resources to operate distribution networks that deliver fuel and other commodities to combat formations. If we can produce those commodities where they are needed, we can reduce the resources necessary to operate those networks. Again, the commercial sector leads the way in developing advanced manufacturing capabilities that produce munitions and repair parts on site. Both the Army and the Department of Defense are developing means to adapt these capabilities to military logistics.

3D printing technology, for example, may significantly reduce the need to ship repair parts around the world. The Army has long been able to fabricate simple, field-expedient repairs at the tactical level. AFC is pursuing technologies that will enable tactical units to produce more complex items, such as vehicle and communications components. Brigade support battalions and support maintenance companies are currently adding this capability as part of the metalworking and machining shop set, a system that produces polymer-based components in a field environment.

Meshed power networks will likewise offer commanders the flexibility to generate, store, and access electrical power anywhere within the area of operations. Based on a concept developed by the Army Research Laboratory at Aberdeen Proving Grounds, Maryland, these networks would integrate various sources of electrical power, collecting that energy within a grid and distributing it where needed. For now, meshed power networks only exist as concepts or prototypes, but the

military applications could change how we sustain combat formations.

The benefits of meeting demand at the point of need come at a cost. Pushing this capability forward increases responsiveness and reduces the burden on the theater distribution network, but it also increases the need for electrical power in the forward area. Most of the potential solutions are in the early stages of development, and there is currently no blueprint for an integrated system.

Change the Culture

Changing the culture of consumption within the Army will be the most important ingredient in meeting the demand reduction challenge. Our current formations benefit from very few limits on energy resources. Units frequently run their engines from dawn to dusk, while every generator inside the assembly area operates 24/7, regardless of load. As the gap between demand and supply increases, this luxury will disappear, and commanders will have no choice but to husband energy supplies in the same way they protect their time or ammunition.

To change culture, we must change how we develop the next generation of leaders. Because energy translates directly into operational reach, professional military education systems must identify the risk of squandering energy before it's needed and the value of monitoring available energy and anticipating the need for more. Just as today's leaders carefully allocate their limited stockage of precision munitions, future commanders must forecast energy requirements and incorporate these within their scheme of maneuver.

In the field, leaders will need to train and evaluate their Soldiers' awareness and ability to monitor and use energy, regardless of its source. In our schoolhouses, we will need to integrate energy employment into training, developing doctrine and tasks, conditions, and standards that illustrate the employment of energy as a weapons system. Finally, senior leaders must incorporate the value of demand reduction within their strategic messaging, ensuring that subordinate leaders echo that priority at every echelon.

The Way Ahead

Marie Curie stated the way of progress is "neither swift nor easy." If the Army is to achieve the progress necessary to reduce and meet demand on future battlefields, several tasks require attention.

First, the sustainment enterprise must develop and communicate a clear message to Army senior leaders regarding the risk of demand creep. Toward that end, TRADOC and AFC are developing a comprehensive Sustainment Modernization Strategy to synthesize the perspective of the operational force and other key stakeholders.

Second, we need to improve situational awareness. We are working now to improve communication and collaboration with our partners, and we are developing new knowledge management techniques to monitor modernization efforts across the Army.

Third, demand reduction must be incorporated within our doctrine, training, and education programs, teaching and training Soldiers how to monitor, preserve, and apply energy successfully on the battlefield. As future areas of operation expand in distance and complexity, commanders will need to preserve energy just as they preserve other elements of combat power.

Finally, the Army should embrace a systemic approach to modernization, seeking to develop systems of systems based on common platforms, common power supplies, and common software. AFC's "Project Convergence" represents an important step towards this goal. Without commonality, we may field combat formations that depend on ad hoc sustainment solutions. Instead, we need to modernize our sustainment capability in step with the rest of our combat power, ensuring we maintain the operational reach and technological edge necessary to fight and win the next war.

Maj. Gen. Mark T. Simerly serves as the commanding general of the Combined Arms Support Command at Fort Lee, Virginia. He previously served as the commander of the 19th Expeditionary Support Command, He was commissioned as a lieutenant of Air Defense Artillery and awarded a Bachelor of Arts Degree as a Distinguished Military Graduate from the University of Richmond. He holds a Master of Science in National Resource Strategy from the National Defense University and a Master of Military Arts and Sciences Degree from the Army Command and General Staff College.

GREAT Team

Changing the Culture of the Force

By Maj. Christina Harryman

Over the past few years, the Army has taken an in-depth look at ground maintenance and equipment readiness. Between March 2018 and August 2019, the U.S. Army Audit Agency (USAAA) conducted an audit of five Forces Command (FORSCOM) armored brigade combat teams (ABCTs). The objective of the audit was to determine if ABCTs maintained equipment within established goals to sustain required readiness levels. The USAAA concluded that all five brigades fell short of these directives and goals. In its final report, the agency highlighted nine recommendations FORSCOM should take to overcome the observed shortcomings. To summarize and outline these findings to the field, USAAA categorized their results and recommendations into four broad-focused areas: mission capability of equipment; command oversight; knowledge and proficiency of maintenance personnel; and protected time to perform maintenance.

In response to the report, the FORSCOM G-4 published guidance to the field in March 2020, directing actions to support ground maintenance requirements identified by the USAAA. The command also established the FORSCOM ground readiness evaluation assessment and training (GREAT) team to provide oversight and an external review of potential challenges that impact readiness within BCT formations. FORSCOM based the GREAT team on the Aviation Resource Management Survey (ARMS) team program and developed it to support the overall FORSCOM Foundational Training Strategy leveraging commander-to-commander dialogue to improve and reinforce the BCT's multi-echelon training strategy and overall operational readiness.

The team's fundamental purpose is threefold: provide the BCT commander an indication (evaluate) of where their unit stands relative to Army policies and regulation; gauge (assess) soldier knowledge, training, and ability to execute the BCT's established standing operating procedures; provide immediate feedback (train) to operator and crews, as well as operations/supply/maintenance personnel. The FORSCOM GREAT team reinforces the Army's action plan to prioritize people and teams by measuring the BCT's "interconnected network" of vehicle crews, squads, and logistics teams. To provide the BCT commander actionable information to build from, the team bases its assessment on three functional areas: maintenance, supply, and training. The sub-areas and individual tasks under these functional areas connect directly to Command Discipline Programs, Army regulations, policies, or relevant technical manuals.

The team has conducted six GREAT evaluations since September 2020. In these engagements, the team discovered the following findings and observations.

Knowledge and Proficiency of Personnel. Establishing a maintenance culture begins with individual knowledge, proficiency, and "ownership" of assigned equipment. Reinforcing readiness culture starts with closing the knowledge gap of leaders and Soldiers. Equipment operators/crews struggle to identify all non-mission capable (NMC) faults during Preventive maintenance checks and services (PMCS). This is due to a lack of a well-executed PMCS certification program (knowledge), operator/crew attention to detail (discipline), and inconsistent supervisor review of the DA Form 5988-E (leadership). Commanders should not overestimate the skill levels of young Soldiers and young leaders to execute these basic tasks to standard. Units need to take every opportunity to build proficiency in readiness by incorporating validation and certification programs. Commanders need to tailor programs to the level and skillset required, such as apprentice, journeyman, or master level certification. Finally, units require a properly functioning driver and operator standardization program to build PMCS proficiency.

The intent lies with educating and training leaders at platoon, company, and battalion levels with the overall goal to change the culture at the BCT level to one of maintenance management and supply discipline. This cultural change will lead to an improved world-leading lethal fighting force.

Mission Capability of Equipment. Proper assessment of equipment readiness comes from leader emphasis and understanding of the Army Maintenance Standard (Technical Manual 10/20) with discipline down to the crew/team/squad level. During GREAT engagements, 34% to 74% of equipment considered fully mission capable by unit personnel had additional NMC faults identified by the team. A significant number of overdue services were identified within Global Combat Support System-Army (GCSS-Army) for each BCT. This is a combination of units not maintaining proper documentation (accurate and complete service packets, posted in GCSS-Army) and not conducting timely equipment services. BCTs lack a standard load test program within their formations and have primary and secondary lifting devices out of tolerance (e.g., material handling equipment, Forward Repair Systems, recovery vehicles). Vehicles with overdue load testing are NMC and should not be overlooked. The lack of a well-established calibration and load test program places operators and crews at severe risk.

Command Oversight. Command Discipline Programs require oversight and follow-up at every echelon. Units have not consistently evaluated their subordinates' Command Maintenances Discipline Program (CMDP) and Command Supply Discipline Program following applicable regulations. Inspections are not conducted at the required frequency, and the higher headquarters' follow-up inspections are not documented. Commanders need to review these critical programs within their formations at echelon. These command pro-grams are not just an administrative requirement for logisticians but are vital to combat readiness. Units that operationalize their command discipline programs are the best prepared to accomplish their mission. Additionally, driver and operator standardization programs at the unit level are not per regulatory guidance. The lack of priority, visibility, and accountability for driver's training causes commanders at all levels to assume unintended regulatory, operational, and safety risks. Maintenance culture begins with driver's training, where the foundation of PMCS is learned.

A guest evaluator from 1st Cavalry Division assists the Ground Readiness Evaluation Assessment and Training Team with verifying preventive maintenance checks and services performed on equipment from 3rd Armored Brigade Combat Team, 1st Cavalry Division during an inspection June 21 at Fort Hood, Texas. (Photo by Mike Simmons)

Protected Time to Perform Maintenance. The BCTs require a balanced focus on lethality, mastery of the fundamentals, collective training, and maintenance. Although all units engaged by the GREAT team attempted to 'fence' time on training calendars to execute supply and maintenance activities, higher priorities took precedence over services, recovery, command maintenance, and dedicated focused readiness periods. Successful commanders reinforced maintenance discipline throughout training activities and not just during recovery or motor stables.

Considering the specific findings from the first six engagements, several trends emerged from commanders who scored highly on the evaluation:

- **Supply Support Activities (SSA)**. Leaders who emphasized efficient processes and effective personnel training in supply support activities resulted in reduced backlog and accurate property accountability.
- **Automation.** Units that embraced automated tools and technology to conduct supply activities reduced errors and saved thousands of man-hours.
- **Standard operation procedures** (SOPs). Effective units have established, published, maintained, and executed SOPs. SOPs are the cornerstone of good maintenance, supply, and deployment programs and, when used consistently, codify best practices and reinforce the prescribed standards from BCT to the company level.
- **Manuals.** Units that have established publication accounts and readily available hard copies of technical manuals and other publications ensure that Soldiers have the most updated information on hand to troubleshoot their equipment thoroughly in every operational environment, whether it be garrison, field, or tactical.
- **Excess Equipment Management.** Commanders at every echelon who leverage Modernization Displacement and Repair Sites and assigned SSA to reduce the burden of excess equipment within their organizations free up man-hours that would otherwise be spent conducting services and inventory on this equipment.

- **Maintenance Management Operations.** Effective units intensively manage service schedules for all equipment commodities, including small arms, communications and electronics, power generation, and ancillary equipment. Units optimize maintenance requirements and save additional man-hours by enrolling equipment in the non-combat operations maintenance plans, performing services based on usage rather than time.
- **Using Enterprise Resources.** Commanders who achieve higher marks use the logistics assistance representatives at their regional Army Field Support Battalion and other available installation resources (i.e., commander's maintenance evaluation team (COMET)) to close knowledge gaps. These organizations provide 10-level training to Soldiers and build proficiency through extra sets and reps, especially for GCSS-Army training. The local COMET tailors its instruction to meet unit-specific requirements.
- **Documentation.** High-scoring units maintain documentation as required, such as updating DA 2408-4s ('gun cards') for large-caliber weapons. In addition, good units establish and maintain effective tools sign-in and sign-out procedures per regulations. They inspect, inventory, and maintain the Standard Army Tool Set, Forward Repair System, Shop Equipment Contact Maintenance, and all other special tool and test equipment following the applicable technician manual and bill of material.

In addition to shared best practices across the operational force and increased accuracy in reporting at the BCT level, FORSCOM has made a few additional changes to increase the operational readiness across the command.

- **Company Leader Training.** FORSCOM directed division commanders to include CMDP requirements into company commander and first sergeant training classes and leadership professional development programs.
- **Master Drivers.** FORSCOM re-energized commanders at all levels on the importance of the master gunner and master driver programs, spelled out in command training guidance.

A Ground Readiness Evaluation Assessment and Training Team guest evaluator from the Fort Hood Command Maintenance Evaluation and Training Team verifies PMCS, tools, and equipment on a Shop Equipment Contact Maintenance vehicle June 21 with members of 3ABCT, 1st Cavalry Division. (Photo by Mike Simmons)

A Soldier from 3rd Armored Brigade Combat Team, 1st Cavalry Division, delivers a briefing to Lt. Gen. Leopoldo Quintas, deputy commanding general, FORSCOM, during a Maintenance Terrain Walk, as part of the unit's June 21 Ground Readiness Evaluation Assessment and Training Engagement. (U.S. Army Photo)

- **Driver Training**. Commanders are briefing driver proficiency (not just licensed driver numbers) and driver sustainment qualifying events in quarterly and semi-annual training briefs, as well as key metrics at monthly FORSCOM Logistics Readiness Reviews.
- **AMC 101**. FORSCOM has directed every brigade-level commander to attend Army Materiel Command 101. This two-day course provides commanders the installation-specific tools needed to leverage the entire sustainment enterprise.
- **Shop Stock Initiative.** Efforts are underway in coordination with Army Materiel Command to operationalize shop stock within BCTs, standardizing stocked items and reducing the organization's burden. FORSCOM utilizes BCT GREAT engagements to gauge the initiative of this shop stock initiative.

FORSCOM assesses that similarity to the ARMS program for aviation brigades, the GREAT initiative will increase BCT readiness as those commanders leverage the external review to focus on ground readiness, identify gaps, and apply leadership and resources to improve. The intent lies with educating and training leaders at platoon, company, and battalion levels with the overall goal to change the culture at the BCT level to one of maintenance management and supply discipline. This cultural change will lead to an improved world-leading lethal fighting force.

Maj. Christina Harryman currently serves as a maintenance officer in FORSCOM G-4. She has a master's degree in business admin with a concentration in strategy and leadership from Kenan-Flagler Business School, North Carolina, and has completed military courses such as Operational Contract Support, the Army Strategic Broadening Seminar, and Command and General Staff College.

NEWS ALL UNITS CAN USE:

NEW PRODUCTS FROM THE SUSTAINMENT CENTER OF EXCELLENCE

ENGLISH PHILOSOPHER ROGER BACON FAMOUSLY OBSERVED THAT KNOWLEDGE WAS POWER. FOUR CENTURIES LATER, BACON'S CONCLUSION STILL MAKES SENSE. AS A MEANS OF EMPOWERING BOTH SUSTAINERS AND NON-SUSTAINERS ALIKE, THE SUSTAINMENT CENTER OF EXCELLENCE DEVELOPED A SERIES OF NEW PRODUCTS THAT WILL INCREASE YOUR KNOWLEDGE AND SHARPEN YOUR SKILLS.

Army Sustainment Resource Portal: Serving the Warfighter

The Army Sustainment Resource Portal (ASRP) is the successor to the Sustainment Unit One Stop and serves as the primary vehicle CASCOM uses to deliver pertinent sustainment resources to the warfighter in operational units. Combined Arms Support Command (CASCOM) has modernized the ASRP's user interface and serves multiple devices, allowing the warfighter to access ASRP via telephone and tablet, not only computer. ASRP has also undergone a transformation and has moved away from sustainment unit categorization of resources. To better serve the operational force, the site has moved to a resource-driven organization of references and other material. Usability is further enhanced through a built-in search function, optimizing user experience while perusing numerous sustainment resources, references, and training aids.

The ASRP is CASCOM's premier one-stop-shop for sustainment needs, including doctrine, collective training tasks and standards, mission essential tasks, and force structure. The ASRP also features many virtual training resources and aids, such as virtual maintenance terrain walk, Petroleum and Water Department (PWD) virtual training products, property accountability virtual playbook, virtual training schematics covering weapons, equipment, and vehicles, unit movement officer resources, ship navigation, and the Sustainment Virtual Playbook (SVPB).

The SVPB is targeted toward leaders, brigade and below, and covers myriad topics such as roles and responsibilities, deployment and reception, staging, onward movement, and integration (RSOI), sustainment planning, decisive action, unit defense, and more. The SVPB is part of a larger effort seeking to operationalize sustainment resources, making this a site for all leaders and Soldiers, not just logisticians.

Resources are also offered to the Warfighter organized under the Operations Process, to better enable leaders and staff officers to locate the best references to plan, prepare, execute, and assess. Resources have also been curated to best serve the end user through training focus areas, including deploy, relocate, establish, defend, and conduct mission. These changes have been made to best serve leaders across the Army, in operational units. The ASRP team here at CASCOM always welcomes feedback. The contact link on the ASRP reaches the entire team at once, and they are eager to answer questions or review feedback for the ASRP to better serve the customer. Army Sustainment Resource Portal is found at

https://cascom.army.mil/asrp/index.html.

Sustainment Training Strategy

The CASCOM recently updated the Sustainment Training Strategy (STS). In the five years since CASCOM last published a training strategy, sustainment force structure, and Army doctrine has changed considerably, driven by the publication of Field Manual (FM) 3-0, Operations, and FM 4-0, Sustainment. The Army now faces a large-scale combat operations (LSCO) operational environment that presents more complex challenges to the sustainment force than any experienced in Iraq and Afghanistan.

The STS is designed to support building and assessing LSCO sustainment unit progressive training readiness which directly impacts our ability to provide critical support to units and enable their operational reach, freedom of action, and endurance to prosecute campaigns.

It provides an overarching training vision for the sustainment force, and it articulates that vision, by echelon. It focuses on foundational training for sustainment units such as deployment, unit defense, establishing a new support area, operating in an austere environment, and sustainment unit gunnery that units must master to accomplish their core missions.

The STS provides a step-by-step overview and reinforcement of the FM 7-0 Training unit training management (UTM) process. Commanders and leaders need to embrace current training products to train their unit mission in a progressive crawl, walk, run approach to build and assess unit training readiness. Appendixes provide a detailed description of unit training paths by echelon, with emphasis on platoon level training. They contain Notional Training Path Models for "how to train" at sustainment platoon, company, and higher headquarters level (battalion, brigade, theater sustainment commands, and expeditionary sustainment commands).

The STS can be found on the Army Sustainment Resource Portal at:

https://cascom.army.mil/asrp/index.html

Brigade Combat Teams Logistics Battle Book (BCT LBB)

The Brigade Combat Teams Logistics Battle Book (BCT LBB) is a handy pocket guide that provides a quick, consolidated reference for BCT logistics in tactical environments. The book focuses on maneuver and logistics planners, and it provides useful information for leaders at all levels within the armored, infantry, and Stryker BCTs. When printed to actual size, the BCT LBB is 6 inches wide and 5 inches tall, allowing it to fit conveniently in the Soldier's ACU cargo pocket or take up minimal room in an assault pack.

The BCT LBB provides an in-depth break down of the mission and capabilities of all maneuver battalions and supporting logistics organizations within the BCT, to include a wire diagram of each. The book then details all classes of supply to include capacity, running estimates, and consumption rates based on current doctrine and trends. It also describes combat trains, distribution methods, and resupply techniques. Lastly, the BCT LBB provides the reader a guide on operational terms and graphics, sustainment considerations in decisive action, and much more.

This battle book can be found on the Army Sustainment Resource Portal at:

https://cascom.army.mil/asrp/index.html

Army Tactics Publication (ATP) 4-90.5, Logistics Platoon Leader

The platoon provides the basic building block for every warfighting formation within the Army. Leadership at the platoon level can spell the difference between victory and defeat. Based on a handbook developed by Army Logistics University, Army Techniques Publication (ATP) 4-90.5, Logistics Platoon Leader, codifies basic troop leading skills at the small unit level.

The publication provides logistics platoon leaders with a knowledge baseline, identifying what logistics platoon leaders must know and do to effectively command and control their platoons. The principal audience for ATP 4-90.5 is junior officers who are leading or preparing to lead ordnance, quartermaster, and transportation platoons. The contents also apply to other members of the profession of arms. In addition, the ATP includes a fictional account, "The Resupply of Duffer's Drift," which updates a century-old allegory about combat leadership to address basic leadership challenges in the 21st century.

Along with the Logistics Battle Book, ATP 4-90.5 offers a valuable resource for commissioned and noncommissioned officers seeking to improve their knowledge of tactical level logistics. The ATP is available for download from the Army Publication Directorate website:

https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN34147-ATP_4-90.5-000-WEB-1.pdf and will be made available on the Army Sustainment Resource Portal

CASCOM designed each of these tools to provide leaders with the information necessary to maintain the readiness of their personnel and equipment. Each of these publications deserves a place on your reading list. These publications are not perfect, share with us any recommendations for updates and improvements. Collectively we all share the same important goal, to ensure the Army's readiness to fight and win the next war.

Commercial as Possible, Military as Necessary

How the Army is Changing the Way We Do Business

By Chief Warrant Officer 5 Gregory Besaw and Chris Lindstrom

As Enterprise Business System (EBS) continue to evolve, the Army will be better able to operate its financial and logistic systems at the speed of conflict. As the transformation continues in the information age, the Army is looking to simplify, streamline, and standardize business operations—the sustainment and financial operations your teammates work daily—to increase readiness using one unified system. The intent is to provide Soldiers, the civilian workforce, and contactors a modernized warfighting capability that enables integrated operations from the strategic support area to the tactical edge of the battlefield for rapid, informed decision-making at the echelon.

With any change, there is uncertainty. The General Fund Enterprise Business System (GFEBS), GFEBS-Sensitive Activities, Global Combat Support System-Army, Logistic Modernization Program, Headquarters Army Environmental System, and Army Enterprise Systems Integration Program are the primary systems being considered for convergence. These systems are EBS, the Army's term to describe the hardware and software that teams operate daily. These systems are based on commercial software, which become more expensive to operate with age. Consider the applications on your smartphone — they are updated often, and if you don't allow the updates, soon you can't use it anymore. Companies do not want to support legacy software. Doing so gets expensive. The Army can become more efficient using industry best practices and embracing rapid software technology improvements. This decreases costs while providing a better interface and experience for Soldiers and civilians.

The Army EBS software must be updated, integrated, efficient, and effective to win future great power competitions. Convergence allows for the development of better software systems from the GCCS-Army operator in a motor pool at Fort Hood, Texas, to a budget analyst at a desk in Grafenwoehr, Germany.

Today, the Army's various EBSs have more than 164,000 users—the contractors, civilians, and Soldiers who manage more than $250 billion in funds, equipment, and assets across the Army. These stats rival some of the largest and most influential companies in the world. The current EBS suites brought the Army from the age of paper and desktop computing with labor-intensive "reporting to higher" into the connected enterprise environment used today. In the past 20 years, the Army has merged a dozen legacy systems, established authoritative centralized data sources to standardize cataloging and configuration, eliminated the "daily disk drop" and status updates, removed the need for transaction reconciliations between systems, and improved transparency of our inventory and assets from foxhole to depot. We have come a long way, but it's time to take the next leap.

Business Process Reengineering—what is it and why are we doing this?

Instead of simply replacing existing software, a new system called Enterprise Business System Convergence (EBS-C) begins with the foundational business processes. EBS-C Business Process Reengineering (BPR) rethinks how work is performed to accomplish supply, transportation, acquisition, maintenance, deployment/redeployment/retrograde, and finance goals.

BPR begins by defining the challenges with current work processes and ensures we focus on solving the right problems. To accomplish BPR in a comprehensive, collaborative environment, the Army brought together more than 400 of its best people from more than 26 organizations to serve as process owners, subject matter experts, and policy experts. Including the impacted and invested people from the very beginning builds buy-in and sets the stage for the better adoption of new processes and assures organizational change management is baked into the process reengineering effort. The population of experts ranged from "field-to-factory" world-class technology and architecture specialists, to industrial supply chain consultants, and to career Soldiers and civilians. The vast majority of those personnel have decades of experience navigating through the challenges the Army faces from the unit level to the strategic depots. The Army has never conducted BPR at this scale before.

The personnel were then divided into teams of specialized expertise to conduct BPR in one of the dozen end-to-end processes within the integrated supply chain during an eight-month period. The BPR process owners led their teams through intensive daily workshops, assessing the current processes, identifying friction points, gaps, and integration requirements to truly understand the challenges across all classes of supply and each echelon of the Army's supply chain.

Through consultation with commercial industry supply chain experts, the BPR process teams identified opportunities to adopt best practices employed by industry leaders as part of the redesigned Army processes. Teams proposed converged solutions to enable planning, integration, monitoring, and assessments across engineering, logistics, acquisition, financial management, and supply chain activities to enhance decision-making and increase operational readiness. Each team sought to introduce automated technologies that will reduce inaccuracies in data management, increase the availability of key information for rapid decision making, and enhance the overall user experience. Additionally, recommendations provided opportunities to standardize policies and processes to improve integration across the DOD by decreasing variances in lexicons, automating data transfers, and converging solutions that enhance the execution of support activities across the force.

Each BPR team followed the EBS-C guiding principles throughout every workshop to challenge legacy habits rather than simply repackaging "how we do it today" into the new technology.

- **Challenge the Status Quo.** Break the boundaries of what is possible and challenge the way things have "always been done."

- **Value People First.** Create value in partnership with the EBS community to benefit the warfighter and workforce.

- **Embrace Change.** Adopt a growth mindset in all actions that enables the team to improvise, adapt, and overcome.

- **Practice Radical Honesty.** Embrace productive conflict to drive productive disruption. Foster a safe environment to share and challenge ideas. Communicate with authenticity, respect, and truthfulness.

- **Create One Team, One Fight, One Product.** Seek out partnerships, erase the line between "us and them," and use lessons learned from those who have come before to achieve a common mission.

Business process reengineering gets the Army closer to fully understanding the requirements to ensure it's the best solution. BPR allows the Army to rethink the fundamental processes behind acquiring, managing, and sustaining equipment; budgeting, funding, accounting for, and reporting financial and materiel resources; and how units deploy and sustain equipment and warfighters. Additionally, EBS-C BPR leverages commercial best practices to reduce the cost to the Army for unnecessary customization of EBS-C.

By fully understanding the processes, friction points, gaps, and integrations, some challenges can be solved today while ensuring optimal future converged capability. Employing agile software development will involve process owners and subject matter experts in the development cycle, providing real-time feedback on design and operation to ensure the best product gets into the user's hands.

As the Army continues forward with EBS-Convergence, the overarching theme is to be "as commercial as possible; as military as necessary," which enables stakeholders to capitalize on information-age capabilities, rapid-paced software improvements, reduced customization, and eventual divestiture of legacy systems. By basing proposed solutions on the commercial industry's best practices, the Army will ensure EBS-C can support large-scale ground combat operations in a multi-domain theater.

Chief Warrant Officer 5 Gregory Besaw serves as the senior warrant officer of Enterprise Business Systems Convergence Multifunctional Capabilities Team. He served three years in HQDA G-4 in his previous assignment, authoring strategic policy, procedures, and orders for property accountability. He holds a master's degree in Management- (Logistics Management) from the Florida Institute of Technology and is certified as a Demonstrated Master Logistician by the International Society of Logistics.

Chris Lindstrom is a business process reengineering professional for the U.S. Army's Business Process Reengineering (BPR) Center of Excellence (CoE), responsible for increasing BPR capabilities through a broad range of curriculum offerings and improvement projects. The BPR CoE implements a standardized methodology for BPR and provides support services for reengineering the Army's business processes. He is currently assigned as the BPR Lead for the Enterprise Business System - Convergence (EBS-C) program.

Feature Photo
After working for 24 years in legacy systems, Budget Analyst Cheryl Brophy now processes actions in the GFEBS system. (Photo by Pamella B. Gray)

SUSTAINING THE FUTURE ARMY THROUGH DEMAND REDUCTION

An Interview with Gen. John M. "Mike" Murray

By William C. Latham Jr.

As the first commander of Army Futures Command (AFC), Gen. John M. "Mike" Murray leads a team working to enable and synchronize the entire Army modernization enterprise to effectively deliver the competitive technological advantage needed to defend the nation. Having previously served as the commanding general, 3rd Infantry Division, and Deputy Chief of Staff, G-8. Murray has successfully integrated efforts critical to funding, fielding, equipping, and sustaining current and future military force requirements. *Army Sustainment* sat down with him to discuss how the concept of demand reduction nests within a future vision of the Army.

The Army has been discussing demand reduction for more than two decades. How do you define demand reduction?

So, first of all, two sets of words come to mind: force protection and combat multiplier. When we look at the development of combat platforms, I want to design the most effective system or weapon I can get into Soldiers' hands. And yes, we're going to get to sustainability, reliability, reduction of demand—those are all part of an eventual requirements document. I always want the most reliable, sustainable, effective, and efficient combat platform weapon I can put in Soldiers' hands. But where are the trade-offs in terms of force protection? If I can reduce the number of Soldiers on the road carrying fuel or reduce the Soldiers on the road carrying water or rations, for instance, it becomes force protection.

We assume that future battlefields will be exceptionally lethal. The other thing that we've been assuming for a long time is that units will have to operate in much smaller units and much more dispersed. So, how do

you conduct sustainment operations when you have smaller units more widely dispersed, and you have that high lethality from the forward edge of the battle area back to the rear? If we're going to operate like that, we've got to figure out how to reduce demand. Because of the days of running log packs every 24 hours to these highly dispersed units—maybe some great logistician will figure out how to do that—but I think those days are pretty much gone. We're going to have to reduce demand to be effective in that future operational environment.

Given the probability that increased capability will require more sustainment, where do you see the sweet spot between those two competing needs?

We will probably build some elements of demand reduction in terms of fossil fuels into the next-generation combat vehicle. If you look at it compared to Bradley, we will try to reduce and almost certainly will reduce demand for fossil fuels. If you look at the extended-range cannon artillery, it's the same chassis as that of the Paladin Integrated Management program. Suppose you look at the precision strike missile, it's the same chassis, the High Mobility Artillery Rocket System and Multiple Launch Rocket System chassis, but we have designed it to fit two munitions inside the same pod that the Army Tactical Missile (ATACM) goes in right now. So we're actually reducing the amount of ammunition convoys on the road, so we reduce demand for ammunition just because they can carry more organically.

On the other hand, the integrated visual augmentation system, or enhanced night vision goggles binocular, both Soldier-worn and Soldier-carried, will increase the amount of battery power required by Soldiers.

So, some of the Science and Technology (S&T) and Research and Development (R&D) work we're doing begins to address that—we're not there yet. I don't think it's an all-or-nothing. In some areas, we are looking at reduction. In some, we're looking at increases. I don't think it's all or nothing or its additive or subtractive. I think it's case by case.

Are you concerned about the expanding gap between future energy demands and our ability to meet them?

Yes. In the past, it was not a major topic of discussion. Does it need to be as we go into the future? I would argue that we need to start paying more attention to it than we currently do. Not demand reduction for the sake of demand reduction. But if we're going to have viable sustainment operations on that future battlefield, operating more widely dispersed and in smaller and smaller units, reducing the demand placed on the logistics system is absolutely key and critical to being successful on that battlefield.

Do you favor hybrid platforms or electric vehicles at the tactical level, or are you looking for a mix?

With the current state of technology, I am absolutely in the hybrid camp. I don't see the ability to pull up to a charging station in the middle of nowhere and recharge a major combat weapon and I don't see us hauling around charging stations. I don't think you reduce the risk to Soldiers at that point. I think [hybrid technology's] ability to generate enough onboard power to power the fuel cells to operate electrically is the only near-term solution for our tactical systems. I think there's a great opportunity for all-electric in our non-tactical vehicles, the vehicles we have running around our installations. Then we can build up the charging infrastructure as the country moves forward. Look at the electrification effort going on in the country; we ought to follow that research in terms of charging and batteries. We've got to provide a different level of protection for onboard batteries in tactical and civilian vehicles, given the threats they are exposed to. We've got to allow the civilian market to lead the R&D and S&T, making things more efficient. I think they'll move much faster than we can and make much bigger investments in that research. Then, we ought to be prepared to quickly follow and do the modification necessary for military use. But for the near term, I am firmly in the hybrid camp for tactical vehicles.

Given your emphasis on Project Convergence, how do you ensure that the future force can function as a compatible, mutually supporting team rather than a dysfunctional, grab-bag of high-tech solutions that can't operate together?

You just described the reason that we are doing Project Convergence in the first place. Last year's Project Convergence pulled together five cross-functional teams, and the realization is just what you're talking about. When you look at this, the whole has to be greater than the sum of the individual parts. So how do you pull this stuff together to work together to achieve that greater outcome? And that's what we did last year in terms of sensor to shooter.

Then the realization was that it's much bigger than the Army. So what you're talking about has to be beyond the Army because the Army will always fight as part of the joint force. So with Project Convergence 21, we stood up a 3-star board of directors to figure out how the services begin to do key universal joint task list tasks—situational awareness, air missile defense, and joint fires—so that you don't have a grab-bag of individual technologies. That's Project Convergence 21, forcing them together to figure out how to work together, those three key mission areas.

Then for Project Convergence 22, we're bringing in allies and partners. One of our asymmetric advantages is that we always bring allies and partners with us, an advantage our near peer adversaries don't necessarily enjoy. In the meantime, we stood up the Joint Systems Integration Lab at Aberdeen Proving Grounds, Maryland, so that we can do this on a near-continuous basis in a laboratory setting. The goal of Project Convergence is to avoid exactly what you asked in your question.

If we can get Prognostic and Predictive Maintenance (PPMx) to work, how does that change the way we're going to fight?

I think that we are under-investing in PPMx right now. I mean, I've had people tell me, the commercial airliner you get on is communicating to wherever it is going—let's say it's going to Austin, Texas—communicating to Austin before it gets there. The repair parts it needs are on the ground when it gets there so they can turn. The commercial market from an airline standpoint is motivated by profit. So the faster they can turn that airplane, the more use they get out of it, the more profit they make. And there is predictive maintenance on new automobiles. Things like the warning lights—the system begins to identify that it's going to break before it actually breaks, unlike some of the older cars that I still own.

I've got way too many rotations at the National Training Center and even the Joint Readiness Training Center where you think you're going to cross the line of departure (LD) with a certain amount of combat power and it turns out, you know, 15 minutes before you're due to cross the LD you get your combat slant and you've got a lot less than you thought you were going to have. PPMx gives us the ability, I don't want to call it scheduled maintenance, but to do the maintenance, the preventive maintenance that we need to do on our own schedule as opposed to the machine's schedule. I think it also should enable us to save some money, avoiding unnecessary services. We do services by a schedule, but it's by calendar, it's not by the need. I think there is some money savings there. So, operational availability I think, will go up. I think cost savings will go up or costs will go down.

I also think it gives you the ability, in terms of the force protection piece, to smartly schedule delivery of the materials for the repairs, routine maintenance, or service, for lack of a better term, so instead of running three or four convoys or log packs, you can begin to consolidate, reduce the number of vehicles you have on the road, the frequency of those vehicles on the road, and ultimately the most important thing, the number of Soldiers on the road.

I'm not sure the battlefield described in the multi-domain operations concept can function with the iron mountains we had in Desert Storm.

You're right, they won't survive. We're working extended range capabilities because we were out-ranged by both peers and near peers and they're not slowing down their modernization efforts. The ranges are going to continue to increase. And importantly, what most people don't think about is the fact that we can now shoot a cannon, a self-propelled howitzer 70 kilometers, or we can replace ATACMs, which is roughly 300 kilometers, with Prism, which will go north of 500 kilometers. The fact that we're shooting and working with hypersonic missiles that will go 2,000 nautical miles plus is really, really cool. If you can't sense and maintain custody

of targets, that's all it is. It's really, really cool. It's not an operational capability.

The only reason I say that is because we're working all that. So are our adversaries. On that future battlefield one of the things that I am predicting is that every Soldier is a sensor, everything on that future battlefield will be a sensor. So, it doesn't matter where you are—rear, deep, or close—in terms of the geography of the battlefield. It will be nonlinear. You won't have the ability to hide any place. So this omnipresent sensing capability is going to be there. So it doesn't matter whether it's a bag farm, a supply-support activity (SSA), a brigade combat team headquarters or whatever it is, you're going to have to be small enough you can move relatively often compared to what we look at today.

You play an important role in developing the necessary capabilities to fight and win the next conflict—something we haven't always done well, for example, the (1950s-era) Pentomic division. Given your responsibilities, what keeps you up at night?

I sleep like a baby (laughs), but you hit it on the Pentomic division. That's good because when most people think of AFC, they think of the 31 plus 4. So it's also, you know, the (organizational) structures we are going to have to modify, or do away with, or create. That's in close conjunction with the Combined Arms Center and Training and Doctrine Command. It's also how we're going to have to think about fighting differently. Part of fighting differently is sustaining differently.

I'm serious, nothing really keeps me up at night….one though is that we do deeper looks at the modernization effort, particularly in China. They are investing a lot of money, and they move very quickly. One of the things that enables them to move very, very quickly is the theft of intellectual property from our industrial base from us and from our universities. That does concern me greatly because they're not having to spend the S&T and R&D dollars that we invest in developmental programs. They just take the intellectual property. The amount of money they're investing in artificial intelligence is astronomical. The amount of data collection they have going on around the world is mind-boggling, and they're collecting that data for a reason. So that, that does concern me.

Then I am concerned about our own ability to move at speed. Technology development is about a three-year cycle. If you look at our history, all the way back to the big five and probably before, but definitely the big five, we run about a 12- to 15-year cycle. So the way, I describe it to civilians that are not familiar with our process is, I've got three daughters and they're all grown and gone from the house. They've all got kids of their own, but if they had asked me for cell phones in 2010 and last year at Christmas I gave them three flip phones, they probably would not have been very happy. That's exactly what we do to our Soldiers—we frequently deliver 10- to 12-year-old technology when we deliver a platform. So we've been fairly successful here with the 31 and the plus 4, reducing that in most cases by at least half, and in some cases more, to a 3- to 5-year cycle, at least in terms of the initial capability.

We've got to figure out a way to capitalize on the technology and the rate of refresh of technology and new technologies emerging every 2-3 years. So, how do you begin to look at building systems to account for that? Most people call that open systems architecture—the ability to upgrade through software, not necessarily hardware. But it all comes down to this ability to move at speed.

We also are very good at incremental upgrades. We've got to quit focusing on delivering the 100% solution and worry about delivering something that is safe, effective, and efficient from a demand perspective, and it may only be the 80% solution. We're going to begin upgrading it almost as soon as we deliver it. Hopefully, primarily through software, not hardware upgrades. I think there's some things we're going to have to look at differently in terms of how we develop material, because we're going to have to move at pace.

Lastly, if you're going to move at pace, you're going to shoot for less than 100% solution, you have to be willing to accept some risk. We tend to be a very risk-averse culture when you look at things like material development, and rightly so—it's taxpayer dollars. We don't want a lot of mistakes with taxpayer dollars. It's going to happen if you move fast. You have to be willing to accept some level of risk—sometimes you're going to get it wrong.

Another thing we don't do very well at all is when it's wrong, admit you're wrong and move on before you have a program in development that ends with a B, a dollar figure that ends with a B. So, learn early, decide early, cut risks early, and deliver capability faster.

How does commercial off-the-shelf (COTS) capability figure into that equation for you? In the early 90s, every command post had a Hewlett Packard desk jet printer, and that was the gold standard. Nothing the Army bought, certainly not our 88-pound tactical fax machine, could hold a candle to it.

Yeah. So, Harvard graphics and Word Perfect, if I remember right. COTS plays a big role. The network is a great example of that. The network modernization strategy is, we're going to modernize the network every two years. We're in the process of fielding capabilities set 21 right now. It still has a Warfighter Information Network-Tactical backbone; you just can't throw everything away and start over. Then capabilities set 23 will build upon capabilities set 21—in some cases, new technology for additional capabilities and in some cases replacing old technology with new technology. We will do the same thing in 25, 27, 29, 31, and people said, well, when does all this end? I don't think it ever ends—just given Moore's Law and, you know, the ever-increasing rate of technological innovation. COTS plays a big role in that. The primary strategy is to bring industry together every two years against a common problem set and let's see what they can do. You know, we talked about the replacement for the medium and heavy truck fleet. We are starting off with a COTS approach. What's on the commercial market? You mentioned the printer, the dot matrix printer I'm sure it was back then. I know, I remember dot matrix printers. If you look at the commercial trucking industry, drive-by-wire, anti-lock brakes, anti-idling systems, the safety configuration in terms of the back-up camera, the blind spot indicators. So we're not taking it…. we could probably build all that in a lab, but why would we? Why would we not at least take advantage of the commercial innovation that's going on?

What are you reading right now? And what would you recommend for those of us who are worried about sustaining the future?

I don't have a specific book for sustainers. We talk about things like PPMx, which relies on machine learning and artificial intelligence. We talk about leader follower technology, which relies on some of the same. I think one of the fundamental problems we have in the Army is we have a lot of people that can spell artificial intelligence, who can spell machine learning, and want to talk like they understand what that means, which often results in some guidance being given that is probably less than optimal. I think the Army needs a huge self-education so we can talk intelligibly about some of the technology we talk about.

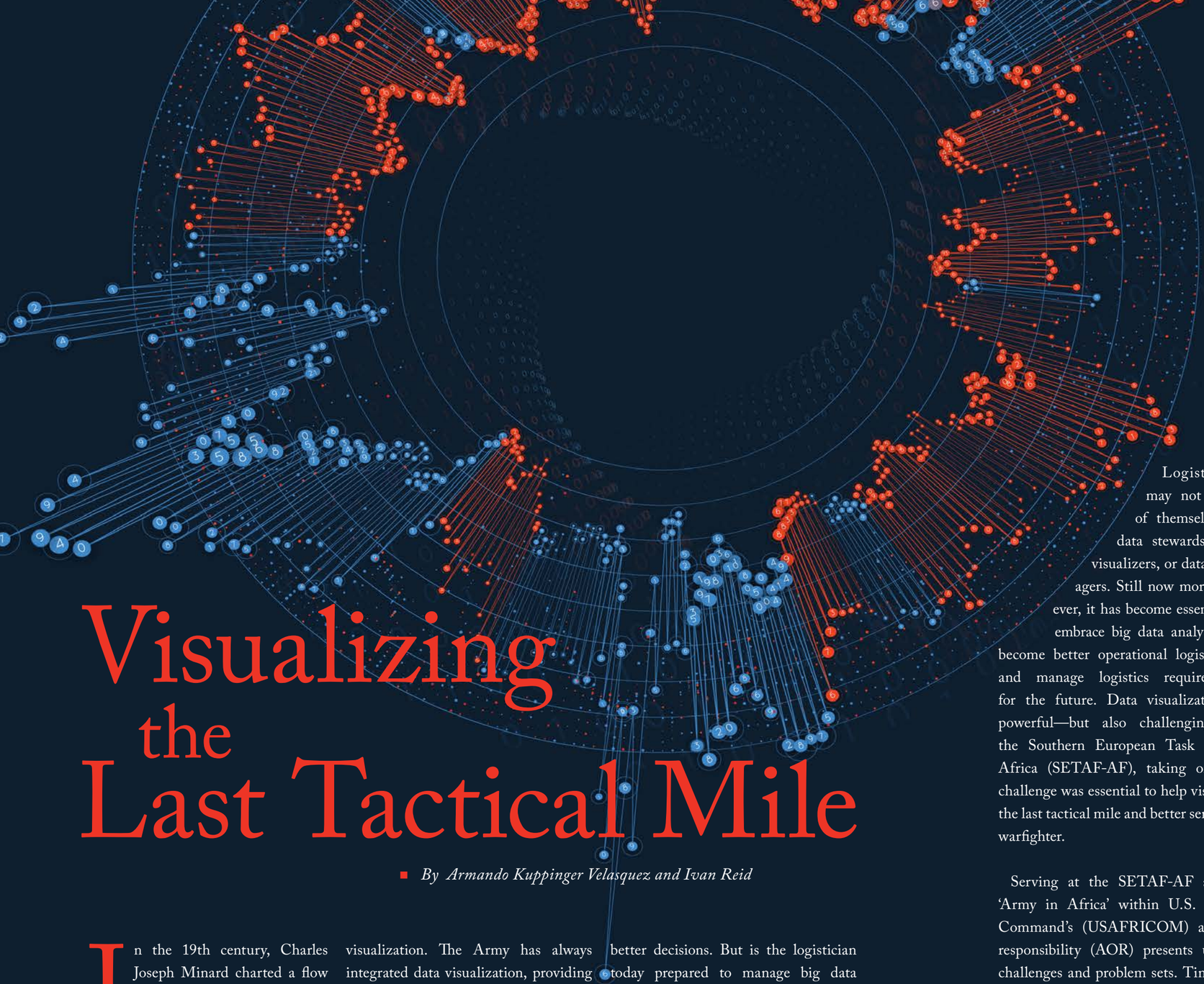
It's why I'm reading Dave Johnson's *Fast Tanks and Heavy Bombers*, which looks at the innovation of the U.S. Army between 1917 and 1945. You go back to the interwar period. The French had tanks. The French had airplanes. The French had radios. The Brits had tanks, airplanes, and radios. The Russians had tanks, airplanes, and radios. The Poles had them. We had them. The German army figured out how to put those technologies together in a way nobody else had figured out.

So it's not autonomy, robotics, and artificial intelligence—it's how we put those three together to create an operational, tactical, and strategic advantage, which the Wehrmacht did very well for at least the first couple years of WWII, until everybody else caught up. I think some fundamental understanding of the technologies that are here today—not at scale—in the Army and where they're going to go and start thinking about how we combine those differently to achieve all kinds of things. From a logistics standpoint, how do you combine autonomy, robotics, and artificial intelligence to accomplish some of the things we've talked about for the last hour to sustain a widely dispersed force, operating in smaller and smaller units on a very lethal battlefield?

Autonomy, robotics, and artificial intelligence are coming to the next battlefield, and in some cases, it's already there. We don't want to get there second. We have got to figure out how to take advantage of these technologies from all kinds of different angles if we're going to be successful.

William C. Latham, Jr., currently serves as the Chief of the G-3/5/7 Doctrine Division at the Combined Arms Support Command, Fort Lee, VA. He has written extensively on military affairs and is the author of Cold Days in Hell: American POWs in Korea.

Feature Photo
U.S. Army Gen. John M. Murray, commanding general, Army Futures Command, along with his command staff, and U.S. Army Maj. Gen. Charles K. Aris, deputy commanding general, 36th Infantry Division, met with U.S. Army Col. Carrie Perez, commander, 36th Sustainment Brigade, Texas Army National Guard, at South forward operating base at Camp Grayling Joint Maneuver Training Center, Grayling, Michigan, during Northern Strike 21, August 4, 2021. (Photo by Staff Sgt. Charles Robertson)



Visualizing the Last Tactical Mile

■ *By Armando Kuppinger Velasquez and Ivan Reid*

In the 19th century, Charles Joseph Minard charted a flow map of Napoleon's disastrous Russian campaign from 1812-1813. The chart beautifully incorporated data, design, and storytelling—thus set the standard for military data visualization. The Army has always integrated data visualization, providing commanders another way to see their formations and the operational environment. Today, the Army has embraced data more than ever, fostering data management visualization to make better decisions. But is the logistician today prepared to manage big data analytics? Are they trained on how to visualize data to serve decision makers better? How does the force produce technically-savvy, data-driven logisticians?

Logisticians may not think of themselves as data stewards, data visualizers, or data managers. Still now more than ever, it has become essential to embrace big data analytics to become better operational logisticians and manage logistics requirements for the future. Data visualization is powerful—but also challenging. At the Southern European Task Force-Africa (SETAF-AF), taking on this challenge was essential to help visualize the last tactical mile and better serve our warfighter.

Serving at the SETAF-AF as the 'Army in Africa' within U.S. Africa Command's (USAFRICOM) area of responsibility (AOR) presents unique challenges and problem sets. Time and distance—a logistician's two greatest constraints—are major challenges within USAFRICOM's AOR. The operational environment is dispersed, volatile, and expeditionary. The African theater requirement places low demand on the joint logistics enterprise; however, the nature of the mission yields higher risk and is critical to achieving national objectives. The logistician operating within USAFRICOM does so as an economic force, meaning they must continually find ways to achieve the mission without bringing in large sustainment footprints or infrastructure. Reliance on our partners, commercial vendors, and host nations is critical to fulfilling logistics. However, operations in this manner can create an information blind spot.

The defense transportation system and defense supply chain are disciplined, well-oiled machines. These systems also incorporate technology that allows the enterprise to track and monitor supplies. However, when operating outside of that network to support intra-theater logistics (through contracting, acquisition cross-service agreements, inter-service agreements, and transportation tender programs), collecting, housing, analyzing, and visualizing sustainment data becomes challenging. The component must rely upon multiple sources for information, numerous stove-pipe data spreadsheets, and good old-fashioned telephone and email reporting to flow materiel and supplies into the AOR continuously.

SETAF-AF supplies, delivers, and services USAFRICOM customers superbly. However, data collection and analysis are critical to continual process improvement to gain efficiencies and become more responsive. Without a last tactical mile data program, an organization will find itself reactionary versus anticipatory.

Six-Step Data Management Program

The SETAF-AF G4 has tremendous capability to deliver supplies and services on the Africa continent; however, there wasn't a process to capture and visualize sustainment data. Common to other operational and tactical units, this challenge is not new, nor is the solution revolutionary. Harnessing multiple data elements into one location is a core principle to enterprise resource planning and data architecture, but the execution is the challenge. This is especially challenging within a DOD operational level environment where multiple units and agencies operate from the commander's intent to achieve mission success.

To begin improvement, SETAF-AF G-4 began a supporting objective to "Programmatically Set the Theater"—and created a data management project. SETAF-AF G-4 understood that commanders needed to see the strategic to tactical environment better to be prepared for a no-notice crisis response or shift in national objectives requiring flexible sustainment and distribution. The data management project developed a 'Data-Driven Execution Plan', a simplistic framework to capture, house, analyze, and visualize logistics and sustainment data. The plan included the following:

- Leadership defined objectives.
- Subject matter expert identified supporting data.
- Spreadsheets.
- Built ArcGIS or analytical dashboards.
- Regularly updated information.
- Leadership measured progress via dashboards.

The challenge at the tactical and operational level is that units are often constrained on what software or hardware they can utilize to collect, house, and visualize data. This is a reason why staffs often rely on simple spreadsheets. This is not a bad thing—rather, it is an example of a low-cost readily available tool that most staff officers are familiar with. However, organizing that data into common formats that allow for exporting and visualizing becomes the real challenge. When using other low-cost, readily available data analytical tools, data must be formatted in an exportable format such as 'comma separated value' or CSV. When formatted header row data and standardized column data becomes the method that an organization captures data, visualization using products such as: Microsoft Business Intelligence, Tableau, or ArcGIS can easily be incorporated to conduct analytics. If your organization adopts these methods, a readily available cloud-based warehouse may also be used. The common and readily available tool is SharePoint and the software's 'list' application. It's not cutting edge, but the simplicity of the tool, coupled with its' availability, allows the software to be adopted by operational and tactical level units all over the globe.

ArcGIS and the COVID-19 Pandemic

In 2019, a devastating novel coronavirus (COVID-19) took hold of our society. At the time, SETAF-AF was experimenting with an Esri web-based software called ArcGIS and had built nominal common operating dashboards on the software's web-based platform. At this time, the 'John Hopkins COVID-19 Dashboard' increasingly gained notoriety, as it visualized COVID-19 infections. Soon, organizations were asking how to incorporate dashboards such as this one into their day-to-day operations.

Thankfully, SETAF-AF was already working with partners to expedite data visualization and planned to achieve a web-based common operating picture. It wasn't easy and continues to present challenges to ensure sustainable and repeatable processes. Fast-forward two years after embarking on this project, SETAF-AF G-4 and the greater command have a fully-functioning common operating picture on the ArcGIS platform. The result has allowed commanders to see the operational environment and their formations better and with more analysis.

The benefits far outweigh the cost, but one must recognize that last tactical mile common operating pictures come with challenges. Behavior change is by far the single most challenging hurdle to overcome. The DOD is a slide show presentation-friendly environment, which can stifle organizing information within a data analytics compatible manner. Since their basic course, staff officers have been indoctrinated with depicting common operating pictures using unstandardized sketches within slide shows. Slide shows are quick and easy to learn. Organizing data and using data analysis tools require extra steps and strict formatting; however, once those steps are taken, one can employ the concept of operations and sustainment briefings to the next level of presentation and decision making.

Best Practices

After achieving common operating picture success at SETAF-AF, other commands seek lessons learned and best practices to adopt data visualizations within their organizations. The following are best practices, advice, and recommendations to help leverage data and data visualization within your unit:

Don't wait to begin measuring your data. The quicker a data plan is formulated and implemented, the sooner your organization will collect data to measure and visualize. It doesn't happen overnight—but before long, your unit will amass enough data over time to better understand, shape, and influence decision making.

Adopt a simple data management plan that your team can understand and follow. SETAF-AF G-4 found success in our Six Step Data Management Program. Ask yourself, "How will you communicate to your customers, units, and staff members the task of managing, analyzing, and visualizing data?"

Read, follow, and implement the DOD Data Strategy and the eight guiding principles:

- **Data is a Strategic Asset.** DOD data is a high-interest commodity and must be leveraged in a way that brings both immediate and lasting military advantage.
- **Collective Data Stewardship.** DOD must assign data stewards, data custodians, and a set of functional data managers to achieve accountability throughout the entire data lifecycle.
- **Data Ethics.** DOD must put ethics at the forefront of all thought and actions related to collecting, using, and storing data.
- **Data Collection.** DOD must enable the electronic collection of data at the point of creation and maintain the pedigree of that data at all times.
- **Enterprise-Wide Data Access and Availability.** DOD data must be made available for all authorized individuals and non-person entities through appropriate mechanisms.
- **Data for Artificial Intelligence Training.** Data sets for A.I. training and algorithmic models will increasingly become the DOD's most valuable digital assets. We must create a framework for managing them across the data lifecycle that provides protected visibility and responsible brokerage.
- **Data Fit for Purpose.** DOD must carefully consider any ethical concerns in data collection, sharing, use, rapid data integration, and minimization of any sources of unintended bias.
- **Design for Compliance.** DOD must implement information technology solutions that provide an opportunity to fully automate the information management lifecycle, properly secure data, and maintain end-to-end records management.

Choose a readily available cloud environment, like SharePoint or OneDrive, to warehouse data and allow your unit members access.

Use simple data formats that can be imported amongst multiple data visualization tools such as ArcGIS, Microsoft BI, Excel, Tableau, Vantage, and/or any common operating picture mapping software. Once the data is in CSV format, it can be imported or exported into several systems keeping up with changing technologies, or amongst various commands.

Document as you go. Develop standard operating procedures and How-To guides to help your staff replicate and carry-on data gains & quick wins.

Take advantage of training. Across the Army, more and more data analytics courses are offered to Soldiers and civilians to create a culture of technically-savvy logisticians. Rigorous and rewarding training is available to Sustainers, such as the Financial Management Advanced Business Analytics Course, TS410 SAP Business Consultant Program (at the University of South Carolina), the Army Logistics University Data Analytics Course, ITIL4 Foundation and Development Course, Agile Certification, and Esri ArcGIS courses to name a few.

Leverage existing enterprise databases to extract AOR and formation-specific data. Often, the data is out there—but it's either not readily accessible or presented in a manner that tells a story. Be familiar with tools such as Integrated Data Environment/Global Transportation, Integrated Mission Support for Surface Deployment and Distribution Cargo, Global Combat Support System-Army, General Fund Enterprise Business Systems, etc. Contact and coordinate with data owners to find out potential solutions that may improve sustainment across all stakeholders. Know who on your staff has access and determine what information element you need to visualize. Extract those raw data files and incorporate them into your visualization tools.

Conclusion

Becoming a technically-savvy data-driven logistician is our new reality. Commanders must see their logistics data in ways that allow them to make the best tactical, operational, and strategic decisions to win. Our responsibility is to gain the knowledge to enable better data analytics and visualization to envision the last tactical mile. The problem set is timeless, but today we have technological advantages to see our problem.

Armando K. Velasquez served as the chief, programs & policy branch at the Southern European Task Force-Africa G-4. He now serves as a senior federal partner manager within the private sector. He is a graduate of the Command and General Staff School and holds a Master of Arts in International Relations from the University of Oklahoma, a Bachelor of Science in Political Science from Missouri State University.

Ivan P. Reid is a logistics data analyst within the private sector that worked with U.S. Army Southern European Task Force - Africa G-4 to modernize and advance their logistics common operating picture. He holds a Bachelor of Science in Industrial Management & Applied Engineering from Southern Illinois University.

Parts to the Point of NEED

An Interview with Maj. Gen. Darren Werner

By Lt. Col. Altwan Whitfield and Mike Crozier

Maj. Gen. Darren Werner assumed duties as the commanding general of U.S. Army Tank-Automotive and Armaments Command (TACOM) in June of 2020, where he is responsible for overseeing activities at the Integrated Logistics Support Center, three depots, two arsenals, and one government-owned, contractor-operated facility, which support the Army's ground equipment supply chain and key sustainment efforts for active-duty units both at home and abroad. A team from Army Sustainment sat down with Werner to discuss the Army's progress operationalizing advanced manufacturing (AM) to effectively meet parts demand where required across echelons at the speed and scale necessary to maintain pace with modernization initiatives.

Since former Secretary of the Army Ryan McCarthy's 2019 Directive (2019-29) charging the Army to embrace AM, what has been TACOM's main role in delivering those capabilities across echelons?

Our main enabling role here is best exemplified by what we did to support AM now, and in the future, so we established a role for a program manager covering AM. This person helps TACOM look out across the organic industrial base (OIB) to identify where we can most effectively drive AM efforts that are consistent and integrated with the Army Modernization Strategy. A good example of this is how we're engaged with the 31+4 modernization efforts by playing a key role in those related to ground combat. We're directly aligned and engaged with three cross-functional teams (CFTs)—next-generation combat vehicle (NGCV), precision fires, and Soldier lethality—to best develop, create, and sustain the Army's future capabilities. Still, all this needs to be synchronized with the logistics space and developed in tandem with the OIB. Our next generation of equipment needs to be organically sustainable when ready for fielding, and we're working to identify where AM can really support these efforts. We've already seen that AM can absolutely enhance OIB operations and support the warfighter down the echelon stream. A main end-goal is focusing on 2035—when we get there, our OIB should be ready to manufacture and remanufacture those systems at the pace of war.

How is TACOM approaching these efforts to effectively establish AM as a readiness enabler?

Of course, there's also a major doctrine and policy development aspect to all of this, so we've outlined a concrete, actionable strategy—what we're calling the Critical Path—to help us take any system component or part and go from 0 to 100 percent AM-capable. It's a highly disciplined process where we outline all the tasks and key stakeholders involved to identify, certify, manufacture, qualify, and deliver a part. We know having this doctrine in place will be foundational to AM as a readiness enabler. With this, everyone involved recognizes their specific responsibilities so that we can maintain our momentum. The Critical Path addresses the process from the cradle to the grave—from the idea of printing a part for a Bradley to its qualification and, finally, its provisioning in our supply and requisition systems. We can do everything from protecting intellectual property (IP) and technical data to testing how newly printed parts perform to sustain our materiel capabilities. We recognize that no two parts are the same, so respecting this process becomes critical as we aim to expand the reach of AM and overcome development challenges along the way. Standardizing this approach will help us scale across echelons and weapon systems, and that's where the true power of AM lies—we're laying the foundation, so to speak. When we get to 2035, then we'll be in a much more proactive sustainment and readiness position across all the activities taken on by the CFTs as we field new equipment.

How is TACOM working to integrate efforts across the OIB's supply chain to ensure AM will help meet demand at the point of need?

We operate under two strategic imperatives and organize around their ideal end states: we must deliver parts and other componentry at both the strategic—including the OIB—and tactical level in an effective and efficient manner. Right now, we're working closely with Combined Arms Support Command (CASCOM) and other units across the Army to identify parts that can be produced at the tactical level using their metalworking and machine shop set (MWMSS), which has both AM and subtractive manufacturing (SM) capabilities. We're in the process of establishing a comprehensive database containing all the technical data necessary for a specific part's polymer-based printing, so long as it's a battle damage assessment and repair (BDAR) part. With CASCOM's help, we're expanding that database of parts so that we can produce as many as possible in the field using that BDAR-based concept with integration into the Global Combat Support System-Army (GCSS-Army). Integrating AM into the OIB is really the crux of our second imperative, obviously, so we established the AM Center of Excellence (AMCoE) at Rock Island Arsenal, Illinois. Right now, we have 27 3D printers: one sand, one wax, 18 polymer, and seven metal, as well as polymer and metal post-processing equipment at the AMCoE, ranging from older polymer units to those that are brand new, which can complete metal printing.

Most importantly, we didn't just procure these printers in isolation—we worked with partners at the Ground Vehicle Systems Center to ensure the printers we have and maintain will support our most critical capability sets. This helps shape how we deliver those parts across the OIB, starting with really nailing down our process to best leverage the printers themselves. We're now in the implementation phase, where we can identify parts and tools, tie them to various depots, and contribute to the remanufacturing of legacy combat systems.

How will these efforts evolve in the future to meet needs borne from modernization?

We must look at how we acquire equipment capabilities and how we can integrate what we're doing on the AM or advanced sustainment side of the house to be effectively future-ready. In the past, sustainment seemed to be brought in towards the tail end of the acquisition process—we didn't necessarily have lots of influence over how new equipment was developed. Today, alongside Army Futures Command's CFTs, we are tied right into these processes from the start. In fact, AM techniques and requirements are a key component of the competition process for procurement and fielding. When different companies compete to develop the NGCV, for example, requirements will stipulate that the Army will receive the critical technical data needed to best leverage our AM capabilities to produce parts needed by these new systems from day one. This is foundational to ensuring sustainment tracks directly alongside modernization. It means that as soon as a system is fielded, we have data on its parts that we can produce using organic assets across our OIB and distribute directly to the point of need at speed and scale. The Program Executive Office Combat Support and Combat Service Support worked tirelessly to ensure our access to this technical data; this is a one-team effort across the board to ensure we don't let anything slip through the cracks as we press forward with AM.

What additional steps are needed to make AM a routine practice in the tactical space? From these, are there any necessary efforts that were unforeseen when this capability really came to the forefront in 2019?

To make this routine, the technology must be able to deliver capabilities consistent with new and evolving

Our next generation of equipment needs to be organically sustainable when ready for fielding, and we're working to identify where AM can really support these efforts. We've already seen that AM can absolutely enhance OIB operations and support the warfighter down the echelon stream.

Maj. Ben Hormann (left), Military Lead for the Leader–Follower project, talks about the multi-light indicators and the antenna array on the top of the Follower vehicle during an April 5 Leader–Follower demonstration at the Detroit Arsenal, Michigan, as Maj. Gen. Darren Werner (right), commanding general U.S. Army Tank-automotive and Armaments Command, and Brig. Gen. Glenn Dean (center), Program Executive Officer Ground Combat Systems, look on. (Photo by Scott Wakefield)

engineering requirements. To put that in context, we can use the Abrams tank as an example. With the Abrams, we can't rely just on polymer parts, as we need the strength of metal to maintain operational availability—as we speak, the technology needed to print all parts for the Abrams isn't fully developed. However, as we keep progressing on that technology continuum, we've worked to develop and implement guiding policies and deliberate processes—such as the Critical Path—to ensure that, when the technology is ready, we are ready to hit the ground running and take lessons learned from past development. We've already set the conditions needed for future success, which is a huge piece of the puzzle to ensure we don't need to be reactive as things evolve. AM can be retroactively beneficial, too. We have systems in place with legacy equipment to develop the data needed to produce parts, such as for a Bradley, which we may not be able to purchase in an existing supply chain. We can also re-engineer parts to make the whole remanufacturing process more efficient and reliable, like taking the technical data from three parts and combining to print one assembly.

How does the sustainment enterprise, in general, need to evolve to support AM from the Strategic Support Area downward?

The evolution begins here at TACOM, frankly, and starts with our ability to integrate AM as a supply chain solution. Item managers (IMs) across the enterprise should be able to use AM as a choice when it comes to sourcing repair parts. If I'm an IM for a Bradley, and I get a requisition for a part that is obsolete, then we must be able to avoid procuring that part through a slow, expensive contracting process. Alternatively, we need to produce that part on our own with our own printers; a process that once took years now takes hours or days. To get there, we must ensure we have a broad base of technical data and tools to support that IM while also being intentional with how we prepare to surge our support in the field and really bring these capabilities, and not just their outputs, to the tactical point of need. We've already seen this start with MWMSS usage at the tactical level, so I believe we're on the right glide path.

The AMCoE opened its doors in May 2019; how has the journey to full operational capability (FOC) progressed?

In 2018, Rock Island designated the opening of AMCoE, which has allowed the Army to prioritize investment in the Joint Manufacturing and Technology Center (JMTC) and helped us gain AM expertise with the knowledge that this is all nested in the drive to 2035. Still, you must balance operating within certain constraints, such as the JMTC's printer volume sizes and concerns around IP. The crux is developing technology and establishing procedures to project into the tactical space—we want to augment the supply chain. From 2019 until now, a huge JMTC accomplishment was, really, its establishment and progress towards FOC. We've used the printers there to do small-scale prototyping and provide rapid COVID support. In the next six months or so we'll look to produce parts out of Rock Island's JMTC that are fed into the OIB to feed remanufacturing lines at Red River or Anniston Depots and produce tools and fixtures to support similar efforts. Another piece to this is continuous development—the team is working on a space that will be used for the largest gantry-style metal printer that's ever been built for the Army. It can print an entire hull for a combat system, such as one that the CFTs can use as they develop options for the NGCV. Rock Island really plays host to these large-scale AM efforts, and their push to FOC has proceeded at a torrent pace. Additionally, we emphasize collaboration with Combat Capabilities Development Command to continually integrate new technologies and consistently engage with industry to ensure we keep up our pace and learn as they learn. This ensures we don't overinvest too soon in any capability that may be dated before providing the return we expect to see.

The rapid pace of technological adaptation and adoption, coupled with the Army's drive to full MDO-Readiness in 2035, ensures that change will be a constant in the world of Army sustainment. What advice do you have for Soldiers both new and experienced as we posture ourselves for the evolving nature of warfare?

Successful Soldiers operating in any echelon understand how to adapt to the world around them; that's no great secret. From what I've seen already in just a few short years of real exposure to AM, I believe the Army's AM approach and persistent efforts are progressing as expected and needed to get us where we want to be. I'd say my best piece of advice is to remain open-minded, operationally curious, and ready to learn—our adoption and systemic implementation of AM will only continue to take form if the force writ large is prepared for its deliberate and thoughtful use. We, as an Army, will continue to collaborate with partners in academia, industry, and across the DOD to integrate our efforts and best train and educate our Soldiers, so I hope those interested are prepared to undertake those growth opportunities as this space continues to develop. This has been and will continue to be a team effort across the Army Sustainment Enterprise. Each organization involved thus far has brought everything needed to the table. I'm excited for AM's future as we at TACOM continuously synchronize with other stakeholders to further bring this capability to life.

Lt. Col. Altwan Whitfield is currently serving as the deputy director of the Army G-4's Logistics Initiatives Group. Previously, she was the commander of 841st Transportation Battalion at Surface Deployment and Distribution Command. She holds a bachelor's degree in Special Education from Converse College in Spartanburg, South Carolina and a master's degree in Public Administration with a concentration in Education from Troy University in Montgomery, Alabama.

Mike Crozier is a strategic analyst in the Army G-4's Logistics Initiatives Group. He holds bachelor's and master's degrees from Georgetown University.

Feature Photo
Maj. Gen. Darren Werner, commanding general, Tank-automotive and Armaments Command, receives updates on equipment, current programs, and challenges in the Advanced Manufacturing Center of Excellence during his April 7 visit to Rock Island Arsenal – Joint Manufacturing and Technology Center, Rock Island Arsenal, Illinois. (Photo by Debralee Best)

Port Diversification and STRENGTHENING

Sustainment Relies on U.S. Military's Ship-to-Shore Capacity in Europe

By Lt. Col. Jermon D. Tillman and Maj. Adam M. Karlewicz

America's national defense strategy continues to be a partnered approach with the joint and multinational forces to achieve global deterrence that enables peace. Achieving an end is made possible through ways and means. America's armed forces achieve this end state through power projection via strategic sealift into a desired area of operations.

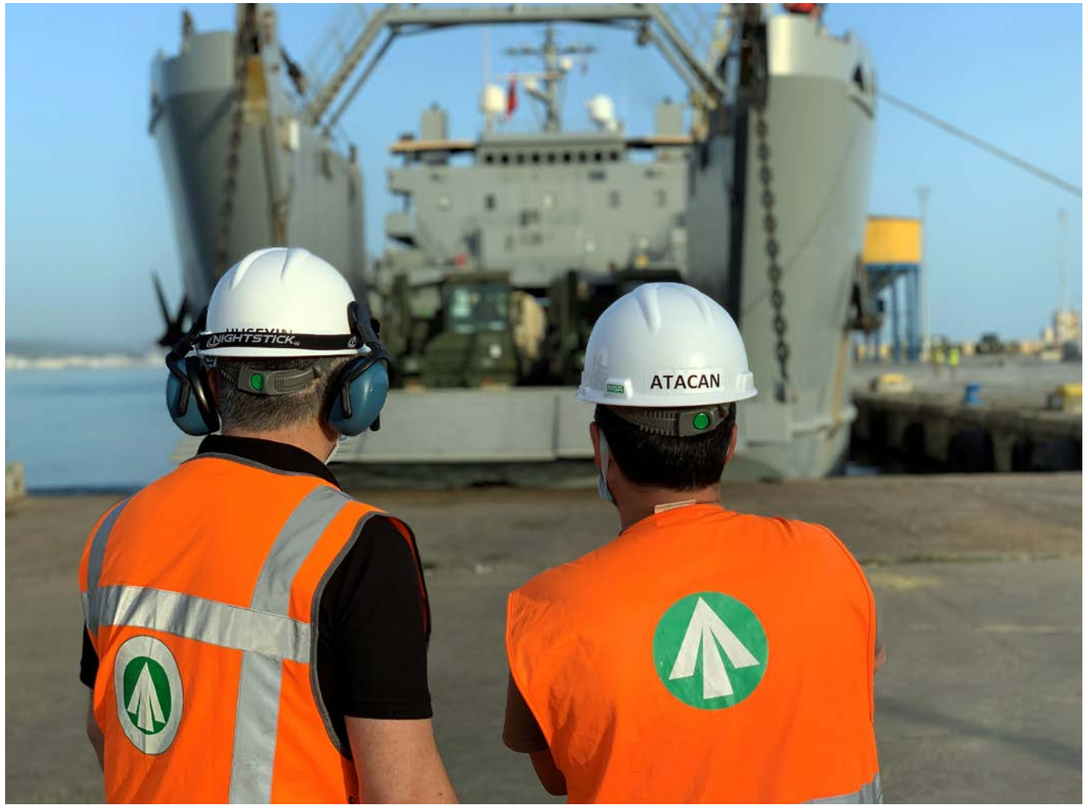
In Gen. James C. McConville's March 16 publication Army Multi-Domain Transformation, he describes the focus of foreign actors on the degradation of American power projection to counter our overwhelming offensive and defensive capabilities. A critical way to mitigate efforts against American power projection is through diversification in ports, terminals, and the contracted labor required to execute port operations. Retired Maj. Gen. Stephen Farmen, in an *Army Sustainment* article from 2020, mentioned, "The only way to project our decisive force is by, with, and through our strategic seaports. By diversifying our port usage now, we generate strategic readiness for tomorrow." This allows Army forces to support the demands of strategic sealift while being responsive to the threats against sealift which may occur during large-scale combat operations (LSCO) in a multi-domain battlefield. Projecting decisive force at strategic ports requires terminal diversification, host nation diversification, contractor diversification, and organic unit efficiency.

598th Transportation Brigade, Surface Deployment and Distribution Command (SDDC) is responsible for diversification efforts in the northern European region. Located in Kaiserslautern, Germany, the 838th's mission requires precise collaboration with European joint and multinational forces. This collaboration is essential for the initial utilization of ports, terminals, and ground lines of communication (GLOC). Currently, these GLOCs incorporate ports in northern France, Denmark, and Poland. Key leader engagements have built momentum in ports and pathways for the projected cargo flow into areas of operations. As a result, commanders have many viable options for force projection into northern Europe.

Logisticians and transporters from the 598th Transportation Brigade, Surface Deployment and Distribution Command and the 21st Theater Sustainment Command offload more than 1000 equipment items July 8 at the port in Gdansk, Poland. The equipment will move by rail and commercial line haul to its final destination at locations throughout Poland and eastern Europe. (Photo by Spc. Katelyn Myers)

Terminal Diversification

Lessons learned through exercises conducted at new seaports prepare these ports to handle cargo movements at surge capacity. As a result, the 838th Transportation Battalion, host nations, regional ports, new terminals, new vessels, an array of contracted organizations, and the greater 'Team of Teams' with Military Sealift Command and the 21st Theater Sustainment Command are better able to refine their processes. The 838th Transportation Battalion recently experienced this during the deployment of 1st Brigade, 1st Infantry Division, to Poland and the Baltic states, where multiple terminals and contracted partners were used for the first time.



Transportation professionals from the 598th Transportation Brigade, 839th Transportation Battalion, Black Sea-Turkey Detachment, coordinate the discharge of Army equipment at the port May 5 in Durres, Albania, for DEFENDER-Europe 21. The port operation marked the first time U.S. Army forces deployed through the Durres port and the first Joint Logistics Over-the-Shore operation conducted in the European theater in more than 75 years. (Photo by Jeff Jurgensen)

Months before the operation, the battalion was confronted with coordinating significant amounts of cargo into a few ports. Numerous planners identified these constraints and began devising primary and secondary plans to do the following: redirect sea lines of communication, redirect seaports of embarkation and debarkation, and redirect the applicable GLOCs. Simultaneously, the battalion supported the massive deployment requirement and alleviated cargo congestion in forward locations. The requirement to redirect cargo reception created the need for additional terminals, which were chosen for the new concept of support. Two of the primary factors in determining terminal feasibility are space requirements and availability. Moving an entire brigade combat team requires around 120,000 square meters of the staging area. The 1st Brigade, 1st Infantry Division, planners leveraged three separate ports to alleviate the potential congestion caused by using a single terminal. Moreover, congestion becomes a more pronounced issue when commercial cargo is the primary revenue for a particular port.

Logisticians and transporters from the 598th Transportation Brigade, Surface Deployment and Distribution Command and the 21st Theater Sustainment Command, await instructions before offloading more than 300 equipment items on June 5 at the port in Esbjerg, Denmark. The equipment belongs to the U.S. Army National Guard's 81st Stryker Brigade Combat Team, based in Seattle, which is deploying soldiers from the 3rd Battalion, 161st Infantry Regiment, to Europe in support of NATO's Enhanced Forward Presence. This is the first time the U.S. Army has worked with the Danish armed forces at the Esbjerg port to execute an operation of this kind. (Photo by Spc. Elliott Page)

The challenge of congestion may be replaced with numerous threats during LSCO in a multi-domain environment. For example, a cyber-attack renders material handling equipment (MHE) inoperable, underwater mines block the entrance to a port, and air superiority challenges make sealift vessels vulnerable to attack. As a result, port and terminal diversification is a key requirement for successful import/export of combat-ready equipment into and out of the European Theater to counter these types of threats.

Host Nation Diversification

The 838th Transportation Battalion helps shape decisions concerning port diversification. U.S. Embassies and defense attaché offices are critical partners in relaying requirements and desired terminals to a host nation. During a recent Stryker brigade deployment into Denmark, the 838th Transportation Battalion partnered with the host nation military to assist in the vessel discharge. The Danish played a significant role in the full spectrum of port operations, resulting in an enhanced, mutually supportive relationship.

Diplomatic lines of communication help tremendously with the process of port selection. Recently, through diplomatic channels, the battalion was placed in contact with host-nation counterparts (e.g., French 519th Regiment du Train) to support future operations in France. Host-nation partners have an active voice in the port selection. However, terminal selection within a port is determined via fair market competition through the U.S. government's contracting policies and procedures.

Contractor Diversification

Fair market competition persists as a critical element regarding contractor diversity. And thus, using newly awarded contractors to enhance their growth and development likewise remains extremely important. In addition to leveraging new contractors, ensuring the battalion is prepared for combat is also critical. Many contractors want to become more competitive by developing additional port capabilities through purchasing mobile ramps, increasing rail capability, gaining additional MHE, and dredging vessel berthing locations to receive larger vessels. Capable contractors reduce costs and provide options to exercise multiple ports and terminals simultaneously. Contract finalization results come from the U.S. Transportation Command's Acquisition Directorate, who award terminal services contracts. The awardee's capabilities are assessed with regards to their knowledge and experience of U.S. military seaport operations. Efficiencies gained through this process result from repetitions built during port operations and reflect in the battalion's capability to project combat power at the speed of war.

Organic Unit Efficiency

By building capacity and experience in ports across northern Europe, the Army increases its organic proficiency related to port operations. In addition, through analysis of previous operations, the 838th Transportation Battalion has identified several areas of improvement. These measures have strengthened the relationship with the battalion's primary continental U.S. (CONUS)-based SDDC counterpart, the 842nd Transportation Battalion. This relationship is what the battalions call "pitch and catch." Every port is different, and every vessel cannot accommodate the desired order of discharge. For example, a CONUS pitching port terminal may possess a vast capability with numerous types of lift equipment and resources available that are not available at some ports in Europe. This dynamic can cause time-consuming delays in discharge operations. Solutions to these challenges are rapidly developed through individually applied initiative, leadership, and unity of effort.

Aside from building extremely vital professional relationships, port diversification efforts build organic experience. Subordinate units assigned to a specific area of responsibility in northern Europe understand integration with the theater's objectives, the theater's global posture framework, essential cross-training, and the benefits of port diversification efforts. For the deployment of 1st Brigade, 1st Infantry Division, and concurrent redeployment of 1st Brigade, 1st Cavalry Division, the 838th deployed its United Kingdom Detachment to Gdańsk, Poland. This allowed the Detachment to qualify on deploying an armored brigade combat team outside its normal port of operations. At the same time, the 838th Transportation Battalion deployed personnel throughout Europe to assist.

The 838th benefits from a vast array of experience that preserve the battalion's ability to deliver rapid combat power projection throughout Europe.

Conclusion

Force projection is a critical component in support of joint all domain operations and the Army's multi-domain transformation. The 838th Transportation Battalion is enabling this effort through port diversification efforts in northern European ports and terminals, along with contracted labor. The battalion increases its organic capability by providing the commander options and redundancy for assured power projection. In addition to the 838th Transportation Battalion's efforts, the battalion's sister unit (839th Transportation Battalion) is fully engaged in port diversification throughout their region (Greece, Romania, Georgia, Albania, and Slovenia). By exercising new seaports throughout the European theater, the 838th Transportation Battalion is a key enabler regarding deterrence while strengthening America's alliances throughout Europe. The 838th Transportation Battalion's mutually supportive relationships are helping provide strategic readiness and maneuver for Army and joint force commanders.

Lt. Col. Jermon D. Tillman currently serves as the battalion commander of the 838th Transportation Battalion, 598th Transportation Brigade, SDDC. His education includes a Bachelor of Arts in History, Texas A&M University, Master of Arts in Military History, American Military University, Master of Arts in International Relations, Webster University. He has also earned a Certification in Strategy and Policy Development from the U.S. Army War College.

Maj. Adam M. Karlewicz currently serves as the battalion S-3 for the 838th Transportation Battalion, 598th Transportation Brigade, SDDC. His formal education includes an associate degree in math and science from Hudson Valley Community College in Troy, New York, a bachelor's degree in electrical engineering from Rensselaer Polytechnic Institute in Troy, New York, and a Master of Operational Studies from the Army's Command and General Staff College.

Feature Photo
Logisticians and transporters from the 598th Transportation Brigade, Surface Deployment and Distribution Command and the 21st Theater Sustainment Command began offloading more than 300 equipment items at the port in Esbjerg, Denmark, June 5. The equipment belongs to the U.S. Army National Guard's 81st Stryker Brigade Combat Team, based in Seattle, which is deploying soldiers from the 3rd Battalion, 161st Infantry Regiment to Europe in support of NATO's Enhanced Forward Presence. This is the first time the U.S. Army has worked with the Danish armed forces at the Esbjerg port to execute an operation of this kind. (Photo by Spc. Elliott Page)

Enabling Demand Reduction for Current and Future Special Operations Support

■ *By Col. Tavi N. Brunson, Lt. Col. Robert J. Rowe, Maj. Joe Colbert, Maj. Jordan Lester, Maj. Mark E. Collins Jr., and Maj. Guy E. Reynolds*

The 528th Sustainment Brigade (Special Operations) (Airborne) (528th SB) sustains Army Special Operations Forces (ARSOF) operations in cooperation, competition, crisis, and conflict to extend the operational reach and maintain freedom of action. The sustainment and support personnel of the brigade enable ARSOF to set conditions for strategic competition and multi-domain operations (MDO) to win future conflicts. These highly trained personnel leverage human networks and relationships, enable commanders to converge capabilities and create windows of positional advantage to enable decisive operations on a complex battlefield. Synchronization is critical to the success of sustainment operations, as it fosters unity of command from the strategic to the tactical level across all warfighting functions to support for Army and Joint Special Operations Forces. The 528th supports ARSOF operations through three organic battalions: 528th Special Troops Battalion, 112th Signal Battalion, and the 389th Military Intelligence (MI) Battalion. The 528th SB leverages small units of action (UA) that rapidly configure and deploy responsive, flexible, and modular teams known as Army Special Operations Forces Support Operations (ASPO) teams supporting global special operations requirements. The brigade also benefits from forward-positioned Army Special Operations Forces liaison elements (ALEs). The ALEs serve as the Special Operations logistics liaison to the Army Service Component Command (ASCC) and the Theater Special Operations Command (TSOC), geographically aligned to combatant commands. ALEs are responsible for coordinating and synchronizing logistics plans and Army common sustainment in support of TSOCs.

ARSOF support professionals from the 528th provide sustainment, signal, and intelligence support at the speed of SOF, enabling those at the tip of the spear to meet ARSOF's unique battlefield requirements. From its inception as a Quartermaster Service Battalion in 1942 to its modern configuration, the 528th SB anticipates requirements and leverages its people to innovate solutions to provide the right support, in the right place, at the right time.

The 528th SB is postured to support future concepts, including incorporating the requisite demand reduction needed to sustain an MDO fight. The need for demand reduction as a readiness enabler has been highlighted as a key initiative across the entire enterprise to effectively support the joint force in MDO. The Army's distributed supply nodes will require tailorable, scalable support teams and agile sustainment leaders. These are the same leaders who will continue to innovate to solve tomorrow's challenges by advancing several tenets key to effectively reducing demand as outlined by Training and Doctrine Command, which will improve our effectiveness and efficiency, help us meet demand at the point of need, improve situational awareness, and lead the requisite cultural change.

To best improve effectiveness and efficiency, the 528th SB aims to operate with disaggregated cross-functional teams that are tailored, scalable, and rapidly deployable. As defined in the National Defense Strategy, irregular warfare "favors indirect and asymmetric approaches" by countries "in order to erode an adversary's power, influence, and will." Supporting the Chief of Staff of the Army Gen. James McConville's five lines of efforts, demand reduction must focus on improving effectiveness and efficiency by enabling small units' ability to innovate in the face of adversity, aimed to increase geographic commander (GCC) and TSOC's freedom of movement through loosening of the logistics tether. This latitude is focused in three areas: (1) creating a certified pathway supporting multifunctional NCO development, (2) increasing information awareness to influence rapid decision making, and developing relationships with joint, interagency, intergovernmental, and multinational (JIIM) partners, and (3) influencing prepositioned war reserve materiel. The 528th SB supports demand reduction by focusing on the basics to maintain a coterie of highly proficient, forward-deployed sustainers empowered and enabled with the latitude, authorities, resources, and trust to ensure mission success.

Establishing a certified multifunctional development pathway for NCOs supports a small team's ability to adapt and innovate with changing support requirements. An article published in the November-December 2005 issue of *Army Logistician* penned by then-Maj. Ronald Ragin on "Transforming Special Operations Logistics" addressed four fundamental missions: Soldier development, SOF-unique equipping, operational planning and synchronization, and dynamic execution. Investing in multifunctional training and immersion in operational planning enables teams to facilitate adaptive execution. ARSOF invests in a certification, verification, and validation pathway validating small, tailorable, scalable teams that increase GCC and TSOC commanders' operational reach,

Parachute riggers with the 528th Sustainment Brigade (Special Operations) (Airborne) train on the Joint Precision Airdrop System during a training event April 1, 2017, at Fort Stewart, Georgia. This was the brigade's first time using JPADS, and it provided valuable experience for the parachute riggers. (Photo by Sgt. Vance Williamson)

resulting from reducing the size while maintaining capabilities provided from commodity managers/EMS teams and the Austere Resuscitative Surgical Teams. 528th SB's ability to continue to support multifunctional training and a tailorable organization postures units to support warfighters competing against highly capable near-peer threats in degraded, contested, and lethal operational environments. Innovative training, proper manning, and modernized equipping are not enough to reduce demands. But, with a nested operational concept, 528th SB projects forces forward while reducing resource requirements that enable freedom of action.

SOF's global presence requires demand reduction due to the scope of the mission. Supporting UAs globally dispersed on a level equivalent to conventional forces (CF) is expensive, cumbersome, and inefficient. Operating at the speed of SOF compared to conventional Army operations greatly differs at the point of need. SOF requirements are small in quantity, quick in execution, and are inherently decisive in nature. While the 528th SB employs small teams forward, those teams are dependent on many of the CSA's lines of effort in the context of demand reduction, such as setting the theater through modernization of Army pre-positioned stock, leveraging industrial base modernization to reduce distribution system demand, and sustainment for distributed operations through increased partner capacity and interoperability. For example, reducing the demand of U.S. contractors by leveraging foreign resources and operational and fiscal authorities enables demand reduction by reducing the size and weight of packaging requirements for projection from the continental U.S (CONUS). This concept allows 528th SB teams to surge capacity to assist at the TSOC level with operational

transitions, exercises, and other short-duration missions. The ability to surge capacity forward when required demonstrates the difference in support philosophies: SOF's "just-in-time" vs. CF's "just-in-case" methodologies. SOF utilizes CONUS-based base operational support or "over the horizon" support to deploy UA's forward based upon operational requirements. SOF also prepositions equipment while modifying the supply chain to meet demand at the point of need. Supplies and equipment are moved forward into the operating environment where modifications are made before transport to the end-user; therefore, increasing the supply chain's response time. The ability to meet demand and anticipate requirements depends on a vast human network, enabled by well-positioned sensors that enhance future innovation and bolster situational awareness.

The 528th SB visualizes the competition space in the context of specific mission needs for global sustainment to improve situational awareness. Improving situational awareness to support demand reduction requires both human and technological components. Fortunately, 528th's core strength is its people and their innate networking capability. The brigade maintains a continuous forward presence with its ALEs and signal support detachments located at each TSOC. The ALEs set conditions and nest with GCC, ASCC, and TSOC planning. These "outstations" have regular engagements with 528th headquarters, the 528th Support Operations Cell's Global Support Operations Center (GSOC), and the group support battalions (GSB) to share situational awareness. These critically placed personnel build and sustain relationships at the TSOC and link the ARSOF support enterprise into one synchronous entity. Another key benefit of the 528th human network is the shared dialogue of lessons learned during exercises and operations. The shift to MDO, large-scale combat operations (LSCO), and strategic competition requires an intimate understanding of host nation support, Army pre-positioned stock locations, and geography. The 528th's ALEs provide ASPOs and GSBs rotating into a theater for operation and exercise real-time insight into each of these disparate components.

Integrating technology into sustainment systems will improve situational awareness to make timely decisions and support demand reduction. While human factors will remain paramount, technology will enable commands to realize a real-time common operating picture (COP) in lieu of untimely logistic status reporting. Integrating new technology and artificial intelligence to increase a real-time sustainment COP into the ARSOF communications platforms will include the Systems Integration Office (SIO) within 528th's 112th Signal Battalion. The SIO analyzes existing communications systems, informs requirements, assesses emerging technologies, and assists with developing innovative solutions to modernize the ARSOF command, control, communications, computers, collaboration, intelligence, surveillance, and reconnaissance architecture. The SIO's work will enable SOF elements of various sizes to extend their operations by communicating accurate logistical requirements and eliminating unnecessary resupply that potentially jeopardizes the mission.

The 528th's 389th MI Battalion is the operational intelligence arm of 1st Special Forces Command (Airborne). The 389th increases ARSOF's situational awareness in MDO, LSCO, and strategic competition through the support of the Information Warfare Center and its inherent processing, exploitation, and dissemination (PED) capability. An embedded intelligence capability within a sustainment brigade supports demand reduction by providing sustainment leaders with accurate, real-time situational awareness that fosters a better situational understanding of the operating environment and rapid, informed decision-making. For example, 389th PED analysis from an unmanned aircraft system, Grey Eagle, presented to an ARSOF commander, can lead to a decisive change in an operation. Rapid changes in operations, fused with the aforementioned communications improvements and live sustainment COP, would allow ARSOF sustainers to tailor support to each UA, on time and on target. The real-time exchange of information reduces the transportation of supplies to an area where they are no longer needed or a quantity that does not match the updated requirement based on the situation.

The 528th SB's sustainment culture enables operations at the speed of SOF, with an eye toward additional change needed to support future operations in all phases of competition, crisis, and conflict. To support the other aspects of demand reduction, sustainment leaders must champion a deliberate change in organizational culture. Some of the challenges facing the sustainment community include: supporting dynamic small teams forward, enabling teams to operate without constant resupply, and avoiding large immobile stockpiles while leveraging prepositioned resources. The 528th enables small teams to operate and make decisions forward by preparing leaders and creating a culture of trust and accountability adhering to the philosophy of mission command. Flat and fast communication is critical at all echelons of command, understanding that flat communication means creating a shared understanding and sharing information, good and bad, without fear of reprisal. In SOF, trust is the "coin of the realm," and it serves as the bedrock for the latitude and authorities SOF operations rely on.

Our Army is at an inflection point that demands our logisticians rethink how and by what means we sustain operations in an evolving strategic environment. LSCO, as outlined in 2017's rewrite of Field Manual (FM) 3-0, and the subsequent FM 4-0, gives us a view of how the Army would fight with our current operating concept (Unified Land Operations) supported by current levels of manning, training, and equipping. The future operating concept, MDO, prescribes a joint operating concept where competition is the steady-state and the desired condition. Escalation includes a rapid response from small teams who communicate, target, and synchronize to create convergent effects at the right moment. The experience of both SOF and CF over the previous 20 years has not prepared leaders for either of these futures. Large fighting formations, extended duration, size of operating bases, dependency on owning supply lines, and medical evacuation within one hour to a higher echelon of care may be relics of the past, either not feasible in LSCO or not suitable for MDO. The 528th SB is postured to lead sustainment of SOF into future competition and conflict while maintaining a vital link with JIIM partners and conventional sustainment formations. Creating a culture of shared learning and unlearning of past techniques will break leaders free from repeating the past or using yesterday's solutions for tomorrow's problems.

528th SB's strength is in our people. These adaptive leaders make up tailorable, scalable cross-functional units of action who leverage networks and relationships to provide options for the supported command. The command and control of these teams are informed by forward-positioned personnel who gain and maintain contact with the problem to provide the rapid and purpose-built capability. This model is forward compatible with MDO, and the demand reduction required to sustain positional and capability advantage, timely response, rapid delivery, asymmetric options, and integrated mobile forces. A change in organizational culture that allows advanced sensors to improve situational awareness will drive efficiencies and effectiveness at the point of need. As part of the joint force, sustainers must develop ways to enable the operational reach, tempo, and speed of escalation between competition, crisis, and conflict now and at any time.

Col. Tavi N. Brunson is currently serving as the commander for the 528th Sustainment Brigade (SO)(A) at Fort Bragg, North Carolina. He served in operational assignments in Afghanistan, Iraq, Syria, and multiple countries across Africa and the Middle East. He is a graduate of the University of North Carolina at Chapel, the Air Command and Staff College, the Joint and Combined Warfighting School, and the Army War College.

Lt. Col. Robert J. Rowe is currently serving as the deputy commanding officer for the 528th SB(SO)(A) at Fort Bragg. He has served in the 10th SFG(A), 7th SFG(A), CJSOTF-Afghanistan, USARCENT, 2nd and 3rd Infantry Divisions, and the 82nd Airborne Division, and has multiple deployments to Iraq, Afghanistan, and Korea. He has a master's degree in international relations from Troy University, a bachelor's in political science from Fayetteville State University, North Carolina, and is a graduate of the U.S. Army Command and General Staff College.

Maj. Joe Colbert is currently serving as the support operations officer for Special Troops Battalion, 528th Sustainment Brigade (Special Operations) (Airborne) at Fort Bragg. He has commanded a Special Operations Logistics Support Element Detachment at Fort Bragg, North Carolina, and the 24th Ordnance Company Modular Ammunition at Fort Stewart, Georgia.

Maj. Jordan Lester is currently serving as the S3 Officer for the 528th SB at Fort Bragg. He commanded the 632nd Support Maintenance Company at Fort Stewart, Georgia, and served as the battalion S3 for 87th Combat Sustainment Support Battalion.

Maj. Mark E. Collins Jr., is currently serving as the executive officer for the 528th SB. He is a Logistics Corps officer with over 13 years of experience serving in the 8th PSYOP Group (A), Quartermaster Basic Officers Leadership course (Instructor), 4-160th Special Operations Aviation Regiment (A), 3rd Infantry Division, and 82nd Airborne Division. Maj. Collins is a graduate of Georgetown University and the Indiana University of Pennsylvania.

Maj. Guy E. Reynolds is currently serving as the plans and exercises Officer for the 528th Sustainment Brigade (SO) (A) at Fort Bragg. He has commanded the Service Detachment, 3rd BN, 1st SFG (A) at JBLM, Washington, and served as a Logistics Management Officer for USASOC at Fort Bragg, North Carolina. Reynolds has a Master of Science in Supply Chain Management from Kansas University and a Master of Arts in Transportation and Supply Management from American Military University.

Featured Photo
Army Special Operations Forces have been extending distribution networks through the use of the Joint Precision Airdrop System, such as this one used to set up a SOF Aviation Forward Arming and Refueling Point in California in July 2021. (Photo by Maj. Chris Lancia)

DEFENDER-Europe 21

Solidarity on the Move

By Lt. Col. Scott Gum

Under hazy early-May skies, elements of the 21st Theater Sustainment Command (TSC) hit the beach at the Adriatic Sea port of Durres, Albania. But this was no seaside picnic, rather it was the leading edge of complex joint logistics over-the-shore operations powering the major U.S.-led, NATO-backed multinational training exercise, DEFENDER-Europe 21 (DEF-21).

Maj. Gen. Christopher Mohan, 21st TSC commander, oversaw the offloading of enough bulk fuel and other supplies to keep 28,000 troops from 26 countries on the move as they prepared to execute simultaneous operations across more than 30 training areas spanning Europe, from the Baltics to Albania in the strategically important Balkan region.

Mahon said during an interview on Defense Visual Information Distribution Service conducted In Durres, Albania, on May 4, "The role of the 21st TSC is to set the conditions for the success of this exercise. We have Soldiers…teams deployed from Estonia all the way down to Greece. The central point of operation is here at Durres…."

While DEF-21 was designed as a rehearsal to practice international interoperability among allies facing a fictional foe, the real-world stakes touch the very core of what it takes to keep the "Free World" free. A successful sustainment operation underpins the difference between victory or defeat.

By most measures, a nation's military power is calibrated by its ability to project combat forces at speed and capacity to austere locations. As NATO expanded eastward in the post-Cold War era, the challenges in projecting forces and sustaining them also expanded exponentially. Deploying forces and their supply chains needed to overcome red tape at international border crossings fraught with domestic customs regulations as well as unpredictable infrastructure constraints, yet somehow still cover vast distances in very short amounts of time.

To increase national military power and reliably project forces, the U.S., working with allied and partner nations, must maintain the ability to converge movement plans and data as forces roll through transit nations to their final destinations. Only by developing a common sustainment language that deconflicts and coordinates actions can militaries of all involved nations along with their commercial partners efficiently transit troops and supply chains to target destinations by maximizing utilization of all available local infrastructure and security resources.

Since the end of World War II, the concept of solidarity among NATO nations has been a foundation for spreading peace and prosperity across Europe. True solidarity is achieved when a group, acting upon shared interest, unites as a singular entity. Opportunistic enemies readily exploit real or perceived gaps in solidarity to weaken alliances and the force multipliers they provide.

It is that very solidarity of nations and the ability for nations to converge movement plans and data that was put on full display during DEF-21. The complexity of planning and executing deployment and integration of thousands of allied personnel and their equipment across widely dispersed European locations posed significant logistical and administrative challenges. Other previous mass-deployment exercises produced serious military-mobility lessons learned as U.S. and NATO shipments and convoys were stopped dead in their tracks at border crossings or national points of entry by mind-numbing customs paperwork or tedious road or railway access requirements.

Famously, a convoy of U.S. M109 Paladins en route from Poland to Germany as part of the 2018 multinational exercise ALLIED SPIRIT VIII was stalled just past the border when German authorities deemed the self-propelled howitzers too heavy and too wide for the trailers carrying them. The paperwork supporting the movement, conducted by a Polish contractor, was also declared wrong. Police said driving time violated regulations restricting convoys to use German roads only overnight between 9 p.m. and 5 a.m. The stoppage delayed the equipment's arrival and the training mission it supported.

To aid in avoiding future international incidents and improving international coordination, at the direction of the U.S. European Command (USEUCOM), the 21st TSC, employs NATO's Logistics Functional Area Services (LOGFAS) suite of automated tools.

Although 21st TSC has used LOGFAS in the past, the DOD could not share detailed data with LOGFAS from the DOD tools used in planning and executing deployment and sustainment, forcing all data to be recreated and maintained manually. DEF-21 proved a turning point on an investment in data interoperability and automation started in 2017.

7th Transportation Brigade (Expeditionary) crew members prepare to head out underway to deliver petroleum over the shore during a May 5 training exercise in Durres, Albania. (Photo by Staff Sgt. Elizabeth Bryson)

The ability of the U.S. to translate and share national data with LOGFAS immediately enabled NATO and other participating nations to achieve a full-sight picture of DEF-21 movements in its newly validated NATO Movement Coordination HUB (NMCH) in Ulm, Germany, in the beginning of March. The NMCH brought in 13 allied and partner nations alongside the NATO Allied Movement Control Center to focus on the best practices for projecting forces using communication and coordination with each nation's National Movement Coordination Centers, which are the linchpin for resolving issues that lead to delays during military movements.

For LOGFAS to be useful, it requires detailed information on force requirements, units, transportation assets, infrastructure, deployment plans, routes, consumption rates, shipping manifests, and timelines for each operation. In the DEF-21 deployment phase alone, LOGFAS tracked 836 inter- and intra-theater movements of 96 U.S. and embedded United Kingdom units, supporting coordination for port operations, convoy security, crew rest, and border crossings—all of which would have been accomplished previously with emails, phone calls, liaisons, and spreadsheets.

The DOD's global nature means personnel rotate assignments every few years, producing "institutional memory" deficits. This fact of military life, combined with weeks of training required to competently operate LOGFAS, led to the U.S. decision to limit utilization of LOGFAS to staff that directly coordinate with NATO and partner nations, and continue planning and executing logistics operations for DOD units within DOD systems.

The key to this approach is enabling smooth data interoperability between DOD and LOGFAS. U.S. Army Europe, 21st TSC, and USEUCOM utilize the Joint Enterprise Data Interoperability (JEDI-X) application as a bridging platform to map, augment, and translate required data from DOD systems to LOGFAS at prescribed intervals during planning and execution. JEDI-X was developed by a U.S. veteran-owned small business for data interoperability and was initially validated by translating U.S. deployment data from the Joint Operational Planning and Execution System for re-use in LOGFAS during NATO exercise TRIDENT JUNCTURE 2018.

This LOGFAS initiative must meet several tenets to be successful: It supports the integration of assigned (theater) and allocated (U.S. Army Forces Command provided) Army units and equipment, including Army pre-positioned stock.

- It supports the integration of U.S. Army units with joint and multinational partners.
- It supports the rapid execution of operational plans and contingency plans.
- It supports all phases of operations.
- It maximizes re-use of common data:
  - Data sourced from Army or joint (preferred) systems of record
  - Data consistent for many administrative, transactional, and planning efforts, and documents
  - Data kept current during planning and execution
  - Data sharing compliant with U.S. laws and regulations for classified data and foreign disclosure
- It supports the U.S. and NATO planning processes and is compliant with NATO Agreements (STANAGs).
- It is useable globally by other geographic combatant commands and with non-NATO partners.

Equipment belonging to 53rd Infantry Brigade Combat Team arrives at the port of Durres May 1 on the U.S. Army Logistics Support Vessel Maj. Gen. Charles P. Gross (LSV 5), while it was operating in the Adriatic Sea during DEFENDER-Europe 21. (Photo by Chief Warrant Officer 5 Mark Shupe)

The NATO Movement Control HUB, was established in Ulm, Germany in late March as part of the Allied Movement Control Center and welcomed 13 national representatives who played critical roles in the coordination and de-confliction of Allied cross border movements, during an event April 23. (Photo by Capt. Mike McKinney)

Even the hemisphere-spanning scope of DEF-21 pales in complexity to potential real-world NATO Article V scenarios, which is why U.S. successes in 2021 in collaborative planning and execution with allies are not the finish line. To respond to a contingency, the 18-month exercise-planning cycle will have to collapse to weeks. Multidomain operations, contested logistics, and Great Powers-conflict scenarios further complicate planning and exacerbate the need for convergence on tools and processes for collaborative operational planning and execution with America's allies.

NATO has recently announced its Enablement Support System (ESS) will augment LOGFAS with military engineering and medical collaboration modules in 2022 and eventually replace LOGFAS entirely. U.S. military sustainers must embrace this opportunity to influence the future of allied logistics collaboration by helping shape ESS to enable shared future needs. We must also continue to increase the automation and alignment of our processes and systems to rapidly converge with NATO and our allies globally.

DEF-21 provided a realistic proving ground for using LOGFAS to overcome the challenges of deploying and integrating a large-scale multinational force. Data interoperability and automation using JEDI-X enabled most U.S. personnel to continue working in familiar DOD tools while re-using common data for timely coordination with allies. The data boundaries between national systems used for planning and execution have been breached, and common tools are now used for coordination with positive effects.

Quantifying these effects is an ongoing effort, but a qualitative initial assessment is that the use of LOGFAS by the U.S. and allied nations led to reduced competition and congestion between elements of the multinational force and commercial traffic on critical infrastructure, streamlined administration of host and transit-nation compliance, and enhanced a general sense of international partnership to accomplish a shared mission.

For proof of progress, look no further than the 21st TSC's successful operations during that first hazy May day on the beach at Durres.

Lt. Col. Scott Gum serves as the chief of transportation plans and operations and the Theater Movements Center- Europe for 21st TSC. He served two years as the operational logistics planner for USEUCOM J4. He has a Master of Science Degree in Homeland Security from Colorado Technical University.

Featured Photo
The Pastrimi Detar, a locally procured fuel barge in Durres, Albania, on 4 May heads to sea with members of the 7th Transportation Brigade (Expeditionary) and 21st Theater Sustainment Command to conduct joint petroleum over the shore as part of DEFENDER-Europe 21. (Photo by Lt. Col. Scott Gum)

SUSTAINMENT TRANSFORMATION

How the Joint Artificial Intelligence Center Supports Army Logistics

An Interview With: Mr. Nand Mulchandani

By Lt. Col. Altwan Whitfield and Mike Crozier

Nand Mulchandani serves as the chief technology officer of the Joint Artificial Intelligence Center (JAIC).He is responsible for transforming the DOD into an agency prepared to adopt and leverage next-generation analytical techniques supported by modernized software technologies. A veteran of several successful Silicon Valley startups, Mulchandani has introduced an agile, venture capital-influenced approach to capability development within the Pentagon to more rapidly develop, test, evaluate, and field emerging artificial intelligence (AI)-based capabilities across the DOD. He joined the JAIC in 2019 and previously served as the agency's acting director for a short stint in 2020. Army Sustainment sat down with Mulchandani to discuss the JAIC's efforts writ large and those specific to driving logistic efficiency and readiness across echelons.

The JAIC was established in 2018 to integrate and scale AI efforts within and across the DOD – how have you and your team worked to best define the center's mission so it's able to operate and deliver like an agile startup?

At the highest level, defining that mission upfront is extremely important. In our earliest days, Lt. Gen. John Shanahan, the inaugural director of the JAIC, and I put together a slide that sought to hone and portray our business model and operating plan effectively. We each came to a few key conclusions, some of which were inspired by my time spent in Silicon Valley. The one thing that tech startups always must do well is to identify their operational constraints so that anything they build or develop will generate leverage. So, we, the tiny little JAIC which at the time, were probably 150 people or so sitting in the middle of a two-million-person organization, worked to find the key control points and develop a business plan in a model that would allow us to do just that. From the get-go, we knew we had to put ourselves in our customers' shoes and understand at a very deep level what their needs are. Then, translating those features and functions into what a product team needs to deliver in order to satisfy those needs can be executed. We knew we needed to make the JAIC a fully customer-centric organization. We've gotten at that issue by structuring it very much in line with a tech company to make sure those products are delivered rapidly with customer needs at the forefront—from ideation to deployment.

It sounds like the JAIC had to be very tactical about how it picked its battles from its onset—how did your team approach hiccups or roadblocks in that product development space as you approached full operations?

I'll start by saying I've been at the JAIC for about two years, and that makes me an old-timer in our office—which is a cool dynamic. Congress appropriated money to stand up the JAIC, and we were given a mission to go execute. Our biggest challenge up-front was forging an entire team out of raw material, so to speak. Some of the first folks detailed to the JAIC didn't have tons of software experience, so that made us be intentional about how we structured the organization up-front by taking the best of both military and classic tech startup structures. There's a common misconception that tech companies are inherently flat by organization and those in the military are inherently hierarchical, and that's true to an extent, but there is nuance. In general, tech companies tend toward being very specialized, hierarchical, and functionally oriented. Each employee, down to the most junior engineer, would know what was going on in the company and the challenges it's confronted with. When I got to the JAIC, everybody thought that the whole organization was flat, meaning everybody was reporting to a three-star general. With that, poor Lt. Gen. Shanahan was just completely overloaded with about 150 people trying to get his attention. So, we had reconfigured our structure, and we did this by creating divisions in terms of who did what and for what purpose. Naturally, we were able to create product manager and owner roles in the likes of private industry with respect to the government context we were operating in. Once we were able to strike that operational balance, then things were able to take off—and all of that was borne by a focus on our people, which I know the Army places a large emphasis on.

People tend to use AI and machine learning (AI/ML) as a buzzword that will hopefully be a catch-all problem solver, but there's foundational legwork to be done between now and that end-state, it seems. What does that end-state need to look like when AI/ML is effectively scaled and utilized within the Army and the other services, and how will we know when we're at that point?

I don't necessarily think we're ever going to be done, and I don't believe anybody will ever be done in the space unless we simply stop iterating on tech completely. Here's a somewhat rudimentary but still functional analogy that I like throwing out there: think of yourself as living in a land before fire, and somebody walks up to you and tells you about their latest hot discovery. They tell how fire will transform everything we do and how we do it. In this case, AI/ML are fire, and JAIC is the Department of Fire trying to integrate everything. With fire, there is no "end-state," you simply keep finding new ways to better make it work for you. The same holds for AI/ML—we will continue to innovate and adapt it to whatever space we're in. At some point, it will absolutely become commonplace. AI has already revolutionized certain parts of our lives, and logistics is certainly one of those parts. With logistics, we're currently at a point where we can leverage what's called narrow AI, where that's applied to specific use cases—such as with predictive maintenance. That's already given us great results, but there's lots more juice to be squeezed from that orange.

There are several misconceptions surrounding what AI/ML can and will do, which leads to mismanaged expectations. What's the best and most realistic sales pitch for AI/ML when it comes to enabling sustainment?

I don't think you need to have heaps of direct military experience to quickly learn how pivotal or foundational logistics and sustainment are to making the Army run. Where AI/ML and other aspects of software engineering, which may not be super germane for this conversation, really come into play are breaking down those silos which enable warfighting operations on a scale that's incredibly massive—large companies face similar barriers, but it's the DOD's scale that really makes the issue unique. What we're trying to tackle at the JAIC is changing how we think about integrating internet-scale platforms and other systems so we can really break down those silos and integrate sustainment and warfighting functions so that we can really unleash AI/ML to deliver insight at the speed and scale we desire. The Army and the other services are being intentional with how they are building and integrating these systems to most effectively consolidate their critical data in a place that's easily accessible, which is key to this whole movement. The next step is taking that data and making it ready for AI/ML—the irony here is that the presence of AI algorithms is not limiting; it's the readiness or cleanliness of the data feeding those algorithms. This all comes down to delivering optimal functionality and fully integrated logistic awareness to a commander in the field, so they are connected to work done on a piece of equipment by a maintenance operator in a depot or elsewhere.

There seems to be a necessary balance between functional expertise and digitizing old processes that limit our ability to best leverage that expertise, and data appears to be at the heart of that issue. How will data be commoditized so it can be used as an enabler of AI/ML?

As I mentioned earlier, the data aspect of this is critical, which is having the data in a clean, AI-ready format. As an example, some of our earliest days at the JAIC spent on various predictive maintenance projects really revolved around data cleaning. We built an algorithm to make sense of handwritten and highly variable maintenance descriptions used as data. From there, building an optimization algorithm is the less difficult part, honestly. Accessing usable data is the biggest hurdle. For instance, we worked with the 160th Special Operations Aviation Regiment on algorithms to predict engine fatigue and failure. At the start, all that data had to be sourced from hard drives and downloaded. In other cases, the Army may not even own this data, which is another challenge that we, as the DOD, are working to address early in the system acquisition process. The real next question will answer how we need to continue to leverage the experience and intelligence of the logisticians that are doing that really challenging work to ensure what we develop on the AI/ML side of the house supports those efforts as opposed to just running parallel or even serving as a barrier to that work.

How well are we approaching these developments from a joint perspective?

There are two ways to look at this since everything we do at the JAIC is, of course, joint in nature. When I first started with the JAIC, I was warned that service-specific constraints, like budgets and priorities, will make integration a huge challenge. While we're still evolving as a joint force in terms of AI/ML, we've made huge strides in some foundational efforts which will support that integration at scale in the future. Namely, we've worked to establish the Joint Common Foundation (JCF), to build a common development environment for AI/ML that anyone across the department can use. We now have all the services developing within the JCF, which is amazing to see and a huge accomplishment in advancing that joint concept. We still have work to do to really break down those data silos we talked about earlier, but this is a big step in the right direction for the Army and DOD writ large.

What excites you most about what the JAIC is doing to support the sustainment space in the near and long term?

I cannot think of a more important system or suite of operations, such as those for sustainment, which will connect to the broader electronic fabric that we're working to build. There's a wealth of optimization capability that's already built around logistics and sustainment that we can apply now and in the future at scale. The next frontier is ensuring we have the right digital systems in place with the right architecture and platforms to go execute this. Our military's logistics operations are world-class, and these functions are imperative in perpetuity. We now have the opportunity to accelerate these capabilities and do them even better, which really excites me as we work to keep moving ahead in such a competitive environment. I'm confident we'll build on the wins we've already achieved as a joint force to keep advancing in this space on behalf of logisticians and sustainers in the Army and across the services.

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Featured Photo
Nand Mulchandani, director of the DOD Joint Artificial Intelligence Center along with Army Colonel Brad Boyd, the JAIC's Chief of Joint Warfighting Operations and Dr. Jane Pinelis, the JAIC Chief of Testing and Evaluation hold an on-camera, on the record press briefing in the Pentagon Briefing Room, Sept. 10, 2020. (Photo by Marvin Lynchard)

Forward Support Company Perspective

Company-level Logistics Trends, Shortfalls, and How to Find Success

By Maj. Russell Vickers

Success in tactical logistics begins at the home station, far away from the terrain, enemy, and battle. The fight itself begins with you, the leader and Soldier that will be on the ground calling the shots by firing the volleys, traversing the terrain in vehicles, evacuating the wounded, and many other tasks. It requires sophisticated training, communication, and decision-making that may push individuals further than they thought possible. The list of everything Soldiers and units do to prepare for combat operations or deployment is infinite; however, the principles of sustainment in Army Doctrine Publication (ADP) 4-0, Sustainment, are indicative abilities that help spell success at every level in the chain of command. Unfortunately, many units and their leaders find pitfalls before and during training, preparation, and execution of tactical logistics. Exactly how to avoid these traps and trends is up to the individual leader and the chain of command, but a winning plan and its procedures are largely driven from home station and the utilization of the principles of ADP 6-0, Mission Command and the ADP 4-0.

Anticipation

APD 4-0 defines anticipation as "the ability to foresee operational requirements and initiate actions that satisfy a response without waiting for an operations order or fragmentary order." The ability to foresee a supported unit's sustainment needs begins with the knowledge, a diagnosis of the capabilities of both the supported and supporting unit, and what equipment will best suit that support.

Trending Shortfalls. Units leave behind useful equipment due to:

- Poor load plans
- Improper or incomplete pre-combat checks (PCC) and pre-combat inspections (PCI)

- Lack of training on equipment
- Perceived uselessness

Avoiding the Pitfall. Know and understand the modified table of organization and equipment. Understanding precisely what equipment the platoon and company have available creates a better understanding of any unit's intended role in sustainment. Understanding the equipment is essential to knowing its best use, applicability, and shortcomings. Logisticians must anticipate commodity and service requirements for all units and balance them against what the sustainment unit is physically capable of supporting.

To avoid poor load plans, the exercise of load plans is imperative. This includes physically loading every piece of equipment, aligning towed equipment to prime movers, and aligning drivers, truck commanders (TCs), and gunners to equipment. Often units have enough assets but not the qualified personnel to move them. Consider what happens should any one piece (or multiple pieces) are damaged or destroyed. How will the unit recover that vehicle? How will the unit move the vehicle and the assets it is carrying if they are not damaged? What is the contingency movement plan for personnel and equipment with the loss of assets?

Basic individual and leader functions of PCC and PCI cannot be emphasized enough. They are consistently the cause of many disparaging moments for units. Insist and enforce checks on Soldiers and leaders throughout the organization to display all equipment needed for any operation. Frequently overlooked articles of common individual equipment are mission-oriented protective posture (MOPP) gear (especially boots), Rhino mounts, J-Arms, and clear eye protection. The lack of a Rhino mount, the small piece that allows night vision devices to be attached hands-free to the helmet, can strand a convoy if the movement lasts until darkness or limited visibility. Never assume any Soldier or leader has thought through every possible uniform scenario for a training event; it takes a collective effort to ensure packing lists are thorough and completed with enough time for Soldiers to secure items they may not have. It's imperative to know and check driver's licenses and qualified training amongst the unit at this stage.

Train on all required or authorized equipment in your unit shipped to an area of operation. The right piece of equipment is there for the unit. Too often, units can overcome a debilitating obstacle, but they lack trained individuals to accomplish that goal. When training, there needs to be a primary, alternate, contingency, and emergency (PACE) plan for individuals trained on the equipment in the likely event of a casualty.

Equipment not being used by an organization does not necessarily mean it is useless. Both decisive action training event scenarios and large-scale combat operations (LSCO) are unlike what many seasoned veterans have witnessed during deployments to Afghanistan and Iraq. This complacency with forward operating bases (FOBs) has led to atrophy in the use of equipment. This atrophy often goes unnoticed due to contractor and distribution support to a FOB. None of that support may be available during significant training events or in decisive action, and leaders must anticipate this shortfall.

Integration

Planning and preparing for tactical operations require the full complement of the team effort to succeed. This means combining all sustainment elements to ensure unity of command and effort, the central tenant of the Integration principle of sustainment. Failure to plug into what a sustainment unit's higher and lateral units are doing manifests little chance for success. Integration requires joint efforts from across several facets of the company/battery/troop and the battalion and beyond. At the company level, it is vital to understand your place and role on the battlefield.

Trending Shortfalls. Proper integration fails by or with:

- Lack of or inefficiency on communications to include a properly understood and executed PACE plan
- Focusing on solely a linear concept of support
- Inaccurate or poor reporting of commodities

Avoiding the Pitfall. From the commander down to the most subordinate junior enlisted Soldier, every unit member should know how to operate and transmit messages via each level of the PACE plan. This includes utilizing Joint Capabilities Release / Joint Battle Command-Platform (JCR/JBC-P) and similar platforms, communicating via FM radio, changing channels on an FM radio, knowing call signs, and understanding how to convey appropriate and accurate information. Often a unit will become stranded or have a severe lack of guidance as soon as they are outside of FM radio range with the company command post (CP). This will not be the case if the convoys can integrate other forms of communication with the CP, such as JCR/JBC-P, or utilize nearby units to help transmit communications on a more powerful platform. When casualty numbers are high, the importance of multiple Soldiers understanding the communication plan and how to reach alternate and contingency forms of communication will ensure a convoy or unit is not lost and directionless.

The shortest distance between two points is a straight line. Unfortunately, a unit may travel further than necessary for resupply, medical assistance, or security without proper integration. By knowing and understanding the array of friendly forces on the battlefield, a leader can ensure they know, at all times, where the closest unit is to provide any necessary commodity or resource. This is especially true for casualty evacuation, where minutes can save lives by meeting at ambulance exchange points or understanding that your organic Role I medical support may not be the closest medical facility. The battalion S-2 or medical common operating picture generates this knowledge and should be consistently updated at the company CP and referenced before any movement. This is also important in planning logistics rally points (LRP) to avoid giving away critical location information to enemy forces by not entering firing locations or company-level assembly areas.

A logistics status report (LOGSTAT) is perhaps the single most important report to ensure a unit does not run out of any commodity or resource and is properly provisioned and resupplied. It is vital that every unit accurately and consistently reports this information to their headquarters so that integration can occur up to the brigade support battalion (BSB) and brigade levels for sustainment support. A leader should maintain and report accurate expenditure and consumption reports on all supply classes to accomplish this. Some classes, such as Class I water and sustenance (like MREs), can be easily calculated ahead of time, and a resupply schedule can be easily integrated into a plan. Other supply classes, such as Class V and VIII, require accurate and timely expenditure reports to assist the forward support company (FSC) and S-4 in calculating resupply times and quantities. With practice, these calculations are completed at the FSC and battalion level, and a unit will avoid sinking critically low on a commodity. However, the reports must be timely, accurate, and complete to be useful. This means that the format for any report must be understandable, standardized, and full of all necessary information to avoid lags in action due to confusion or uncertainty of meaning.

Responsiveness

Even with the best planning and logistical forecasts, the inexplicable always occurs, the enemy has a vote, Mother Nature plays a role, and terrain features will be unforgiving. ADP 4-0 establishes that it is imperative that a unit and commander maintain operational pressure, operating tempo, and extend operational reach as needed to maintain sustainment to the fighting force. No matter the abilities of a unit, some of these incidents are unavoidable; the response to the unavoidable is where units can succeed or fail.

Trending Shortfalls. Units have an ineffective or deficient response to changing requirements by or with:

- Failing to set, express, or follow priorities of support
- Lack of understanding or reporting of degraded capabilities
- Poor communication with higher echelon levels of support, specifically the division service support battalion (DSSB)
- Not cross-training Soldiers

Avoiding the Pitfall. The finite number of resources on a battlefield requires every echelon of support to have established priorities of support. Commodities and resources are limited, and enemy activities may constrain movement, further hindering sustainment possibilities. The importance of knowing who will receive what commodity and to what extent is paramount to success. By understanding this, the sustainment force can create forecasts with the limitations to inform lateral units and superior commanders. To avoid commanders from constantly making decisions on resupply, a set priority of supply that everyone understands is vital for each commander, especially the ones lower in priority. Both commodity and supply priorities can, and should, change as the mission changes, but publication and dissemination should reach all those involved.

The degradation of a sustainment unit will often go unnoticed until supplies do not arrive in the desired quantities. Understanding the supported unit's mission and capabilities will help ensure the supporting unit supplies the appropriate mix of commodities and supplies. Understanding and communication by both the logistic unit and their higher echelon are required for decision-making.

An unambiguous plan for support by the DSSB is important. For subordinate echelons, this means forecasting the exact requirement for the next mission set. Receiving exactly what is required can be tricky without a well-informed liaison officer (LNO) knowledgeable of unique types of supplies. Open communication with higher echelons and exact requests filled with pertinent information yield a higher success rate with an available LNO.

Cross-trained Soldiers are an under-used and a necessary aspect for success. The most heavily abused section in nearly all sustainment units is the distribution platoon. Their missions are lengthy, demanding, and never-ending. Cross-trained Soldiers amongst the other sections and platoons make it possible to give those Soldiers a break as prescribed in sustainment principles as avoiding exhaustion for the crews.

Simplicity

The simplest solution is often the best. In the chaos of a multi-domain LSCO, convoluted command relationships and expectations of units readily appear. Simplicity requires clarity of tasks and standardized procedures to prevent indecision by commanders and troops on the ground. Units will often forego the simplistic for the complicated because of uncertainty in their processes.

Trending Shortfalls. When unable to maintain the simplicity of an operation, a unit struggles with:

- Using mission command principles
- Contingency planning
- Standardized sustainment procedures

Avoiding the Pitfall. A clearly defined commander's intent coupled with the dissemination and understanding of the mission throughout the organization will speak volumes toward a unit's capabilities and cohesion and encompass three mission command principles. When Soldiers and leaders at every level understand the end state of a commander's intent, it allows them to exercise disciplined initiative when the battlefield becomes unfriendly, convoluted, and filled with split-second decisions. Failure to grant disciplined initiative to subordinate leaders creates a severe time lag in decision-making, creating complacent Soldiers and units. Building mutual trust, another principle of mission command, is required for this to occur. The only option is to build, refine, and reinforce these principles at home station. Bringing all these principles together are the use of mission orders for every mission required at the unit level. Commanders and leaders should be comfortable creating these orders on the fly and providing them to subordinates to create the cohesion the principles of mission command are attempting to provide.

As referenced in the discussion on responsiveness, the best-laid plans can become nearly useless when the enemy, terrain, or conditions do not favor the plan. Planning for as many eventualities as possible and training on the execution of plans should they occur helps clear some of the fog of war. Planning, rehearsing, training, and discussing any enemy activity helps create centralized planning and decentralized execution within a unit. Loss of vehicles, loss of driver, destruction of ammo, consumption of water resources, alternate routes, loss of communication with higher, enemy contacts of all types, civilian interactions, media interactions, compromise of communications, and organized crime are only a few of the plethora of contingencies that should be considered, planned, and rehearsed.

Applying the mission command principles and the planning for contingencies leads to the standardization of sustainment procedures. When both the supporting and supported unit understands the method, delivery, capabilities, and limitations of sustainment operations, the process tends to move much easier, smoother, and more simplistically. This begins with the supported unit setting out its standard operating procedures on how things are accomplished. Does the unit use LRPs? Cache sites? Who makes contact during rearming, refuel, and resupply point processes, and how? Does resupply requests move laterally or through battalion? How is a resupply of non-organic units reported and requested? These standardized practices make the identification of enemy personnel and movements easier and expediting logistics resupply missions.

Economy

The economy of sustainment is the ability to provide the prioritized resources efficiently to the greatest effect possible. In short, this means there are no wasted movements, space, or time when it comes to sustainment operations. This principle can rely heavily on the proficiency of integration, anticipation, and responsiveness when anticipation fails or becomes inaccurate. With anticipation, a sustainment unit will plan and allocate space and time for a supported unit. With integration, any changes to forecasts or additional needed supplies can easily be communicated to the supporting unit. Then, when all else fails, the supporting unit's responsiveness to a change can ensure that the opportunity for a sustainment operation is not squandered. The logistician's goal should be to move everything a unit needs at one time and arrive just in time for the mission.

Trending Shortfalls. Any shortfall in the economy will result in losing a logistician's most precious resource: time. Prominent shortfalls that lead to the largest inefficient use of time are:

- Poor mounted land navigation execution
- Focus on only one class of supply or commodity
- Ineffective coordination with the supported unit
- Inadequate preparation of logistics assets between missions

Avoiding the Pitfall. The inability to navigate at night is a frequent issue that a unit faces during sustainment operations. Distances as short as five kilometers can take a convoy more than two hours to travel, simply by making a wrong turn or lacking confidence in the decision to make a turn. The more time a unit spends on the road, the more likely they are to engage with enemy forces. A logistics convoy is typically very large and long due to the size of the vehicles. It is incredibly easy to spot and can lead to casualties, loss of equipment and commodities, and compromise classified communication information, including frequencies and call signs. Secondly, the toll it takes on drivers and TCs being awake for extended periods and the strain on the body and eyes of being in a military vehicle and under night vision devices creates unnecessary strain and fatigue. A third effect is the chances of becoming stranded due to movement past the forward line of troops (FLOT) or ensnaring the convoy in a friendly or enemy obstacle effectively, hindering the entire element. The easiest way to avoid these issues is to train on map reading, land navigation during limited visibility operations at home station. Secondly, conduct route reconnaissance for every movement on a map and, as importantly, check with the battalion S-2 or enemy intelligence reports. This is the responsibility of the battalion S-4 (per ADP 4-0) to keep updated, but the convoys on the ground create a better picture for the battalion. Create a map or directions for the movement ahead of the convoy.

A common infraction is for the FSC to focus on only the one commodity the supported unit needs the most. Poor load plans or poor economic use of haul assets by the logistics element leads to insufficient resupply. The second fault is inaccurate or outdated reports from the supported unit. Accurate LOGSTAT, forecasting at both the supported unit and supporting unit level and using the most efficient haul assets available easily rectifies this concern. Attention to training and communication at home station with each supported element's executive officer and first sergeant for the best tactics, techniques, and procedures (TTPs) for forecasting and accounting for supply classes will help alleviate much of this strain.

Communication is the key to nearly everything done in the logistics world. The coordination with the unit in both time and space can drastically affect how long the resupply mission takes. Finding and agreeing on an appropriate link-up site and time and adhering to that decision is essential to a smooth process. The area must be large enough to support both units and provide protection through cover and concealment to avoid unintended interference from opposing forces. The TTP of each unit varies in the location and timing of link-up and needs to be clearly understood, expressed, and followed to be successful.

A logistics mission is not complete after the resupply. The preparation for the next mission, whether planned or unplanned, must begin immediately. The priorities of work must be followed to ensure the unit is ready for the next mission. This means staging and refueling vehicles, redistributing

Army Capt. Edward Raschen (left), commander of Forward Support Company, 891st Engineer Battalion, serves food to his Soldiers during training Dec. 30, 2020, at Udari Range, Kuwait. (Photo by Staff Sgt. Luke Wilson)

Class V small arms as needed, restocking vehicles, making plans for personnel for the next mission, and completing numerous other tasks.

Survivability

Maintaining combat effectiveness and fire superiority is a vital task for any unit maintaining its position on the battlefield. A key aspect of this is protecting all personnel, weapons, and supplies while maintaining the ability to withstand hostile contact with enemy forces and austere environments. Surviving enemy contact is not enough for a logistics unit; they must also minimize disruptions to sustainment to continue the fight. Survivability is not a one-and-done principle; it must be continuously refined to outlast the enemy.

Trending Shortfalls. Survivability must be at the forefront of every Soldier's mind when conducting operations. Units suffer when they are not considering these things throughout their operations:

- Continuous position improvement
- Situational awareness
- Protective posture

Avoiding the Pitfall. Whether you are staying in a position for one hour or one week, there should be continuous position improvement at that location for the duration of a Soldier and unit's stay. Improvements in individual fighting positions, increased cover and concealment for vehicles, additional Class IV materials and emplacement, and increasingly in-depth observations of surrounding terrain are only a few of the myriad of survivability tasks that a unit can consistently perform when maintaining their position. Leaders should also consider how far out this position improvement should move. The longer a unit stays in one place the more important it is to know the surrounding areas, use the natural features surrounding the unit, and understand likely avenues of approach and course of action from the enemy. Even with a great defense plan, survivability will be difficult if a unit does not realize the enemy is in the area until they are knocking on the door. Position improvement should also include locations for LRPs. If the logistics unit arrives first, find the best suitable location within the vicinity and set up security measures, and improve the posture, position, and location as much as possible until the resupply is complete. Before any movement or emplacement, a good map reconnaissance with the assistance of S-2 intelligence personnel improves survivability for any unit.

Understanding the training and maintaining constant vigilance at every level is the simplest aspect of survivability. Soldiers need to be constantly aware that the enemy is lurking and waiting for them to become relaxed in their guard and security for the time to strike. Things as simple as wearing night-vision goggles, knowing how to use challenges and passwords correctly, and enforcing their use can be the difference in the enemy being identified before or after entering a unit's perimeter. Instilling this vigilance in Soldiers takes constant leadership involvement.

Chemical strikes are a real aspect of future combat scenarios. Being able to react to suspected or real gas attacks is important to all Soldiers. Protective posture goes beyond MOPP and incorporates all the other aspects of survivability discussed. A unit's protective posture is the culmination and combination of its situational awareness, terrain management, and position improvement. Survivability requires maintaining these aspects at a high level through home station training, leader involvement, and Soldier fortitude through the operation.

Continuity

According to ADP 4-0, continuity is the "uninterrupted provision of sustainment across all levels of war." In simple terms, this means getting the right stuff to the right people at the right time consistently. Although all aspects just mentioned are important, for continuity, the emphasis on consistency is most vital. The link between logistics and operations allows commanders to make informed decisions and opens the possibilities of decision-making. Likewise, the interruption of sustainment can wreak havoc on a plan and friendly elements preventing, delaying, or deteriorating operations.

Trending Shortfalls. Continuity requires standards, discipline, and respect for each other principle of sustainment. To establish and maintain continuity of sustainment, a unit must use:

- SOP
- Disciplined Initiative
- Cross-training

Avoiding the Pitfall. A good unit has an SOP; a great unit uses an SOP. This succinct explanation for an SOP should be enough for most leaders to review their SOP and ensure it is present and understood within their organization. Like the principle of continuity, an SOP must link sustainment to operations and sustainment units to one another. Even in good SOPs, this second piece is often absent. The communication and expectations are delineating from supported unit to supporting unit, but the sustainment aspects of resourcing additional supplies are often absent. From an FSC viewpoint, this means how it will interact with the BSB and the DSSB, if at all. The SOP must be consistent and specific but allow flexibility to allow the next pitfall avoidance measure.

Disciplined initiative is a frequently expressed sentiment both within this paper and throughout Army doctrine. Fully anticipating the dynamic of the complexity of LSCO is impossible. For this reason, subordinate leaders must make mission-critical decisions on the spot without reaching to headquarters. This means that commanders at all levels must convey all pertinent information of the larger mission to subordinates for them to make informed decisions when communication is not possible or not efficient. Without this ability and conviction of disciplined initiative, the professional ingenuity to alter the plan but make the mission happen is lost as soon as continuity or communication is lost between subordinate and commander. Training and trust for disciplined initiative begins with the commander.

As discussed under the "responsiveness" principle, cross-training is an under-used and necessary aspect for success. Continuity is dependent upon mission progression regardless of the personnel conducting the mission. An SOP coupled with cross-training will ensure the mission can continue forward no matter who is present or available for a task. Cross-training also ensures that effective TTPs persist through the organization and don't die with the departure of an individual.

Improvisation

The explanation of improvisation within ADP 4-0 includes the key phrase, "…involve changing or creating methods that adapt to a

changing operational environment." Improvisation for the FSC is continuous, inventive, and necessary to deal with the uncertainty of LSCO. Most units in the Army, especially in the sustainment realm, have an enormous amount of practice with improvisation. Although improvisation is a key aspect for the success of sustainment, the familiarity with improvisation has caused many FSCs to rely heavily on improvisation at the expense of several facets of planning.

Trending Shortfalls. To best use the principle of improvisation without overreliance, an FSC should:

- Focus on detailed planning
- Integrate with operations planning
- Practice disciplined initiative
- Train with contingencies

Avoiding the Pitfall. The movement from conceptual planning to detailed planning is often one of the hardest steps for the organizational planner. Simply consider how often an event, training, or meeting had no direction or met a delaying factor that "should" have been planned for. That is often the difference between conceptual, broad strokes, and detailed planning, getting into the multitude of minor details of every mission. To limit the need for improvisation, and therefore the overreliance, get deeper into the details on planning at the company and platoon level.

Logistical planning is nearly always dependent on how the operation is moving. Linked sustainment and operational elements provide opportunities for better planning, resourcing, and an overall better understanding of what is, or will be, needed by the force. Create and sustain this link easily with logistics synchronization, LOGSTAT, and running estimates. Any sustainment element, including the FSC, must be intimately aware of the plans of supported units and prepare to support the next phase of the operation. Frequently the inability to sync with the operational planning results in ad hoc resupply missions, missing timelines, unnecessary movements, and completely missing the supported unit or even venturing beyond the FLOT. All of these can be devastating to a sustainment unit and cripple success.

When improvisation is required, it must be allowed to blossom at all levels. Allowing for improvisation in planning but restricting it at the point of sustainment (i.e., at the LRP or supply point) paralyzes a unit from effective action. Trust in decision-making below the command level must complement a trust in guidance from the subordinate echelons.

Training events will not always go according to plan. Unintended variables create an opportunity to practice for and with improvisation. Contingency planning and executing contingency plans help improve a unit's flexibility and improvisation. It will stress the effectiveness of other tenets such as detailed planning and cross-training to Soldiers and organizations. To train as we fight, adding a little chaos to the mix of training scenarios, missions, and tasks enhances training and knowledge. The ability to plan for contingencies also requires detailed planning to think through alternate courses of action, which will improve a unit's resistance to overreliance on improvisation but allow practice.

Conclusion

The list of possible scenarios, pitfalls, trends, best practices, and TTPs for sustainment operations is infinite. Army doctrine gives a sustainment unit guidelines and ideas about sustaining the fight, but it does not tell a unit exactly what to do in any given situation. The only way to prepare for the next war, conflict, operation, or mission is to get out there and practice, train, and prepare Soldiers and units. This article only presented a handful of issues and recommendations for the typical FSC and sustainment unit to consider when planning training, preparing for a combat training center rotation, or readying for deployment. Every logistician should consider the principles of sustainment and utilize them as a foundation for their professional enterprise while exhibiting the tenets of mission command, emphasizing disciplined initiative from the unit.

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Feature Photo
A U.S. Army Soldier assigned to 710th Brigade Sustainment Battalion, 3rd Brigade Combat Team, 10th Mountain Division, uses an all-terrain lifter Army system forklift to place a pallet of boxed meals-ready-to-eat on a heavy expanded mobility tactical truck trailer while conducting resupply operations at the brigade supply activity during the brigade Mountain Peak training exercise at Fullerton training area Jan. 22 at Fort Polk, Louisiana. (Photo by Staff Sgt. Ashley M. Morris)

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