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PROMOTING CAPABILITIES CONVERGENCE FOR THE JOINT MISSION

COMMANDER'S CORNER



LTG D. Scott McKean Deputy Commanding General U.S. Army Futures Command Director, Futures and Concepts Center



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Program Manager Crew Optimization & Augmentation U.S. Army Combat Capabilities Development Command



- MG Gavin A. Lawrence Commanding General Military Surface Deployment and Distribution Command
- Armored Multi-Purpose Vehicle (AMPV)
- **Data-Centric Autonomous Joint Ops**
- Crew Optimization & Augmentation
- Next Generation Combat Vehicles (NGCV)
- Unified Network Operations (UNO)
- Synchronized And Integrated Transport

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ARMOR & MOBILITY



AMPV: EVOLUTION IN MULTI-THREAT DEFEAT

The U.S. Army is testing its Armored Multi-Purpose Vehicle (AMPV), a significant advancement over the long trusted M1113 Armored Personnel Carrier, or APC.

By Mark Schauer

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Cover: U.S. Army Staff Sgt. Andrew Cantler, 1st Squadron, 98th Cavalry Regiment, 155th Armored Brigade Combat Team, Mississippi Army National Guard, scans a map during a proof of concept exercise at Camp Shelby Joint Forces Training Center, Mississippi, April 29, 2022. The exercise was a part of Southern Strike 2022, a special operations-centric exercise that promotes interoperability between special forces, conventional ground forces, and air assets in order to ensure the U.S. military stays relevant and ready to respond to a peer-to-peer, large-scale combat operation. (U.S. Army National Guard photo by Staff Sqt. Connie Jones)

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SETTING THE FUTURE TACTICAL COMMUNICATIONS STAGE

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MG GAVIN A. LAWRENCE Commanding General Military Surface Deployment and Distribution Command



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Tactical Defense Media Publications







INSIGHTS

With the seasonal change of Summer to Fall comes a clash of climates as warm gives way to cool. Meteorologists learn from this interaction of weather much as the U.S. Army is learning from an integration of old and new capabilities that helps create more effective combat systems. Project Convergence, the Army's campaign of accelerated testing for evolving legacy and emerging solutions across an architecture of Joint force application, is helping align the Force to execute future Multi-Domain Operations (MDO) for superiority on the global battlefield. Just like Winter, that future is coming faster than we think.

The Fall 2022 issue of Armor & Mobility offers a balanced look at both ends of the capabilities development spectrum. From replacement of proven but outdated platforms such as the Armored Personnel Carrier (APC) by a newly developed Armored Multi-Purpose Vehicle (AMPV) to efforts at fostering the evolution of Next Generation Combat Vehicles (NGCV), an emphasis on science and technology (S&T) is only growing. In this edition's Commander's Corner, we hear from LTG Scott McKean, Deputy Commanding General, Army Futures Command (AFC) and Director, Futures and Concepts Center, regarding the fostering of S&T and the development of Joint systems completely interchangeable across the DoD. Helping facilitate this is LTG Thomas Todd, Deputy Commanding General for Acquisition Systems and Chief Innovation Officer at AFC whose job it is to ensure the Army is investing in persistent discovery and innovation in transformative S&T that will shape a Force poised to execute MDO across the future battlespace.

Without the right equipment for the future MDO mission, there can be no mission. That's where folks at the U.S. Army Combat Capabilities Development Command (DEVCOM) come in. In a special roundtable discussion, A&M readers are treated to insight from DEVCOM's Ground Vehicle Systems Center (GVSC) and efforts to advance the Crew Optimization & Augmentation Technologies (COAT) program in delivering faster, quieter, and more lethal operability to existing legacy and next-generation solutions. Of course, faster, quieter, and more lethal means nothing if you don't have the command and control to stay connected to it all. Program Executive Office for Communications, Command and Control-Tactical (PEO C3T) is managing the implementation of a foundation for future network management and security by way of Unified Network Operations, or UNO. Soon Department of Defense Information Network (DODIN) Operations will depend on UNO as a platform for maintaining common operating awareness on a global scale.

On the supply and logistics fronts, we get a look at work being done by the men and women of the Military Surface Deployment and Distribution Command (SDDC), led by MG Gavin Lawrence. Charged with the responsive equipment re-supply of Joint U.S. and Combined Forces worldwide, SDDC continues to be a key player in the delivery of critical assets to Ukraine and other U.S. allies. Similarly, the Defense Logistics Agency (DLA) remains a key DoD ally of small businesses and materials procurement, to include the U.S. Forest Service, on the front lines of the nation's annual fight against wildfires.

As always, feel free to contact us with comments and suggestions. Thank you for your continued readership!

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BDEING

GROUND MOBILITY EVOLUTION ADVANCED FUNCTION AND PROTECTION AMPV: EVOLUTION IN MULTI-THREAT DEFEAT

The U.S. Army is testing its Armored Multi-Purpose Vehicle (AMPV), a significant improvement over the long trusted M1113 Armored Personnel Carrier.

By Mark Schauer, Yuma Proving Ground



The recently developed Armored Multi-Purpose Vehicle (AMPV) has undergone extensive testing at all three of U.S. Army Yuma Proving Ground's natural environment test centers-Yuma Test Center outside Yuma, AZ.; Cold Regions Test Center at Fort Greely, AK; and, most recently, at Tropic Regions Test Center in the jungle of Panama. The test engineers purposely left the vehicle uncleaned after movements each day to simulate the worst possible conditions Soldiers might experience in a jungle combat theater. (U.S. Army photo)

The M113 Armored Personnel Carrier (APC) and its variants are iconic vehicles in the history of mechanized infantry.

First fielded in 1962, the M113 was ubiquitous during the conflict in Vietnam and has seen service in virtually every American military action in the ensuing decades.

Fast forward to the recently developed Armored Multi-Purpose Vehicle (AMPV) incorporating a long list of upgrades that make it significantly more advanced than the M113, we encounter many more expectations for the worldwide-warfighting environments.

MODULAR VARIATION FOR MEETING MYRIAD ENVIRONMENTS

The AMPV's five variants—a general purpose vehicle, mission command vehicle, mortar carrier, and medical evacuation and medical treatment vehicles-- have nearly 80% more interior volume than the M113, and significantly more power, survivability, and maneuverability. The cooling and electrical systems are also more robust to accommodate both existing and future upgrades. It boasts the same powertrain and suspension system as the Bradley Fighting Vehicle and M109A7 self-propelled howitzer, which eases maintenance and logistics challenges for all three vehicles in the field.

The AMPV has undergone extensive testing at all three of U.S. Army Yuma Proving Ground's natural environment test centers—Yuma Test Center outside Yuma, AZ; Cold Regions Test Center at Fort Greely, AK; and, most recently, at Tropic Regions Test Center (TRTC) in the Panamanian jungle. "It's the first tracked vehicle we've seen in the tropics since the 1980s," said Rolando Ayala, TRTC senior test officer. "We were excited to have the opportunity to test it."

With tropical regions comprising nearly 40% of the world's land surface and serving as home to more than half the world's population, the U.S. Army ensures military equipment works as it should in this extreme tropical environment. Drenched by well over 100 inches of rain per year, the consequences of a tropical environment can be disastrous to all manner of kit and gear. Thick vines and vegetation can strip exterior components from transiting vehicles, insects can eat through Kevlar, and high humidity and salinity in the air can rapidly corrode even stainless steels. Vehicles in particular face special

GROUND MOBILITY EVOLUTION ADVANCED FUNCTION AND PROTECTION

challenges: mud and other jungle biomass caught in wheels can degrade performance, or worse stop it completely in its tracks, and extreme humidity can cause water intrusion in fuel or lubricants.

RIGOROUS PACES TO ADDRESS UNFORGIVING SURROUNDINGS

Following a successful test of the Stryker combat vehicle in recent years, TRTC used the same test facility for the AMPV. The testing environment includes a 5,000 square foot office and vehicle maintenance bay facility and miles of improved, unimproved, and cross-country road courses through double and triple canopy vegetation, which require regular maintenance to keep them from being reclaimed by the jungle.

After months of planning, the vehicle was slated to arrive for testing in October 2021, and personnel from Yuma Test Center-vehicle operators, mechanics, and a data collector with experience testing the AMPV-traveled to Panama to support TRTC's efforts. They arrived anticipating that they would pick up the vehicle from port on a Saturday.

"We were monitoring on Friday and everything was OK," recalled Ricardo Martinez, TRTC's logistician. "On Saturday, the captain decided to detour."

Apparently fearing that his vessel would lose its reservation to pass through the Panama Canal, the captain had unilaterally decided to proceed to another port and return many weeks later with the cargo.

"The vessel wasn't going to stop, but Ricardo convinced the management at one of the largest container transshipment terminals in the region and asked them to expedite the unloading of the vehicle. This action is unheard of, in the international shipping industry." said Ayala. "You wouldn't have that type of support at these ports without their willingness to help, and that willingness was thanks to Ricardo establishing a relationship with them well in advance."

Though a weeks-long delay was averted, the unexpected diversion of the ship meant the team had to pick up the vehicle from the port in the middle of the night and make last minute changes to obtain the flatbed truck and police escort they needed to deliver the vehicle to the test site.

The platform had undergone substantial testing in Yuma and Alaska prior to arriving at TRTC, and TRTC test officer Tim Quintero had decades of experience testing in the former. Yet tropical testing in the most punishing jungle environment of Central America has its own unique challenges.

"Testing in this type of environment is a completely different animal than testing in the desert," he said.

After 60 days of exposure testing, the team began running miles of simulated missions across road courses that ranged from improved and unimproved to cross-country jungle that turned to iron-gripped muck when heavy rains fell. As they traversed these courses, test vehicle operators continually verified performance of all the platform's sophisticated electronics, and samples of the vehicles' fluids were collected and analyzed at various points throughout the tests. Testers had the benefit of comparing both the performance of tracked vehicles at TRTC in decades past along with the recent AMPV performance data from Yuma and Alaska.

"I had a lot of reach-back capability from YTC's combat automotive testers," said Quintero. "They helped me out with any questions I had related to the vehicle, which they had a lot of experience with."

The AMPV's tracks gave it a significant advantage over a wheeled



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Multiple AMPVs underwent reliability, availability, and maintainability testing at all three of U.S. Army Yuma Proving Ground's test centers, with each running extensive miles in terrain conditions from paved to gravel to punishing desert washboard that would severely rattle less robust vehicles. (Photo by Mark Schauer)



military vehicle in the worst of the jungle terrain, but testers had to be prepared to recover the vehicle with the aid of a bulldozer if the slick, muddy course caused the test vehicle operator to lose control.

"We are dealing with an 80,000-pound vehicle," said Carlos Mora, test engineer. "Recovery operations are more challenging."

Furthermore, the test engineers purposely left the vehicle uncleaned after movements each day to simulate the worst possible conditions Soldiers might experience in a combat theater.

NAVIGATING CHALLENGES TO TESTING ACCESSIBILITY

Unlike other Army test centers, TRTC owns no land and thus relies on host nations to permit testing. The American embassies and associated military groups within each delegation in the countries TRTC operates in, recognize the value in supporting the test center's mission and assist in securing the necessary permissions to conduct these important evaluations.

"As an Army section chief, I want to do whatever we can to get the best equipment in the field," said Maj. Andrew Rember, Army section chief in the U.S. Embassy's Office of Defense Cooperation. "I'm glad we're upgrading from the M113, because it never seemed to keep up with the Bradleys."

In the current world environment, natural environment testing to ensure equipment can be successfully utilized anywhere an American Soldier could deploy is more important than ever.

"If we don't do natural environment testing in the tropics, we are doing a tremendous disservice to our military and soldiers," said Ernest Hugh, TRTC director. "You don't want to give them equipment that is going to break down or rust away. Testing in a natural environment is key."

TAPPING SMALL COMMERCIAL EXPERTISE FOR LARGE SCALE SUSTAINMENT

A research and development program is helping the Defense Logistics Agency (DLA) yield new sources for obsolete parts and raw materials. By Beth Reece, DLA



Lance Cpl. Issac Nakai, a field radio operator for the II Marine Expeditionary Force Information Group, works on a radio inside a Humvee at Camp Lejeune, NC. DLA partners with weapons system program offices and service engineering activities to qualify small businesses for sourcing parts such as field radio battery chargers that have high demand but limited availability. (Photo by Lance Cpl. Henry Rodriguez)

The Defense Logistics Agency's R&D program managers Vaibhav Jain and Denise Price are always seeking opportunities to match America's small businesses with research and development projects that address critical supply chain gaps and security threats. They work with small businesses striving to source parts, raw materials and manufacturing solutions through the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. In fiscal 2021, DLA awarded 75 projects worth over \$43 million through SBIR and STTR.

"Small businesses are the backbone of the defense industrial base, and our goal is to apply the advanced technologies they develop to DLA's mission and priorities," Jain said.

SMALL BUSINESSES KEY TO EASING DECREASE IN NATIVE SUSTAINABILITY

Declining domestic manufacturing capabilities and parts obsolescence threaten the sustainability of aging weapons systems such as the air-launched cruise missile and Ohio-class submarines.

"A lot of original equipment manufacturers have moved on to the latest and greatest technology, so they don't want to deal with older parts that aren't big money makers," Price said. "That leaves the services without a source of supply, and DLA is trying to fill the gap."

DLA uses programs like SBIR and STTR to collaborate with weapons system program offices and service engineering support activities to turn industry's innovativeness into DLA supply chain





Denise Price

solutions. SBIR and STTR are congressionally mandated for federal agencies exceeding extramural research budget thresholds to provide federal funding to eligible small businesses in three phases.

The first phase usually lasts six months as a business determines the scientific, technical and commercial merit and feasibility of a research objective based on projects that are announced three times a year on the U.S. Department of Defense (DoD) SBIR/STTR website. The award is usually for less than \$100,000.

"We make sure we have a program of record in mind for any project we put out, so it's really up to small businesses to present a technology that our warfighter customers are interested in," Price said.

The most promising projects are funded for the second phase, in which businesses produce a prototype and demonstrate the potential for qualifying for a program of record. The award in this phase is typically for 24 months and \$1 million.

ONLY HALF THE COMPANIES MAKE IT TO THE SECOND PHASE

"Usually, if a company doesn't make it to the second phase at DLA SBIR, they either don't have a good commercial application or

transition plan, or they just don't show the effectiveness and efficiency we're looking for," Price added.

The third phase is the commercialization or transition to a program of record and could last around three years. Funding ordinarily comes from the services or another agency.

INCENTIVIZING GREATER PARTICIPATION

While the statutory purpose of the programs is to boost small business' role in R&D, Jain said they also help DLA meet warfighters' needs. Recent successes include the awarding of a contract to a small business that developed a proprietary process for creating premium powder from recycled, nickel-based superalloys. The powder is pure enough to be used in precise processes like additive manufacturing and is suitable for stockpiling.

A San Diego-based small business is also now an approved supplier for a field radio battery charger that was a limited-source item. The company used reverse engineering to manufacture the charger and reduced the cost by 35%.

DLA SBIR projects have even resulted in the creation of a COVID-19 rapid test kit that received Emergency Use Authorization from the Food and Drug Administration (FDA) in February. The company has since provided the kit to government agencies, schools, first responders and more.

DLA currently has about 70 SBIR/STTR projects geared toward easing challenges like identifying counterfeit parts and using additive manufacturing to fabricate fuel oil coolers.

MITIGATING THE THREAT PARTNERING FOR ADVANCED READINESS **JOINING FORCES TO QUENCH THE FIRE**

The Defense Logistics Agency has been laying the groundwork for coordination with the U.S. Forest Service in preparing firefighters for another busy season protecting west coast America.

By Nancy Benecki, DLA Public Affairs



Oregon Army National Guard soldiers support the Oregon Department of Forestry with wildland firefighting efforts in Chiloquin, OR., September 2020. The Defense Logistics Agency provides shovels and a variety of hand tools for use during the annual wildland firefighting season which runs from May through October. (Army National Guard photo by Sgt. 1st Class Zachary Holden, 115th Mobile Public Affairs Detachment)

Reports of wildland fires in California, Alaska, and Oregon, combined with record-high temperatures and a dry summer, present the daunting task of disaster control. The Defense Logistics Agency (DLA) works daily to support firefighters stopping these fires in their tracks through planning and cooperation with firefighting agencies across the country.

Tom Pisarich is the DLA liaison officer to the U.S. Forest Service, the primary wildland firefighting agency in the country and a major DLA partner during wildland fire season. He faces the fight against wildland fires daily by monitoring national preparedness levels and tracking emergency orders placed with DLA's Customer Interaction Center, as well as the availability of critical items provided by major subordinate commands.

COMBINING FORCES TO MITIGATE DANGER

The Forest Service is one of eight agencies with the National Interagency Fire Center (NIFC). Located in Boise, Idaho, the NIFC is the nation's support center for wildland firefighting. It supports a series of caches, similar to warehouses, that are strategically located around the country and stocked by DLA and other sources like the General Services Administration.

Wildfire season spans from May to October, with the peak hitting in July and August. As of Aug. 1, the national Preparedness Level was at 3, and more than 1.5 million acres have burned in large fires, according to the NIFC. Much like hurricane season, planning for the next fire season starts as soon as the previous one ends.

"When the fire season ends in October, DLA gets together with all of the firefighting agencies and conducts after-action reports to discuss what happened the previous year and begin planning for the season ahead," Pisarich said. "We want the caches filled to their required levels before the next fire season begins."

Laura Durback, DLA's whole-of-government customer account manager, agrees that planning is important during wildland fire season.

"That includes looking at stock levels, planning drills and collaborating with other agencies so we have the right points of contact," Durback said. "It's establishing a battle rhythm and holding regular meetings so when something happens, our liaison officers are fully staffed with any support and have all the touchpoints available."

CHANGING OF THE FIRE GUARD

DLA took over supporting items for wildland fire season from the General Services Administration (GSA) in 2014 and created a catalog including specialized equipment the Forest Service needed, Pisarich said. Most items are stored at DLA Distribution San Joaquin, California, because many wildland fires break out on the west coast, then shipped to caches as needed, he added.

The agency's major subordinate commands ensure DLA has what it needs to supply the caches. DLA Troop Support provides items from its four supply chains, including hand tools, protective clothing, water-handling equipment, hoses, gaskets, pumps and ready-to-eat meals. DLA Land and Maritime provides batteries for the Forest Service's radio systems. DLA Aviation also provides light sticks, and DLA Energy provides ground and aviation fuel. In addition to wildland fire support, DLA Disposition Services provides used military equipment to firefighters in rural communities through the DoD Firefighter Program.

DLA Troop Support also provides the Forest Service with a weekly status report on the availability of critical items, Pisarich said.

"When we are in fire season, we like to have those items stocked at San Joaquin to as high a level as possible," he said. "We try to reach that goal by May 1."

ACTIVE FIRE SEASON TESTS PARTNERING

The Forest Service forecasted an increased potential for fires this year based on weather conditions, near-record temperatures, and dry vegetation and underbrush, Pisarich added. The five levels of wildfire preparedness levels are dictated by burning conditions, fire activity and resource availability. Preparedness level 5 is declared when several areas experience major incidents that have the potential to exhaust resources.

In 2021, the United States was at preparedness level 5 for 68 consecutive days, setting an all-time record, Pisarich said. As a result, DLA supported 282 items including 5.1 million batteries, 263,000 meals and 1,945 miles of fire hose.

"Our support to wildfire fighting extends beyond our federal partners, we also support over 40 states and roughly 340 state and local government firefighting agencies," said Tracey Shepherd, DLA's national account manager for state and local programs.

"By purchasing PPE through DLA, it ensures the firefighting gear used by state, local and federal wildland firefighters is interchangeable and interoperable," she said. "It also speeds the exchange, refurbishment, and repair of damaged equipment when deployed."

Buying firefighting material increases DLA's buying power, said Joseph Brooks, chief of DLA's Whole of Government Division. "The firefighting gear we provide our state, local and federal partners is the same that the Navy buys. We have a bigger demand, which gets better pricing from our vendor base," Brooks said. "Whatever work we do for the whole of government is done where it does not detract from the support we provide the services. Rather, it reinforces and enhances our main line of effort, which is to support the warfighter."

TRANSFORMING FOR MULTI-DOMAIN DOMINANCE

U.S. Army Futures Command, stood up in 2018 to lead current and future force modernization efforts, is using Project Convergence to facilitate an evolution to data-centric operations within a data-driven Joint force. By Army Futures Command



Spc. Skylar Cripe of the 82nd Airborne Division take part in an IVAS-enabled air assault exercise in November 2021 at Yuma Proving Ground, AZ, as part of Project Convergence 21. Project Convergence is the Army's campaign of learning designed to aggressively advance and integrate the Army's contributions, based on a continuous structured series of demonstrations and experiments throughout the year. It ensures that the Army is part of the joint fight and can rapidly and continuously integrate or converge effects across all domains: air, land, sea, space, and cyberspace; to overmatch our adversaries in competition and conflict. (U.S. Army Photo by Sgt. Jacob Lang)

Our country and allies are competing with determined adversaries during a period of rapid technological change. Military innovation is about more than materiel. Armies win or lose by a combination of how they fight, organize, and equip. All three start with Army Futures Command (AFC)—we develop concepts that become doctrine, design future organizations, and develop requirements for materiel.

Though war is a fundamentally human endeavor, how we fight must change as technology advances. Technologies visible on battlefields today—including autonomy, AI, and machine learning—will mature and scale. Future battle will be radically lethal and fast-paced, fought on battlefields made more transparent by sensors, with contests in every domain. To be ready for this and other changes in the operational environment and threat, we must transform how we operate, organize, and equip.

Modernization involves the entire Army, our sister services, industry, academia, and other partners. This is a team sport. Army Futures Command's unique role on that team is to stay focused on the future and keep guiding the way. To modernize at the speed of change, we must also transform how we modernize.

AFC accelerates Army modernization by helping integrate and synchronize the effort. We have made the Army's modernization process more threat informed, iterative, and flexible. We have championed Soldier Centered Design by getting prototypes into the hands of Soldiers to experiment early. We iterate often so we can get requirements right before significant investments are made.

Project Convergence makes it real. Project Convergence is the centerpiece of the Army's campaign of learning and experimentation to inform how we fight, organize, and equip as part of a Joint and multinational force. It allows promising technologies to get out of the laboratory, into the dirt, and into the hands of Soldiers, scientists, and Joint partners.

Project Convergence also gets modernization out of organizational stovepipes. In the past, we developed systems separately—we waited too long to try to make them interoperable. Through Project Convergence, we are integrating systems early, while we can still shape the requirements. By doing Project Convergence with the Joint Force, we are getting Joint integration baked into requirements across Services.

AFC is helping pave the way to a data-centric Army as part of a datacentric Joint Force. People are the foundation of a data-centric Army. The Army Software Factory at Austin, TX and the Artificial Intelligence Integration Center at Carnegie Mellon University are piloting efforts to ensure future Soldiers are forward, on the battlefield, with the data and software skills needed to achieve decision advantage.

AFC is proud to support the delivery of 24 transformational systems into the hands of Soldiers by 2023. Together we are building the Army of 2030, and the Army of 2030 is the steppingstone on the path to the Army of 2040 and beyond.

ENABLING THE JOINT AND COMBINED FORCE MISSION

Lieutenant General D. Scott McKean commissioned as an Armor Officer in 1990 from the United States Military Academy at West Point. His military education includes the Armor Officer Basic Course, Armor Officer Advanced Course, Command and General Staff College and the United States Naval War College.

LTG McKean has led at every level from Platoon through Division command. His deployment history includes: Operations Officer and Executive Officer for the 1st Battalion, 67th Armor Regiment, 4th Infantry Division, during OIF I; Deputy G3, 4th Infantry Division in Baghdad during OIF 05-07; Battalion Commander 1st Battalion, 66th Armor Regiment, in Baghdad for OIF 08-09. He deployed to Iraq again as the Commander, 4th Armored Brigade Combat Team, 1st Armored Division in 2011 as part of Operation New Dawn.

Following Brigade Command, LTG McKean served as the Executive Officer to the Commanding General, United Nations Command/ Combined Forces Command/ U.S. Forces Korea. Lieutenant General McKean went on to serve as the Deputy Commanding General (Operations), 1st Armored Division at Fort Bliss, Texas, and as Director of CENTCOM Forward Jordan. He then served as the 49th Chief of Armor at Fort Benning, GA. In his most recent assignments, LTG McKean served as the Chief of the Office of Security Cooperation – Iraq and commanded the 2nd Infantry ROK-US Combined Division from July 2017 to July 2019. From August 2019 to October 2020, LTG McKean served as the Chief of Staff, Headquarters United States Central Command MacDill AFB Tampa, Florida.

LTG Scott McKean, Deputy Commander of Army Futures Command (AFC), spoke with A&M about some current Army modernization efforts and ways AFC is crafting a Joint Force mindset for mission success on the future global battlefield.

A&M: Would you give an overview of the Army's Futures and Concepts Center (FCC) mission?

LTG McKean: The Futures and Concepts Center (FCC) plays a key role in determining how the Army will prevail on future battlefields. Our efforts center on four core interlocking mission areas - concepts, experimentation, requirements, and integration. When we fight, we do so as a Joint and Combined Force. Consequently, our efforts are designed to ensure the Army is a potent contributor to future Joint and Combined warfare.

FCC's Directorate of Concepts (DOC) leads FCC's Future Study Program (FSP). FSP builds on estimate of the Future Operating Environment produced by Army Future Command's (AFC) Directorate of Intelligence and Security. FSP Seminars, workshops, and wargames



LTG D. Scott McKean

Deputy Commanding General U.S. Army Futures Command Director, Futures and Concepts Center

develop and experiment with future warfighting concepts and organizational constructs.

The FCC G-3/5/7 Directorate of Operations and the Joint Modernization Command (JMC) spearhead our experimentation, FCC's second core mission area. We draw on our efforts in concept development to inform and guide experimentation and rely on experimentation to enable concept and capability development.

Project Convergence is our primary program for experimentation, or as we like to refer to it, our Campaign of Learning. Throughout the year we conduct a series of linked experiments that culminate in a capstone event conducted at locations throughout the United States and abroad. The capstone event is conducted at scale and a high level of complexity.

Project Convergence is not only integral to developing the future Army but is also among the Army's contributions to the development of Joint capabilities. As we continue to build on Project Convergence by incorporating allies and partners, we are adding a Combined dimension to our campaign of learning.

Our analysis and experimentation efforts extend beyond Project Convergence. For example, JMC is also charged with conducting Joint

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Warfighting Assessments (JWA) designed to enhance warfighting capability. JWAs are live multi-echelon joint and multinational exercises that play an important role in the assessment and integration of multi-domain operations concepts, capabilities, and formations at echelon.

Concept development and experimentation are critical inputs to FCC's third core mission area of requirements development. FCC's Futures Integration Directorate (FID) leads FCC's efforts in this mission area. FID produces capability requirement documentation that describes technical attributes, functions, and performance standards to achieve overmatch for the Army of 2030 and the future Army of 2040. FID ensures that requirements account for the factors in the DOTMLPF-P framework – doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy.

AFC streamlined and improved the requirements process and the requirements themselves. The Entry Gate Process is one of AFC's little-known successes. FCC played a critical role in its creation and implementation, achieving a 97% approval rate of requirements by the AFC Commanding General and decreasing staffing time by 45%. This enhances our ability to provide requirements more rapidly to the acquisition professionals and capabilities into the hands of soldiers.

FID also leads FCC's final mission area of integration, ensuring capabilities are developed with a system-of-systems perspective and not stovepiped. FID ensures the Army's future capabilities are sustainable, network compliant, and interoperable with existing army systems. Through the Identification and development of concept required capabilities, FID uses concept development and experimentation to



bridge the gap between concept required capabilities and formally defined requirements.

In summary – FCC's core mission areas are concepts, experimentation, requirements, and integration. We are validating the Army of 2030 and informing the Army of 2040, and in doing so contribute to the development of the Joint Force.

A&M: Would you provide us a few thoughts about how you see the future?

LTG McKean: I'll point to three developments on my mind. Please note that these are just three subjects. There are others and we will adapt our thinking based on the results of initiatives including wargaming and experimentation. Regardless of developments, the need to make contact and defeat enemy forces remains a core function of the Army.

First, when contending with peer adversaries all domains will be contested. Whether operating on the ground, in the air, on or under the oceans, in space, or in cyberspace we cannot simply assume that we will begin with or be able to achieve steady state dominance. Our adversaries will make us work to achieve temporary positions of advantage such that we can maneuver to achieve our objectives.

Second, autonomous systems will continue to proliferate across the globe. Whether produced or purchased, more nations will have greater numbers of autonomous systems with increasingly advanced capabilities. This relates to a third trend of sensor saturation. The battlefield of the future will be saturated by sensors making it nearly impossible to hide. This in turn will require that we alter our approach to positioning and maneuvering forces. Future warfare will require a deliberate sensor-counter sensor fight.

We must bear in mind that while the character of warfare is changing, the nature of warfare remains constant. Although there are several ways that the nation may choose to use the military instrument of power, in its penultimate form, war comes down to impacting the will of our adversaries through the destruction of their means of resistance or the seizure and control of territory and populations. This weighs heavily upon the thinking of military leaders and if the nation calls upon us to fight and win a future war, doing so will require a combined arms team on the ground as part of a Joint and Combined force.

A&M: How Does Ukraine factor into your thinking about future warfare?

LTG McKean: It is still too early to draw concrete lessons from the war in Ukraine. I have been watching developments in areas including the impact of urbanization, gap crossing and vehicle weight, the ubiquity of sensors, contested logistics, and the employment of artillery, anti-tank weapons, air defense weapons, and drones.

Human-machine teaming will play an important role. It is safe to say that autonomous systems and capabilities will play an increasing role. As a general principle, we will aim to make first contact with uncrewed systems. Still, Commanders, not machines, will make decisions. Commanders will use mechanisms including rules of engagement or direct control of weapons systems to ensure proper command and control.

I see Combined Arms Teams operating in a more distributed manner, concentrating only to the extent that achieving the convergence of effects requires them to do so. This approach presents new requirements in terms of sustainment and autonomous systems and artificial intelligence are likely to play a role. For example, autonomous systems may provide us the ability to dispatch machines to deliver

COMMANDER'S CORNER

supplies with minimal human intervention. Artificial intelligence will enable us to ensure the right materials are proactively pushed to the warfighter instead of merely responding to requests for materials in response to their expenditure. If you combine those two ideas you may have autonomous systems proactively delivering supplies, freeing up human talent to dedicate to tasks that require human action.

A&M: Several times you have emphasized the importance of Jointness, as well as the importance of allies and partners. Could you explain your thinking in this regard a bit more?

LTG McKean: It is impossible to conceive of a situation in which the Army will not fight as part of the Joint Force and difficult to imagine a scenario in which we will not fight as part of an international coalition. We should not only train as we would fight, but also experiment as we would fight. Or for that matter we should develop concepts with our sister services and our allies and partners, again because we are most likely to fight together.

As a concrete example, we continue to support the development of Mission Partner Environments (MPE). MPEs are operating frameworks that enable command and control and information sharing for planning and execution across the full range of military operations. We are establishing and employing an MPE in Project Convergence to enable a greater level of Joint and Combined participation in experimentation.

A&M: Your comments thus far, combined with your remarks in other events, speak to the importance you place on network capabilities and architecture. It is interesting that networks play such a prominent role in your efforts as opposed to weapons systems. What accounts for this?

LTG McKean: There is a symbiotic relationship between weapons systems, sensors, and networks. FCC uses experimentation to learn how to more effectively design and leverage networks that can integrate sensors and weapons systems. Through experimentation we inform our concept, requirements, and integration mission areas. Together these efforts will enhance our future ability to prevail in all forms of competition and conflict.

We approach networks from both a technical and an operational perspective. The technical perspective concerns the ones and zeros, frequencies, and data standards. It is concerned with which system can "talk" to which system and how they do so. We have challenges in this regard that we are working to overcome. We also approach networks from an operational perspective, and this is a particular area of emphasis for the Combatant Commands. In other words, we must consider the Joint warfighting functions that we need to perform, for example fires or sustainment. Each of these functions must be vertically and horizontally integrated using networks.

The Combatant Commands place a premium on networks that can integrate the Joint warfighting functions. For example, an integrated fires network would account for all of a commander's fires capabilities across all domains and quickly choose the best shooter for a specific target. At the same time, an integrated sustainment network would link to the fires network to consider factors including munitions resupply and predictive maintenance for the systems. These factors would inform the selection of the shooter in advance of the combat action, not in reaction to it.

In future warfare victory is likely to go to the side that can sense, make sense, and act faster and more effectively than its adversary.



Crew members with 2nd Battalion, 82nd Aviation Regiment Assault Helicopter Battalion, 82nd Airborne Division, take part in an air assault exercise in October 2021, near Yuma Proving Ground, AZ, as part of Project Convergence 21. The air assault experimented with technology to help Soldiers better see and understand the battlespace. (U.S. Army Photo by Spc. Ernely Opio)

A&M: Where are we with Project Convergence and what might we expect in future iterations?

LTG McKean: Project Convergence 2022 will center on two scenarios focused on the Indo-Pacific and Europe respectively. PC 22 builds on the achievements of previous iterations. We carry forward lessons learned and will add scale and complexity to the experiment. Further, we have designed the experiment to simulate real world distances and distributed operations. We are also including additional participants and capabilities at more locations. The United Kingdom and Australia will participate in PC 22, and we look forward to adding more allies and partners to future iterations.

We design and govern Project Convergence through a threestar Combined Joint Board of Directors with representation from all the services and our Allies and Partners. Project Convergence is an opportunity for each of the services and our allies to experiment with their respective concepts in support of developing future Joint and Allied forces. Moving forward, we will expand every facet of PC including participants, technology, locations, scale, and complexity.

It is worth noting that Project Convergence is a platform, or a venue, for experimentation. It is Army led but Joint and Combined in its focus. Project Convergence is not separate from Project Overmatch and ABMS initiatives. Rather Project Convergence is a venue that incorporates their learning and brings learning into a Joint and Combined environment. We are committed to learning together with our sister services, Allies and Partners to optimize how we fight as a Joint and Combined team.

A&M: If nothing else, what should we take away from this interview?

LTG McKean: FCC's core mission areas are concepts, experimentation, requirements, integration. FCC is focused on validating the Army of 2030 and informing the Army of 2040. We seek to inform and enable the Joint Force, as well as our Allies and Partners.

Our Army is in the midst of its largest transformation in more than 40 years. FCC plays an important role in continuous experimentation and in developing the requirements to validate the Army of 2030. Based on how Multi-Domain Operations went from concept to doctrine, FCC is embarking on the next Army Operating Concept to design the Army of 2040.

S&T LEADERHIP FOCUS FOCUSING ON TOMORROW, TODAY

Army Science and Technology efforts are dovetailing with force modernization in support of a Multi-Domain Operations-driven future.

By Thomas H. Todd III, Deputy Commanding General for Acquisition and Systems and Chief Innovation Officer, Army Futures Command



LTG Thomas H. Todd III Deputy Commanding General for Acquisition Systems and Chief Innovation Officer U.S. Army Futures Command

United States Army Futures Command is responsible for force design and force development and is the capabilities developer and operational architect for the U.S. Army. Persistent discovery and innovation in science and technology (S&T) are essential to achieve this mission. Army S&T focuses on transforming the Army of 2040 and beyond by making scientific discoveries, designing emerging capabilities, and linking S&T to the operational environment.

The Army invests in S&T to manage risk, create options, and exploit opportunities. The time horizon in view is a crucial driver of the role that S&T work can play. For efforts focused on the Army of 2030, S&T work can burn down risks and deliver near-term capability improvements. S&T lays the foundation for the discovery of future transformational capabilities that have the potential to transform the Future Operating Environment (FOE).

AFC S&T is aligned with the Army's six modernization priorities (long-range precision fires, next-generation combat vehicles, future vertical lift, network, air and missile defense, and soldier lethality), and we prioritize our discoveries in line with the Army's nine priority research areas (PRAs) (disruptive energetics, RF electronic materials, quantum, hypersonic flight, artificial intelligence, autonomy, synthetic biology, material by design, and science of additive manufacturing). The realm of the possible is unlocked by expanding the known realm. PRAs focus on obtaining answers to scientific questions that could change the future of technology for the Army through a leap-ahead scientific discovery or bridge a key scientific knowledge gap that is holding back the advancement of technology. The resulting knowledge products of PRAs should shape the Army of 2040 and be a direct input to Army Senior Leaders for consideration into strategic decisions essential to enduring Army modernization.

To persistently modernize the Army through discoveries and innovations in S&T for the future, we acknowledge that our people are our most valuable resource and most significant asset. Our S&T workforce possesses broad and deep Army-unique expertise organized in competencies and borne of excellent academic preparation and extensive on-the-job experience. In addition, our workforce is empowered to collaborate within and across competencies in pursuing innovative ideas.

In addition to our internal workforce, we have strong relationships with academic and industry partners to continually engage with the knowledge, talent, and discoveries happening worldwide. We engage with academia through the Army Research Office and the University Technology Development Division. We engage with industry through the Army Applications Laboratory and our Small Business Office, in addition to the numerous partnerships within our labs and centers.

AFC S&T works closely in a bi-directional relationship with the Futures and Concepts Center to link S&T to concepts and requirements. We also work to address the gaps and opportunities identified by the operational community by developing potential offset technologies and capabilities that enable these future concepts. An essential and emerging part of our S&T execution plan includes linking S&T efforts to operational experimentation events such as Project Convergence and EDGE. These events inform technology transition, provide opportunities for industry to engage in joint operational experimentation, inform strategic investments, and provide feedback to the S&T enterprise by engaging with Army warfighting organizations and soldiers on the effectiveness of the technologies with future warfighting capabilities.

Army S&T enterprise plays a key role in AFC's mission to assess and integrate the FOE, emerging threats, and technologies to provide warfighters with the concepts and force designs needed to dominate a future battlefield. S&T plays a critical role in fully developing the Army of 2030 and developing a path to the Army of 2040. The combined efforts of the Army labs and centers and partnerships with universities and industry will enable persistent modernization to help ensure dominance on the battlefield.

MATURING NEXT-GENERATION MOBILE GROUND COMBAT

U.S. Army Combat Capabilities Development Command (DEVCOM) Ground Vehicle Systems Center (GVSC) and Army Futures Command (AFC) Next Generation Combat Vehicles (NGCV) Cross Functional Team spoke with *Armor & Mobility* on efforts to facilitate an evolution in manned and autonomous ground combat platform development in support of future Multi-Domain Operations (MDO).



Soldiers work with an Army engineer from the Ground Vehicle Systems Center as they review the Human-Machine Interface for a small robot during the Robotic Combat Vehicle Soldier Operational Experiment at Fort Hood, TX, held during Summer 2022. The SOE was intentionally conducted at the hottest time of the year at Fort Hood, to test how the robots operated in extreme weather conditions. (U.S. Army DEVCOM)

Respondents:



Mr. Blendi Berati Program Manager for the Crew Optimization & Augmentation Technologies (COAT) program, U.S. Army Combat Capabilities Development Command, Ground Vehicle Systems Center



Mr. N. Joseph Kott III, Senior Science & Technology Advisor, Next Generation Combat Vehicles Cross Functional Team, U.S. Army Futures Command



Mr. Jack Hartner Branch Chief for Robotic and Autonomous Software Research, U.S. Army Combat Capabilities Development Command, Ground Vehicle Systems Center

A&M: What is the future vision for armored vehicles, and what will their role be on the future battlefield?

Berati: Big picture, the future battlefield will be extremely hyperactive and lethal. Any future armored vehicle will have to depend on more than just armor for survivability – it will need to be well-protected, but it will also need to be faster, quieter, more aware, and more lethal. They'll need to be able to respond faster than ever before, which will require greater situational awareness than current systems allow.

In terms of role, the value of carrying heavy weapons on a wellprotected platform is probably not going anywhere. In addition, we don't expect legacy systems to disappear overnight. Initially we'd expect future vehicles to serve in specific formations, and in some cases potentially alongside legacy vehicles, in theatres of operation that require their enhanced capabilities.

A&M: What advantages will future armored vehicles offer over legacy systems, and what are some barriers to realizing that potential that must be overcome?

ROUNDTABLE DISCUSSION

Berati: U.S. Army Combat Capabilities Development Command Ground Vehicle Systems Center (DEVCOM GVSC) is proud of the engineering and technological support, via several of its S&T programs, it provides to the whole Army's modernization enterprise, especially in the ground vehicle domain led by the U.S. Army Next Generation Combat Vehicles Cross Functional Team (NGCV CFT).

GVSC's holistic approach to ground vehicle technology development in support of NGCV, including collaboration with industry and academia, using innovative techniques in concept development, applying foundational architecture-based designs to reduce vehicle modernization costs, and leveraging relationships with DoD's various acquisition and technology development agencies, make GVSC the center-of-mass for NGCV technology development.

NGCV is seeking to provide capable replacements to Army's ageing fleet of legacy armored vehicles and introduce new technologically superior capabilities that will deliver lethality, range, maneuverability, reliability and adaptability above and beyond what the current vehicles can provide, in the battlefield of the future.

One of the NGCV priorities is the Optionally Manned Fighting Vehicle (OMFV), a replacement of the decades-old Bradley platform. The Army is seeking a transformational increase in warfighting capability, not simply another incremental improvement over the current legacy system. As part of an Armored Brigade Combat Team (ABCT), the OMFV will not fight alone, but rather as part of a section, platoon and company of mechanized infantry.





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OMFV program is leading the Army in the use of digital engineering, Modular Open Systems Architecture (MOSA), Advanced Manufacturing processes and developing maintenance and logistics support concepts in conjunction with vehicle design. Army's commitment to open systems architecture for the OMFV program will allow for easier integration of future technologies into the platform, something that legacy systems lack, which makes incremental modernization efforts costly and cumbersome for the legacy platforms.

One of NGCV novel platforms, providing a capability that does not currently exist, is the Robotic Combat Vehicle (RCV). The RCV is an Army-Wide solution to delivering lethality by leveraging Artificial Intelligence (AI) and autonomy for unmanned vehicles that every unit in the Army can tailor to its mission set.

Mobile Protected Firepower (MPF) is another program within the NGCV platform, an armored vehicle providing precise, largecaliber, long-range direct fire. MPF represents a new capability, not offered by any of the legacy platforms, which improves the infantry's ability to neutralize prepared positions, heavy machine guns and adversary armored vehicle threats while operating on challenging and restrictive terrain.

The battlefield of the future, fought across all domains, will become increasingly complex and proliferated with intelligent agents such as smart sensors and myriad of unmanned ground and aerial vehicles; and as such there's a crucial need to develop tools that help vehicle crew operators to rapidly gather information, analyze and coordinate in order to quickly adapt to any obstacles or dilemmas. That is one of the technological barriers to future warfare; all of these new vehicle platforms, equipped with the latest in autonomy and AI will still need to be controlled by Soldier crews in various formations. Facilitating the interaction between Soldiers and autonomy, especially in Manned-Unmanned Teaming (MUMT) maneuvers is an important part of the problem space when working to develop the next generation of combat vehicles. This is what GVSC's Crew Optimization & Augmentation Technologies (COAT) program is working to solve.

The COAT program has teamed up with academia, private industry as well as several DEVCOM laboratories & centers such as Army Research Laboratory's Human Autonomy Teaming Essential Research Program and the Soldier Center to provide optimized crew interfaces and technologies that maximize soldier and system performance while reducing crew cognitive load and overall crew manning requirements of various NCGV platforms. Additionally, COAT is working to develop flexible, adaptive interactions between soldiers and autonomous assets of future NGCV programs to enable coordinated maneuver for mixed manned-unmanned formations in the face of dynamic mission environments and adaptive adversaries.

A&M: Please provide some background regarding the inception and evolution of the Army's NGCV program effort, along with primary reasons for its development.

Kott: The Optionally Manned Fighting Vehicle (OMFV) will provide the Army with the capabilities required to defeat a future peer competitor. The OMFV will bring a transformational increase in warfighting capability to an Armored Brigade Combat Team. It is not simply another incremental improvement over the current Bradley Fighting Vehicle. As part of an armored brigade combat team (ABCT), the OMFV will not fight alone, but will operate as part of a section, platoon and company of mechanized infantry.

ROUNDTABLE DISCUSSION



Soldiers receive training from an Army scientist as they prepare for a Manned-Unmanned Teaming (MUMT) mission with robotic assets, in the motion-ride simulator during the Crew Optimization & Augmentation Technologies (COAT) Increment I M&S study at DEVCOM GVSC, Warren, MI, in October 2019. The COAT program is developing optimized crew interfaces and technologies that maximize soldier and system performance while reducing crew cognitive load and overall crew manning requirements of various NGCV platforms. (U.S. Army DEVCOM)

One of the distinctives of OMFV is its development process, where the Army developed nine characteristics of need -- survivability, mobility, growth, lethality, weight, logistics, transportability, manning, and training – and then asked industry for its best solutions in those areas. The Army and industry went through several iterations of evaluating those solutions, culminating in a series of Soldier Touchpoints, so that we could validate the proposed solutions. Through this process, the Army was able to develop requirements for the OMFV that are feasible and achievable. Further, OMFV is being developed with a Modular Open System Architecture which will allow technologies that may not be ready for fielding today to be added to the vehicle when they are ready.

Ultimately, OMFV will provide our ABCT Soldiers the vehicle they need to fight and win on tomorrow's battlefield.

OMFV currently has an RFP out for development of a detailed design and production of prototype vehicles; up to three industry partners will be selected in 3Q FY23.

A&M: What are the characteristics that make NGCV new, novel? What will be the role AI, autonomy and robotics in NGCV?

Kott: OMFV is being designed with a Modular Open System Architecture. We know that technology will continue to evolve. While we will build the OMFV with the best technology available today, we know that new technologies will continue to come online. By using a MOSA approach, we will be able to integrate new technologies as they mature. Artificial intelligence and autonomy are technologies that continue to mature and will be incorporated into the design as appropriate.

Robotic Combat Vehicles are another signature line of effort for the NGCV CFT. In July-August 2022, an RCV Manned-Unmanned Teaming Soldier Operational Experiment was conducted with support of the Soldiers of 1-7 Cav at Fort Hood. During the SOE, Soldiers utilized two different RCV prototypes and an RCV surrogate to conduct platoon and troop-level exercises. Lessons learned at the SOE will inform future decisions about the possibility of moving RCVs to a program of record.

A&M: In terms of enhanced capabilities in future battlefield comprehension, what do you see as the primary hurdles for crew operators in maximizing NGCV combat effectiveness? **Berati:** The future for NGCV involves Soldiers operating under closedhatch conditions, completing extremely complex missions against a near-peer adversary on a hyper-lethal battlefield where decisions must be made very quickly. This means that Soldiers are going to have to process lots of complicated information quickly in order to understand it and respond effectively. At the same time, the NGCV vehicles will be crewed at roughly half the Soldier-system ratio of legacy vehicles (2:1 in NGCV, versus 4:1 in Abrams or 3:1 in Bradley). So, fewer Soldiers to complete a more complex mission.

The combination of crew reduction and closed-hatch operations will have serious implications for Soldiers' ability to maintain situational awareness – they'll need to work harder to maintain the same battlefield comprehension. Our partners at DEVCOM ARL have conducted research on crew workload in armored vehicles, concluding that AI, autonomy, and robotics can help alleviate some of the workload burden for reduced crews, enabling them to fight effectively. Integrating these types of technologies into ground vehicles brings its own challenges, and we will need to help autonomy be a better teammate for human Soldiers.

AI decision support and data reduction tools can help Soldiers process information more efficiently, whereas autonomous mobility and targeting systems can help free them up to act. When machines make decisions, they use information differently than humans – differences in the decision-making process and outcomes can make it difficult for Soldiers to trust the machine. Sometimes skepticism toward a machine's abilities is warranted, so when we talk about trust in a system, we emphasize that we are aiming to produce calibrated trust in a system, where the user understands the system's strengths and weaknesses well and uses it appropriately.

A related challenge is adaptability – general intelligence has yet to be achieved for Al-enabled systems. This means that machines are not yet capable of reasoning their way through problems and applying common sense. Adapting the behavior of Al, autonomous, and robotic systems to changes in context, including the environment, the adversary, and tactics, currently requires a great deal of resources. Common approaches for adapting a machine's behavior include reprogramming, in the case of an expert system, or using a deep learning approach that allows the machine to learn on its own. Expert systems require lots of human attention to update, whereas deep learning approaches require large amounts of data – in both cases, Al, autonomy, and robotic

ROUNDTABLE DISCUSSION

systems will need help adapting to the types of rapid change expected on future hyperactive battlefields.

Last, battlefield comprehension is not just a runtime consideration – we need to plan and learn in order to maintain an understanding of the overall picture. When we start sharing some decision-making authority with AI, autonomy, and robotic systems, we have to start looking at those systems as teammates with inherent strengths and weaknesses. Future systems will generate massive amounts of data – not just diagnostics information from the vehicle, but also crew-system interaction data. As teammates, those future systems will need to be able to contribute to, and learn from, events that happen during the mission. The scientific gap lies in how to enable humans and machines to speak a common language to learn and grow as a team.

A&M: How do you see AI and autonomy helping reduce operator complexity without removing necessary human to system interaction?

Berati: More data does not necessarily lead to better outcomes – raw data has to be synthesized into actionable information in order for it to be useful. In the AI community, this challenge manifests as a data labeling problem – in order to get the most out of that data, it needs to be taken in context. The challenge we face today is that Soldiers have access to more data than they can reasonably process in time to produce actionable information. We see AI and autonomy helping to reduce operator complexity in two primary ways – task sharing and data reduction.

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On the task sharing side, autonomy can perform some limited functions under a human's supervision, which can enable that human to perform other tasks. In armored vehicles specifically, the driver is very heavily taxed – offloading some of that responsibility to autonomous mobility can give that crew member enough bandwidth to edit a route plan or check the vehicle's status. In terms of sensing, computer vision could be used to monitor sensors in order to reduce the number of eye movements necessary to maintain situational awareness. In task sharing, we are not replacing a human crew member, but temporarily sharing tasks in order to reduce the complexity of that operator's overall asking.

We can also use AI for dimensionality reduction – there is a lot of information coming into the vehicle via sensors and battle management software. The challenge for the human crew member lies in attending to the right information at the right time. Humans are very good at pattern recognition, but with all of that data coming in it can be difficult to focus on what is important. In these applications, data fusion approaches and machine learning techniques can help reduce the amount of information that is presented to the operator, in turn reducing the complexity of the task for the crew member. These are amongst some of the technologies that our partners at DEVCOM ARL's Human Autonomy Teaming Essential Research Program are actively working on and transitioning to GVSC's COAT program for further optimization, vehicle-system integration and maturation to support the NGCV CFT requirements.

A&M: As robotics-supported combat vehicle applications advance, what do you see as primary challenges to full-autonomy and what functions are likely to remain rightly semi-autonomous?

Hartner: Navigation into unknown or complex environments is the big challenge to autonomy. When it comes to convoying along known routes and dealing with new obstacles that pop up along the route... we should feel pretty good about full autonomy on that. We've already been able to demonstrate it on several S&T projects. But if you start talking about navigating into an area you don't have a good view of, where there could be different vegetation and terrain types, negative obstacles, dynamic obstacles like other vehicles and dismounts... I think that is a big challenge.

There's not a ton of overlap between the mission of a commercial vehicle and a combat vehicle, so we can't always look to industry for an off-the-shelf solution. We still have some progress to make in terms of the robot perceiving and storing semantic information about the environment and altering its behavior based on that. I think that kind of mission would have to remain semi-autonomous for a while.

A&M: Is NGCV the future?

Kott: The process utilized in the development of OMFV is the future for the design and development of combat vehicles. In that process, we emphasized a collaborative approach with industry, communicating broad design characteristics in the initial RFP to spur innovation. We took advantage of 21st century engineering and design practices to include the use of modeling and simulation to validate requirements. All of our efforts are informed by the use of Soldier Touchpoints in which the end users provide the feedback at every step of the process to inform all key decisions.

COMMS SPOTLIGHT STREAMLINING NETOPS FOR GREATER REACH SETTING THE FUTURE TACTICAL COMMUNICATIONS STAGE

The U.S. Army is moving forward with implementation of its Unified Network Operations (UNO) as a foundation for future network management and security from enterprise to the edge. By MAJ Nathan Shepard, Assistant Product Manager, PM Tactical Cyber and Network Operations, PEO-C3T



A Soldier from the 50th Expeditionary Signal Battalion-Enhanced (ESB-E) participates in a usability assessment of the UNO Planner software at a recent Soldier Touch Point. (U.S. Army photo by PEO C3T)

The U.S. Army's Unified Network Plan has set the stage for a Multi-Domain Operations (MDO)-capable force and the Army of 2030, and has also laid the foundation for a transformative approach to network modernization. A key enabler of the plan is executing Department of Defense Information Network Operations, or DODIN Ops, functions to provide an available, reliable and resilient network that commanders can employ as a weapons system in all operational environments. Taking it even one step further, DODIN Ops critically relies on Unified Network Operations (UNO) to operate, maintain and sustain the network and systems management capabilities.

The UNO Program of Record is delivering an integrated network operations (NetOps) capability – based on an open framework – which aggregates data to enable common planning, configuration, management, monitoring and defense of the network. This is being accomplished through the integration of multiple NetOps systems from handheld devices up through enterprise-level assets. The end goal for UNO is to co-host and federate existing tactical NetOps capabilities developed for the tactical network into a standardized NetOps capability for the S6/G6 and S3/G3 staff of Signal organizations who plan, install, secure and defend deployed tactical networks.

A ROBUST BASIS FOR OPERATIONAL SUCCESS

The network is the foundational Army warfighting platform that enables forces to conduct Unified Land Operations (ULO) executed through decisive action and guided by mission command that enable the successful execution and synchronization of the MDO tenets (i.e., calibrated force posture, MDO formations, and convergence).

The flexible construct of UNO will allow for adaptation to changes in unit structure by providing end-to-end NetOps enabling all warfighting functions and maintain critical situational awareness in all operational environments via a shared common operational picture that fully enables forces to fight and win in congested and contested environments.

To accelerate UNO development, the Program Office has been leveraging the Mid-Tier Acquisition (MTA) Rapid Prototyping construct. MTA begins with a blank slate and allows the program, as decision

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■ COMMS SPOTLIGHT STREAMLINING NETOPS FOR GREATER REACH



A Soldier from 2nd Cavalry Regiment (2CR) uses the Integrated NetOps Battalion & Below (INB2) software. (U.S. Army photo by PEO C3T)

authority, to build an acquisition process appropriate to the capability's maturity and mission needs. With Rapid Prototyping, programs must field a prototype that can be demonstrated in an operational environment, and also ensure operational capability within five years



of an approved requirement. For UNO, the Army has executed several Soldier Touch Points and Operational User Assessments – a total of 13 in FY22 alone – that have produced results exceeding system usability objectives.

MULTI-LEVEL SOLUTION FOR CROSS-UNIT INTEGRATION

Under the UNO umbrella, several specific capabilities have also embraced the Developmental Operations, or DevOps, model and Rapid Prototyping. Integrated Network Operations Battalion and Below (INB2) was demonstrated to provide monitoring and management of the Lower Tactical Internet during the Army's Capability Set (CS) 23 Ops Demo Phase I earlier this year. The live-fire training event conducted in June with the 3rd Squadron, 2nd Cavalry Regiment at the Grafenwoehr Training Area, Germany, proved out mounted Integrated Tactical Network capabilities with a Stryker Brigade Combat Team.

Additional UNO efforts include the Network Operations Management System, or NOMS, which has been fielded to the 101st Expeditionary Signal Battalion, 1st Armored Division DIVARTY and 82nd Airborne Division as part of the Network Integration Technology Enhancement program; and the successful convergence of network tools, consolidating more than two dozen management and monitoring tools into a single tool to reduce complexity.

Additional DevOps engagements with the 3rd Infantry Division, 25th Infantry Division, 198th Expeditionary Signal Battalion-Enhanced will continue to refine MTA prototype development and gather critical data in support of UNO PoR requirements.

LOOKING AHEAD

The UNO Program of Record will begin delivering these critical capabilities in fiscal 2025 in parallel to the Army's CS process and continued integrated tactical network fielding. As the service shifts to a more data-centric environment, UNO will provide a more simple and intuitive tool that ensures the right data gets to the right people at the right time. Most importantly, that data will be secure.

LEADERSHIP PERSPECTIVE

PROJECTING POWER THROUGH CAPABILITY DELIVERY

Major General Lawrence graduated from the United States Military Academy (USMA) in 1995 and upon graduation was commissioned as a Second Lieutenant in the U.S. Army Quartermaster Corps. MG Lawrence has held several key staff and joint assignments to include Supply & Services Officer, Combined Joint Task Force-82 (Afghanistan); Support Operations Officer, 782nd Brigade Support Battalion, 4th Brigade Combat Team, 82nd Airborne Division, Fort Bragg, NC; XO to the Deputy Chief of Staff, G-4, Headquarters Department of the Army, Pentagon, Washington D.C.; and Director of Readiness, Strategy and Operations, Office of the Deputy Chief of Staff, G-4, Headquarters Department of the Army, Pentagon, Washington D.C.

MG Lawrence's command assignments include the Headquarters and Distribution Company for 225th Forward Support Battalion, Division Support Command, 25th Infantry Division (Light) at Schofield Barracks, Hawaii; the 801st Brigade Support Battalion, 4th Brigade Combat Team, 101st Airborne Division (Air Assault) at Fort Campbell, KY; the 25th Sustainment Brigade, 25th Infantry Division at Schofield Barracks, HI and Commander, Defense Logistics Agency Troop Support, Philadelphia, PA.

MG Lawrence, Commanding General of the U.S. Army's Military Surface Deployment and Distribution Command (SDDC), spoke with A&M about some of the command's current mission foci, including efforts to assist U.S. ally Ukraine in its ongoing war effort.

A&M: Describe your role as the new SDDC commanding general and the command's primary mission focus areas as you see them today.

MG Lawrence: I am exceptionally grateful to have been given the opportunity to lead SDDC. This command executes an extremely challenging and diverse mission set and I'm proud to lead such a professional and talented workforce. Although I have not had any previous assignments with SDDC, I've been on the receiving end of the responsive support this command provides and have experienced the incredible capabilities SDDC brings to the table in support of our Joint Warfighters.

As both the Army Service Component Command to U.S. Transportation Command and a Major Subordinate Command to Army Materiel Command, SDDC is responsible for the synchronization and integration of surface transportation capabilities to ensure the projection of combat power and sustainment capability on time and on target in support of combatant command requirements. This is accomplished primarily through our five active-duty transportation brigades, each of which are aligned to a geographic COCOM, that essentially pitch and catch combat power and sustainment cargo



MG Gavin A. Lawrence Commanding General Military Surface Deployment and Distribution Command

while leveraging DoD capabilities and our global transportation contracts with commercial industry. To put it another way, SDDC moves military equipment and cargo by surface, whether it be by truck, rail, ship, or other conveyance. We deliver capability, lethality, combat power and sustainment to the Joint warfighter.

In support of large-scale mobilization, those five brigades grow to nine total force brigades and one Expeditionary Rail Center through the activation and mobilization of SDDC's Reserve component force, the Deployment Support Command.

A&M: SDDC delivers integrated and synchronized global deployment and distribution capabilities throughout the world. How has SDDC been involved in support to Ukraine and our Allies in Europe?

MG Lawrence: SDDC projects combat power anywhere in the world to assure our allies and deter our enemies by using our organic capability and the support we receive from our commercial industry partners. Over the past months, SDDC has executed several Presidential Drawdown missions providing support to Ukraine and our allies in Europe including moving cargo and ammunition from

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LEADERSHIP PERSPECTIVE



Port Briefing – U.S. Army Lt. Col. J.D. Tillman, commander of SDDC's 838th Transportation Battalion, briefs Soldiers at the port of Antwerp-Bruges, Belgium before they unload and stage equipment belonging to 3rd Armored Brigade Combat Team, 1st Cavalry Division, July 2022. The port operation and onward movement supported the rotational deployment of 3rd ABCT to Europe. (U.S. Army photo by Natalie Weaver)

several U.S. ports, as well as larger ammunition movements from our Military Ocean Terminals. In our support to Ukraine, SDDC has moved cargo on 31 vessels, 89 trains and over 1,800 commercial trucks. With all of that transportation power, we also delivered over 950 containers of ammunition, as well as additional mobility and combat platforms, to allied nations in support of global deterrence.

A&M: From a domestic movement support perspective, how has SDDC supported recent humanitarian crisis response efforts across the nation?

MG Lawrence: The most obvious example I can provide is the command's role in the whole of government response to the COVID-19 pandemic where SDDC and our commercial industry partners successfully mitigated COVID risks to continue the safe execution of movements globally. Key highlights include the consistent movement of 1,500 commercial trucks on any given day, despite the driver shortage and limitations caused by COVID. Even while the global supply chain was congested, SDDC still executed 70 vessel operations during the height of the pandemic in 2021. In a normal year, we average about 80 Brigade Combat Team or equivalent-sized movements annually; with COVID conditions, we still moved 57 BCTs during the calendar year and continued conducting global operations that included delivering almost 28,000 equipment items, utilizing 23 CONUS and 45 OCONUS seaports, in support of six combatant commands.

Another operation SDDC played a role in supporting was the Afghanistan retrograde. While most of the cargo coming out of theater was moved via airlift, our team was involved in supporting movement operations here in the States. We also mobilized personnel for Task Force Eagle to support safe haven operations and supported the booking and contracting of sustainment cargo. A&M: SDDC provides global end-to-end deployment and distribution services to support our nation's Joint warfighters. Are there any recent SDDC missions that have been game changers?

MG Lawrence: The Army moves to overseas locations primarily through strategic sealift, with about 80% of its deployed capabilities moving via ocean vessel. To support these movements, SDDC oversees the strategic seaport program where, in coordination with the Department of Transportation and Department of Defense, we maintain oversight for the readiness of port infrastructure as well access to stevedore and related terminal services to facilitate upload and download of equipment at these ports. Included within the strategic seaport program are 24 military and commercial ports in the U.S. and over 180 overseas ports where we conduct operations.

In addition to seaport operations, the use of rail transport is one of our key transportation enablers. Last year we coordinated approximately 270 train movements pulling 17,500 railcars worth of cargo and equipment. This capability will be critical in a conflict situation where, to meet surge requirements, more than 70% of joint force equipment and cargo will move by rail from the forts to the ports. Our commercial rail partners work extensively to survey and maintain the readiness of the strategic rail corridor network and coordinate as required with law enforcement for physical security requirements. SDDC owns about 1,900 specialized DOD rail cars that are capable of handling larger military equipment such as tanks.

A&M: Feel free to speak to other achievements or goals SDDC has moving forward.

MG Lawrence: Port diversification is an important focus area for the command. SDDC uses several key ports for the movement of equipment and cargo in each theater, however as we continue to use

LEADERSHIP PERSPECTIVE

those same ports, they could become targets in times of war. To help reduce this risk, we have built redundancy into our logistics network by expanding and diversifying the different ports we operate through. This proved helpful when our support to Ukraine began, as our units in Europe had already cultivated and maintained exceptional working relationships with alternate ports, paving the way for a possible shift in operations should the need arise. As we expand our global network, these additional ports will play a key role in future operations.

As previously mentioned, the Deployment Support Command is SDDC's Reserve component force. The DSC provides a force multiplier for large-scale movements by adding an additional 2,600 Soldiers to SDDC's ranks in the form of port operators and system managers. In simple terms, the DSC allows SDDC to open additional ports during contingencies or run existing strategic ports at 24-hour operations. While the command's active-duty brigades are globally positioned to execute their missions, a substantial increase in required cargo volume could extend beyond the scope of their capabilities, requiring the addition of DSC's Reserve Soldiers to augment and strengthen critical ports at key points in our operations. Looking forward, I plan to use these elements further to ensure they are ready to support global operations when the need arises. Of note, the DSC just successfully completed their annual Trans-Mariner validation exercise in June, ensuring they are fully prepared to conduct operations.

Another important effort the command is working on, along with its Transportation Engineering Agency, is railcar modernization. Movement by rail is a critical factor in large-scale surface movements and many cars in the DOD railcar fleet, previously mentioned, are nearing the end their lifecycle. As we look at equipment modernization within the DOD, many platforms are becoming larger and heavier, and civilian railcars cannot support these changes with organic assets. Our team is in the process of planning and designing a new generation of railcars that are not only capable of handing the new weight and size requirements but will also include additional improvements to make them more flexible and agile as the Joint Force continues to modernize.

Finally, SDDC possesses unique capabilities to assist and train units with tasks associated with their Deployment Discipline programs. Our Deployment and Distribution Support Teams (DDSTs) have the capability to assist units with deployment planning and completion of administrative tasks such as building unit deployment lists (UDLs). They also have the expertise to assist units with outload tasks such as blocking, bracing, and equipment tie-down. By teaching and assisting units in oversight of these actions, our DDSTs can help build the proficiency needed within our units to deploy, fight, and ultimately win. It's one thing to be trained and ready when you're sitting at your post, camp, or station - that's tactical readiness. But true strategic readiness is our ability to project power anywhere at the time and place of our choosing. That is what makes our force the best in the world.

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