

ARMOR & MOBILITY

FALL 2021

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**FACILITATING EMERGENT
TECHNOLOGY EVOLUTION**

COMMANDER'S CORNER



MG Edmond "Miles" Brown
Commander
U.S. Army Combat Capabilities
Development Command (DEVCOM)



Mr. Michael Sprang
Project Manager
Joint Program
Office
Joint Light
Tactical Vehicles



Ms. Jennifer Moore
Program Manager
Light Tactical
Vehicles
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UNLEASHING THE POWER OF EMERGENCE

Army Futures Command is collectively partnering and discovering new ways to combine multiple research outcomes to generate game-changing capabilities faster.

By Dr. Shawn M. Walsh and Mr. Mathew Correa

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MG Edmond "Miles" Brown
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Mr. Michael Sprang
Project Manager
Joint Program Office
Joint Light Tactical Vehicles

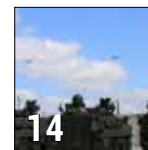


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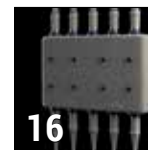
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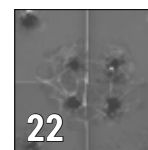
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INDUSTRY PARTNER

**BALANCING PROTECTION
AND LIFE CYCLE SUSTAINABILITY**
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engineered to military requirements.

By Michael J. Arlen

Cover: Spc. William Ritter, a military policeman with 287th Military Police Company, 97th Military Police Battalion, 89th Military Police Brigade, Fort Riley, Kansas, checks the assembly of the RQ-11 Raven, a small unmanned aerial system (sUAS), during Allied Spirit VIII at Hohenfels, Germany. Roughly 4,100 troops from 10 nations are participating in Allied Spirit VIII, a multinational training exercise designed to test participants' readiness and capabilities. (U.S. Army photo by Spc. Dustin D. Biven / 22nd Mobile Public Affairs Detachment)

ARMOR & MOBILITY

Armor & Mobility ISSN: 2151-190x

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INSIGHTS

As seasons change like Summer to Fall, we're reminded that the evolution of new life can only occur through the dissolution of old. Much the same occurs when those charged with determining what systems will best offer future U.S. servicemembers the best protection on the battlefield must scrap proven, older ideas for more forward-looking concepts. Such is the task of U.S. Army Combat Capabilities Development Command, or DEVCOM, spotlighted in the Fall 2021 issue of *Armor & Mobility*, as the research and development entity works to ensure America's ability to defend U.S. and allied freedoms globally is not failed by next-generation combat innovation.

In this issue, A&M is delighted to present a two-for-one cover interview with DEVCOM commander and newly-minted MG, Edmond "Miles" Brown, coupled with a special feature on futuristic efforts engineers are working to bring to life today. As Army Futures Command (AFC) oversees the direction of still-evolving capabilities to fulfill conceptualizations of what Multi-Domain Operations (MDO) of tomorrow might look like, gadgets are being developed from small unmanned air systems (SUAS) capable of clandestine infiltration of enemy airspace to quadruped robots capable of carrying many times their weight in combat-ready supplies. From disruptive energetics to hypersonic-capable aircraft, artificial intelligence-driven autonomy to synthetic biology, additive manufacturing and material by design processes are making the future of MDO-structured battle planning closer to reality.

From capabilities development to fielding, the limits of traditional mobile network integration were singular point-to-point connectivity not long ago. Army Program Executive Office for Command, Control and Communications-Tactical (PEO C3T) is today modernizing those same networks to connect Stryker and mobile armored formations by way of the Tactical Transport Network On-The-Move (TNT-OTM). Now vehicle formations won't need stop to set up tac comms with other units as TNT-OTM will enable connection on the fly, keeping critical mission timing on schedule.

Just as clear communications drive combat tactics, much of what drives combat tactics success is tactical vehicle capability. In a pair of featured interviews with the Joint Program Office, Joint Light Tactical Vehicles Project Manager Michael Sprang and Program Manager Jennifer Moore, Light Tactical Vehicles, U.S. Marine Corps Systems Command, we get great insight into the aspects of ongoing Army and Marine Corps Joint Light Tactical Vehicle (JLTV) fielding and force integration as the state-of-the-art platform replaces the nearly forty year old workhorse High Mobility Multi-purpose Wheeled Vehicle, or Humvee.

Be sure to catch this issue's DLA spotlight focusing on agency efforts to get rid of the need for asset delivery remediation when mis-labeling occurs using advanced asset awareness to assure supply chain integrity. Oh and not to be remiss in mentioning Fall A&M's Industry Partner and Perspective, we get a look at enhanced lightweight, passive armor and mobile, lightweight intercom technology, respectively.

As always, feel free to send us your comments and suggestions. Thanks for the continued readership!

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UNLEASHING THE POWER OF EMERGENCE

The U.S. Army has long demonstrated the game-changing impact of investing in singular areas of scientific research. Army Futures Command is discovering new ways to combine multiple research outcomes to generate game-changing capabilities faster.

By Dr. Shawn M. Walsh and Mr. Mathew Correa, U.S. Army Combat Capabilities Development Command (DEVCOM)



Bay State Battalion ROTC Cadets from Worcester Polytechnic Institute demonstrate "Dog with Fleas and Ticks," a mission-adaptive capability based on a collective of quadruped robots, small unmanned aerial systems, and offloaded sensors. (Photo: U.S. Army)

Project Convergence exemplifies Army Futures Command (AFC) ability to make good on its founding promise to lead persistent modernization of the U.S. Army. Often referred to as a campaign of learning, Project Convergence unites new and developing technologies, including systems of systems, in a relevant operational context. The intent in part is to determine what these new technologies can and cannot do, including resolving any disconnects between other systems and networks.

Project Convergence is especially focused on one aspect of Multi-Domain Operations, or MDO: the ability to continuously converge effects across air, land, maritime, space, and cyberspace domains. The goal is to deliver the right capabilities in the right place to enable the Joint Force to win. Many of the systems in Project Convergence are nascent outcomes from AFC's cross-functional teams, or CFTs. Even though the individual technologies and systems from these CFTs might be functional and meet their targeted performance criteria, assuring they cooperate as part of larger systems of systems is nontrivial. Project Convergence provides the opportunity to experiment with both technology integration and how Warfighters will deploy these new capabilities. Failure is permitted during such excursions but with a caveat: an expectation to capture and resolve capability gaps that are revealed from such experimentation.

Director of DoD Manufacturing Technology (ManTech), Ms. Tracy Frost, highlights the additional importance of assuring an equally capable industrial base to deliver these new systems and capabilities. "As the Army moves forward with Project Convergence, it is linking its development activities to scalable production. Through engagement with



Tracy Frost

the OSD Manufacturing Technology Program Office, particularly the DoD Manufacturing Institutes, the Army is leveraging prototyping capabilities and an ecosystem that represents the 'supply chain of the future'. Manufacturing new systems will be a key element in Army emergence because 'if you can't make it, you can't have it.'

To assure persistent overmatch, the Army needs to improve its understanding of how new research outcomes and technologies from government laboratories, universities, and visionary entrepreneurs potentially combine into future capability. Researchers and concept developers across AFC are now asking a new set of questions: what if we experimented with combining multiple technologies into emergent capability long before they are mature enough for Project Convergence, CFTs, and other Army systems? What if seemingly disparate research from AFC scientists and external contributors converged into a conceptual capability that can't be built yet - but its benefits hypothesized and tested and compared against other possible research combinations? And what if the proven goodness of Project Convergence, such as initiating an early campaign of learning and uniting diverse teams of expertise, could be used to collectively build transformational and 10X capability?

The first step is to promote a better understanding of how the Army develops and deploys new capability.

REVISITING KEY ASSUMPTIONS

There are three assumptions that often limit military and commercial innovators from achieving the shared goal of

deploying decisive competitive advantages to Warfighters.

First is the assumption that the Army delivers the best science and technology, or S&T, directly to the Warfighter. This is incorrect. The Army delivers the right Warfighter capability informed and enabled by the right S&T, concepts, and requirements. More specifically, the Army develops validated DOTMLPF-P (doctrine, organization, training, materiel, leadership, personnel, facilities, and policy) capability. Effective capability relies as much on the right tactics, techniques, and procedures as it does on exploiting technological advances.

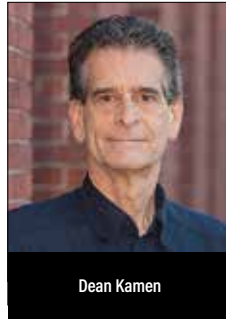
A second assumption is that the Army and the wider Department of Defense, or DoD, need singular scientific breakthroughs to create transformational capability and overmatch. Fostering research that leads to such breakthroughs is absolutely necessary but challenging for several reasons. It's true that technologies like the transistor, digital computer, and the laser have had revolutionary impact on both military and commercial capabilities. However, such profound and pervasive breakthroughs are rare and often take decades to manifest into a practical device, system, or platform. How can the Army still create transformational capability in the meantime? It can more aggressively explore novel combinations of readily available technologies and emergent research to create new capability.

Third is the assumption that we need to focus on exploiting "disruptive" technological advances to stay ahead of our competitors and adversaries. This assumption is woefully incomplete. Equally disruptive and innovative approaches are also needed to improve the agility and efficacy with which the Army and the DoD transform science and technology into deployed Warfighter capability. Our acquisition cycle and procurement system should be a competitive asset. Timely deployment of needed capabilities that exploit the right disruptive technologies should be the proper measure of acquisition success.

With a more holistic understanding of how the Army transforms science into capability, it is possible to explore how Warfighter solutions could emerge earlier from need-inspired combinations of seemingly disparate research outcomes.

GETTING TO EMERGENT CAPABILITY COLLECTIVELY

Biological systems have long exploited one of the most powerful phenomena in nature: emergence. Collectives of individual organisms combine through a process known as self-assembly to create an emergent capability that no single organism can produce alone. A familiar example is the ability of ants to adaptively build a bridge by linking their bodies together. The resulting bridge is an emergent capability that allows for the transport of food and building materials back to the ant colony. The entire colony benefits from this unique and competitive advantage. By analogy, Project Convergence reveals how the Army can generate MDO capability by harmonizing disparate systems of systems into more complex warfighting effects.



Dean Kamen

Similarly, there are numerous examples of commercial capability emerging, often unexpectedly, from collectives of technologies originally developed for other applications. When inventor Dean Kamen began work on his self-balancing iBot wheelchair, it demanded the complex integration of both available and newly invented technologies. Nicknamed "Fred" after Fred Astaire, iBot was a robotic-enabled system that provided unprecedented mobility compared to conventional wheelchairs. This included the emergent capability to walk up and down stairs. Equally remarkable however is the impact Fred's core innovations had, in part, on the emergence of the billion-dollar micro-mobility market. Dock-less electric scooters manufactured by Lime, for example, benefit from unique technologies originally developed for iBot.

Mr. Kamen shared from personal experience, "When adopting and combining technologies, both existing and emerging, we cannot be risk averse. We must seek user feedback early and often to achieve the disruptive capabilities that they seek. Sometimes capabilities that we could not imagine will emerge, because nobody can predict with certainty what ideas will work. Yes, many will fail, but some will succeed. And it is those successes that change the world."

AFC is exploiting the concepts of self-assembly, collectives, and emergence radically earlier, long before new scientific advances mature into actual devices and systems. There are good reasons to do so. In the face

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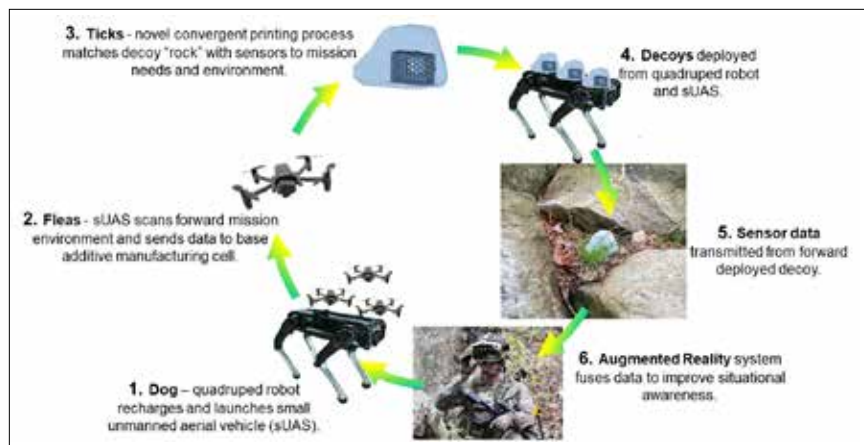
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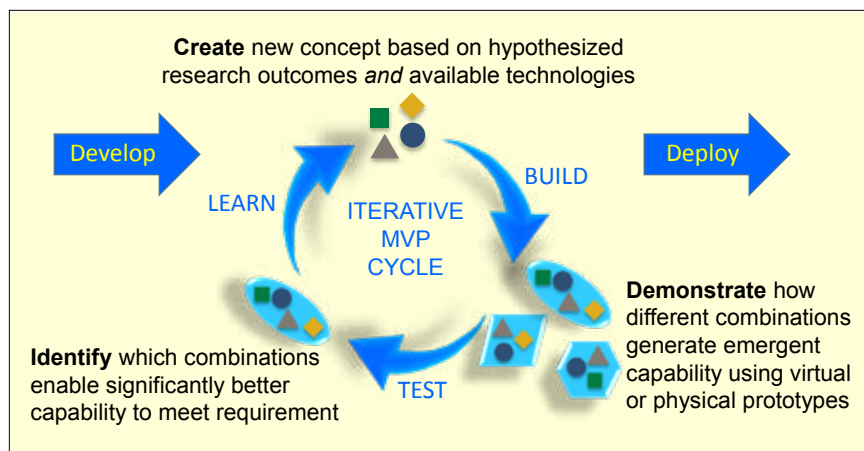
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Individually, quadruped robots, small unmanned aerial systems, point-of-need additive manufacturing, and augmented reality systems are valuable capabilities. Collectively, these technologies can potentially enable emergent capability to improve situational awareness of the mission environment. (U.S. Army graphic)



The minimum viable product (MVP) cycle allows for early testing and assessment of hypothesized capabilities based on combinations of disparate but complementary technologies. (U.S. Army graphic)

of increasingly aggressive near-peer adversaries, incremental improvements of familiar Army systems and platforms will be insufficient. Another key challenge the Army and the wider DoD must face is objectively deciding which research areas to invest in. Anticipating how singular, unrelated research areas might combine to create future capability could help prioritize which areas will have the most significant military impact.

BG David Trybula, Deputy Commanding General of the U.S. Army Combat Capabilities Development Command (DEVCOM), noted, "In an era of persistent competition, emergence is critical to generating DOTMLPF-P solutions for the warfighter to enable persistent modernization and ensure our Soldiers always have overmatch capabilities."



WELCOME TO THE DOG POUND

The idea of combining disparate technologies to create new capability is hardly new. Arguably, most engineered systems rely on integrating multiple technologies and systems to deliver a desired capability. Moreover, terms like "technology convergence," "combinatorial innovation," and "Internet of Things" all recognize the compounding benefits of integrating diverse technologies and systems. The goal here is to foster the emergence of a capability that is greater and more adaptive than the sum of its constituent technologies – including technologies that are still in early stages of research and development.

In an Army experiment dubbed "Dogs with Fleas and Ticks," a small, diverse group of people self-assembled to create hypothesized capability based on multiple research efforts and technologies. In this lexicon, dogs are quadruped robots, fleas are small unmanned air systems (SUAS), and ticks refer to all other enabling technologies (e.g., artificial intelligence, additive manufacturing, offloaded sensors, etc.). The goal was to collectively expand Soldier/robot capability while minimizing cognitive and physical burdens on the Soldier.

The minimum viable product, or MVP, cycle was adapted to create emergent capability from unrelated but complementary technologies. This collective, known as the "dog pound," allowed individual technologies to enter and exit as needed. What emerged was a Soldier/robot capability that assessed and adapted to specific mission needs. In one scenario, chemical/biological hazard sensors with long-term power sources were offloaded from the quadruped robots to greatly enhance situational awareness and perimeter security. In another hypothesized scenario, multiple SUAS and unattended ground sensors, or UGS, detected the relative position of adversaries. This information was used to position quadruped robots with ballistic shields to protect dismounted Soldiers. Wargaming of this robotic-augmented protection concept demonstrated a 36% increase in Soldier survivability.

The benefits of the initial dog with fleas and ticks collective experiment were multifold. New opportunities to exploit the ability of quadruped robots to navigate highly difficult and dangerous terrain were identified. Notional integration of disparate technologies revealed capability gaps, disconnects, and research opportunities that could not be identified by assessing singular technologies. The ability to compose and recompose needed capability from a relatively small number of systems was notionally demonstrated, thereby reducing size, weight, power and logistics burdens. Such insights could help inform more complex and leap-ahead concepts and requirements based on multiple technologies and systems. Most importantly, the dog with fleas and ticks collective gave researchers a much earlier opportunity to explore the potential impact of their individual technologies on future Warfighter capability.

FORGING AN EMERGENT FUTURE

MDO reveals a far more complex operating environment than the Army has ever known. New and adaptive ways to detect, decide, and deploy effects across air, land, maritime, space, and cyberspace domains will be essential. Global diffusion of S&T advances, driven largely by universities and the private sector, suggests near-peer adversaries will have access to many of the same enabling technologies that we do.

AFC and the Army Modernization Enterprise are well-positioned to pursue an additional path to transformational concepts and requirements: emergence. Unprecedented opportunity now exists to explore, demonstrate, and most of all, deploy game-changing warfighter capability by harmonizing multiple S&T outcomes much earlier.

ENHANCED ASSET AWARENESS FOR SUPPLY CHAIN ASSURANCE

Defense Logistics Agency Distribution initiated a continuous process improvement project in June 2020, with a goal of accounting for and reporting improperly marked freight received at DLA Distribution centers on the east and west coasts of the United States.

By Dawn Bonsell, DLA Distribution



Defense Logistics Agency Distribution employees will begin using a process to account for and report remediation work received from various sources to help identify the root cause and assist supply sources and vendors with improving packaging for future shipments. (submitted photo)

When DLA Distribution receives shipments that are not properly labeled, packaged or certified to be shipped to warfighters overseas, the non-compliant shipments cause delays and increase costs to the services, DLA and the national supply chain.

"The implementation of this process will ensure supply chains are aware of non-compliant shipments, allowing for collaboration with their supplies to ensure overseas warfighters receive material without delay," said Sherry Amrhein, project lead and DLA Distribution CPI program manager.

ADDRESSING OUTDATED PROCESSES

The team reviewed data on shipments received at two strategic distribution platforms within the continental U.S. Currently, when non-compliant shipments arrive, it is remediated by DLA Distribution workers and sent out without documenting what the issue was, the amount of time and resources needed to remediate the shipment, or where the shipment came from.

For example, a vendor recently shipped four pallets of hazardous material to DLA Distribution. The shipment was not compliant with International Maritime Dangerous Goods Code, the international maritime shipping regulation created by the United Nations. DLA Distribution workers had to break down each pallet, relabel each individual box

with the hazardous material information, repalletize, shrink wrap and complete hazardous certifications before the material could be shipped to the warfighter.

STREAMLINING SUPPORT TO VENDORS

To address this issue, the CPI project team designed a process to account for and report remediation work received from various sources. This process involves notifying the source of the non-compliant shipment, to help identify the root cause and assist supply sources and vendors with improving packaging for future shipments.

Using the new process, when shipments arrive at a consolidation and containerization point or transshipment point that are mislabeled or packaged, DLA Distribution will create a supply discrepancy report that identifies the reason for remediation and associated costs to the source of supply.

In addition, DLA will seek collaborative joint efforts with contracting officers and government purchase card holders and their vendors to provide information to support compliance with shipping requirements — proper packaging, labeling and including proper OCONUS hazardous shipper declarations.

DLA Distribution will launch the new process for reporting remediation work in early fiscal year 2022.

TAPPING ROBUST TECHNOLOGY TO ENABLE PROACTIVE FORCE READINESS

MG Miles Brown assumed command of the U.S. Army Combat Capabilities Development Command (DEVCOM) on July 9, 2021. As DEVCOM's Commanding General, Brown leads a world-class team of science and technology experts fully focused on empowering the future American Soldier with advanced Army capabilities made possible by cutting-edge technology forecasting, research and development.

Brown is a native of Honea Path, South Carolina and was commissioned as a Field Artillery Officer after graduation from The Citadel. He has served in Korea, Kuwait, Iraq, and Afghanistan with stateside duty at Fort Stewart (Georgia); Fort Hood (Texas); Fort Riley (Kansas); Fort Carson (Colorado); Fort Eustis (Virginia); and Washington, DC. His staff and joint assignments include Aide[1]de-Camp to the Commander, Multi-National Force-Iraq; Chief of Staff, 4th Infantry Division; Deputy Commanding General Support, 1st Cavalry Division; and Deputy Director/Chief of Staff, Futures and Concepts Center, U.S. Army Futures Command. Brown's commands include an Artillery Battalion in Iraq, a Brigade Combat Team in Kuwait, and the Train, Advise, Assist Command-South (TAAC-S) in Afghanistan. He has served eight tours in South Asia during Operations Desert Fox, Intrinsic Action, Desert Spring, Iraqi Freedom, New Dawn, Spartan Shield, Eager Lion and Resolute Support.



MG Edmond "Miles" Brown

Commander

U.S. Army Combat Capabilities Development Command (DEVCOM)

Armor & Mobility spoke recently with MG Edmond "Miles" Brown, Commander, U.S. Army Combat Capabilities Development Command (DEVCOM), regarding efforts to provide the Army and Joint Force with enhanced solutions amidst the demands of ever-shifting global threats to U.S. national security.

A&M: You recently took command of U.S. Army Combat Capabilities Development Command, or DEVCOM. What are your initial impressions of its role and value to Army Futures Command (AFC) and Army Modernization?

MG Brown: Since I took command of DEVCOM in July, I've really focused on getting to know the command, getting out to meet the workforce whenever possible given COVID-19 safety protocols, and learning about our past successes, current challenges and how we see ourselves moving forward.

I've visited nearly all of our centers and labs and my first impression – to be quite frank – is that DEVCOM is one of the most complex commands within the Army. No other Army command has such an expansive, highly technical civilian workforce. No other Army command operates the way DEVCOM does. No other Army command has such a complex set of varying yet integrated mission areas like DEVCOM does.

DEVCOM is unique, and I say that with an appreciation for the fact that I've only begun to scratch the surface. What is already clear to me, however, is that DEVCOM is absolutely critical to AFC and Army Modernization. There is no Army Modernization without DEVCOM, and the science and technology expertise of our team is unparalleled. Our subject matter experts are helping ground Army concepts in scientific reality, exploring theories of emerging science, developing new autonomous technologies, engineering improved Combat Capabilities and driving data analysis to enable the Army of the Future.

A&M: How does your previous experience influence your approach to leading the command that executes the Army's science and technology development?

MG Brown: Each of my predecessors brought a unique skillset to the table when leading this command, when it was known as RDECOM, or now as DEVCOM. I plan to build upon their hard work and successes moving forward. I think I bring a good amount of operational experience to DEVCOM. Since I assumed command, I've told our workforce it's important to remember that we are one of the few Army units with the



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The electronic signature of next generation technologies is increasingly important. Unlike launcher-based active protection systems that generate substantial electronic signatures, StrikeShield's near field defeat technology minimizes APS signature to protect a combat vehicle crew from early detection and enemy indirect fire.

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Strikeshield is offered in the US by Rheinmetall and its partner Unified Business Technologies, Inc. (UBT) headquartered in Troy, MI.



Army scientists at the Combat Capabilities Development Command, known as DEVCOM, are exploring quantum computing as one of the Army's priority research areas and its applications for AI, machine learning, robotics, and data that will enable Multi-Domain Operations and Joint All Domain Command and Control (JADC2). (Courtesy of the University of Chicago, Nancy Wong)

word "Combat" in our name. Why is that important? Because the science we're exploring, the technologies we're developing, and the capabilities we're enabling – they are meant for Soldiers to train for or fight in combat. The harsh realities of combat, the speed with which decisions must be made in combat, the complexities of combat, and the sacrifices combat demands of our Soldiers must always be at the top of our minds.

Every day we are pushing the boundaries of scientific research and development, and transitioning technologies to provide current and future Soldiers with the better, faster and more lethal combat capabilities they need to compete and win in the unforgiving crucible of ground combat. There is no other reason we are here – this is our primary mission.

DEVCOM leaders will continue to put even greater emphasis on the role that early and consistent prototyping, developmental experimentation and testing, and Soldier feedback plays in DEVCOM's technology maturation process.

A&M: You just mentioned Soldier feedback -- in the past year, there has been a lot of emphasis on what the Army calls "Soldier-Centered Design" and "Soldier Touchpoints." How has DEVCOM changed its approach to technology development to involve Soldiers earlier in the process?

MG Brown: Historically, Soldiers were brought in to tinker with and break technology much later in the technology maturation process than what we're seeing today. That change is a direct result of Army Futures Command's unfaltering commitment to doing things differently.

At DEVCOM, there's been a shift in our mindset and processes. It's not enough to wait until a technology is nearing transition to a program of record to finally get Soldier feedback. We are taking our technologies out of the lab and into the field earlier and more often, to gather Soldier insight and truly meaningful feedback as early and as often as possible. This is the cornerstone of Soldier-Centered Design for AFC.

The earlier we put a prototype technology in the hands of an end user, the faster we can get relevant and superior combat capabilities into the hands of our Soldiers to meet their tactical and operational needs. By taking our technologies from the lab and into the field, we can expedite the process, observing how Soldiers would use a prototype technology in an operational setting, troubleshooting issues in real-time and identifying

concerns or limitations early on.

In 2021 alone, we will have more than 200 experimentations and Soldier Touch Points. That offers us 200 opportunities to improve technologies and ensure we're transitioning capabilities our Soldiers and our Army need to deter and defeat our adversaries.

A&M: How does DEVCOM look beyond 2035 and the current Army Modernization priorities to ensure the Army is prepared for the conflict after next?

MG Brown: While our support to the Modernization Priorities is critical, a huge part of DEVCOM's mission to continually deliver capabilities is accomplished through proactive and intentional exploration of basic and foundational research that will have impacts beyond 2035, for – as you said – the conflict after next.

We do this through established Priority Research Areas, primarily explored by our Army Research Laboratory and its global network of academic partners. These Priority Research Areas aim to deliver knowledge to guide developmental research, point to new possibilities, and shape previously unimagined warfighting concepts. They provide Army Senior Leaders with options for future directions that will inform strategic decisions through which the Army's modernization can persist far into the future.

The Army's current Priority Research Areas include: Disruptive Energetics; RF Electronic Materials; Quantum; Hypersonic Flight; Artificial Intelligence; Autonomy; Synthetic Biology; Material by Design; and Additive Manufacturing.

AFC and DEVCOM give Priority Research Areas particular significance due to their alignment with warfighting gaps and the belief that areas of inquiry are likely to yield knowledge that will unlock new warfighting capabilities.

It's important to note that AFC has established a culture conducive to innovation with its commitment to doing things differently and going all-in when it comes to developing technology for the future force. Scientific work is fundamentally different in character from development and engineering work. Rarely is it unidirectional in its progress and it does not always arrive at its expected destination. AFC's culture empowers DEV-

COM scientists to take calculated risks when pursuing good science with great vigor, and trusts that such work will benefit the Army.

A&M: Army Futures Command aims to ensure the Army can fight as part of the Joint Force and perhaps more importantly, the Combined Force. What is DEVCOM's role in this effort?

MG Brown: Multi-Domain Operations (MDO) and Joint All Domain Command and Control (JADC2) are major focuses for AFC, the Army and the Defense Department as a whole. More than ever, it is important Soldiers can operate seamlessly with our sister services and with our coalition partners.

Ultimately, how AFC enables the Army to fight as part of the Joint and Combined Forces starts with the part of AFC that owns the Future Operational Environment. Every day, they are exploring a multitude of potential future scenarios that critically reinforce the need for our forces to be adaptable and flexible, particularly when those who will be fighting alongside us can and will change based on the conflict. We must be ready at a moment's notice to plug and play with our sister services and our allied partners – and with whatever technologies or capabilities they bring to the table.

DEVCOM has foundationally changed our approach to working with FCC through our Ignite Strategy. Ignite brings together concept writers, scientists, technologists, Soldiers and other specialists working in a fully integrated manner to develop the concepts, organizations and capabilities that both push boundaries and remain grounded in strategic

and technical realities. Together, this group identifies future warfighting concepts from recent scientific discoveries; ensures capability requirements are grounded in feasible technological advancements; and uses data and analytics to build a common language across the Army. Joint and Combined Interoperability underscores all Ignite efforts because both the Future Operating Environment and the Army Modernization Strategy recognize the Army will never again fight alone.

It's also important to note that you can't talk about MDO or JADC2 without discussing the gravity of AI, machine learning and quantum computing – all of which are Ignite focus areas as well. To integrate effects across all domains in near-real-time, you need incredible speed to operate, process data and make logical connections. AI and quantum computing will make this possible, and researchers and analysts across DEVCOM are exploring how to advance AI and data processing to the benefit of the Army.

Finally, DEVCOM leads AFC's global partnership mechanisms through our expansive global network. Our Forward Element and International Technology Offices provide a direct connection from combatant commands across the globe to our laboratories, explore new partnership opportunities, scout potentially useful foreign technology solutions and promote interoperability among our allies.

A&M: DEVCOM is primarily a civilian based organization working within the confines of the federal government. How do you maintain an advantage when competing for technical talent with industry around the globe?

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Leader-Follower vehicles are a collaboration between DEVCOM's Ground Vehicle Systems Center and the Renegades of the 41st Transportation Company at Fort Polk, Louisiana. Hundreds of Soldiers have logged thousands of miles while keeping in close contact with software developers in order to create the kind of autonomous vehicle capability need by the Army of the Future. (U.S. Army)

MG Brown: AFC serves as a catalyst to modernize not just equipment and capabilities across the Army, but also the specialized talent needed to manage and conquer future warfare. Following their lead, DEVCOM released its Talent Management Strategy in March 2020 which focuses on establishing a dual system of evolving, adaptive talent pools and the agile employment of multi-talented teams.

Obviously, the world has changed significantly since March 2020. The COVID-19 pandemic opened our eyes to an entirely new way we could operate as a federal entity. My civilian deputy, John Willison, has spearheaded our effort to modernize how we approach the traditional workplace. With support from Kate Kelley, the human capital director at AFC, DEVCOM is exploring what "Future of Work" can mean for an Army organization, particularly one with a predominantly civilian workforce.

In February of this year, we released our Future of Work concept paper, which ultimately is our indefinite commitment to a more flexible workplace with an emphasis on remote work when it makes sense. We want to enable our teams to work when and where they are most productive – and that looks different for different teams, and at different times. Our critical laboratory work cannot be executed from a home office, but there are plenty of tasks that can be accomplished remotely.

So, what does this have to do with recruiting? As you mentioned, there is a fierce, global competition for technical talent. I don't think it's any secret that the federal government hasn't been viewed traditionally as the cutting-edge, hip workplace for young people. Our commitment to greater flexibility in our workplace gives us the opportunity to better compete with industry for STEM professionals, particularly those who wouldn't have otherwise considered a federal job.

Some potential employees may not want to uproot their entire lives in order to move within commuting distance of an Army installation. Previously that would have removed them from our realistic pool of talent. But now, with Future of Work, if we can say to a candidate, "work from where you are – wherever that is – and once a month we'll need you to come to the office, or a few times a month we'd like to you to travel to our regional hub at X location," we can then expand our talent pool.

This benefits the Army because it means we're able to hire a more diverse workforce – in every sense, from background and educational paths to areas of expertise – and a diverse workforce brings fresh perspective, new solutions to challenges, and ultimately better technology and capabilities to our Soldiers.

A&M: When you're not competing with industry for talent, you're working alongside them to develop technology. How has DEVCOM's approach to working with industry and academia changed in recent years?

MG Brown: Science is inherently a collaborative endeavor. Rarely is any notable technological advancement achieved alone, which means our experts need and expect to collaborate with other researchers and developers.

We're constantly looking for new partners and ways to make it easier for those external to the Army to partner with us. In the past few years, we've explored pitch competitions and technology searches where we put out a problem statement and ask small businesses, academia, or non-traditional industry companies to bring us their ideas in exchange for a cash prize and the opportunity to further develop that technology alongside us in our labs. xTechSearch is a great example of this, and one we've collaborated with the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA(ALT)) on for several years.

The Open Campus initiative spearheaded by DEVCOM's Army Research Laboratory is another great example of a new approach to collaboration. Open Campus regional sites are strategically located across the country near hubs of innovation, with the intent to co-locate our scientists with experts in industry and academia and create enduring partnerships that accelerate the discovery, innovation and transition of science and technology.

Under AFC, the Army Applications Lab is another venue to reach non-traditional industry partners. As I mentioned earlier, finding a diverse set of perspectives – particularly from those who have never worked with the Army before – means we might find a solution to a problem we never would have dreamt of on our own.

We have also spent some time reevaluating how we characterize our traditional partnership mechanisms including Cooperative Research and Development Agreements, known as CRADAs. How do we make them less cumbersome? How do we make it easier to collaborate, without sacrificing intellectual property or security? Making it easier to partner with DEVCOM, AFC and the Army leads to better, faster and more effective capabilities for our Soldiers.



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RAISING THE COMBAT-READY COMMS BAR

The U.S. Army is leveraging traditional mobile network integration to modernize Stryker and armored formations.

By Amy Walker, PM Tactical Network, PEO C3T



Project Manager Tactical Network conducts new equipment training for the 3rd Cavalry Regiment on these Stryker platforms, on August 9, 2021, at Fort Hood, Texas, as part of the Army's efforts to convert the unit from At The Halt (ATH) Tactical Network Transport (TNT) to On The Move (OTM) systems. (U.S. Army photo by Amy Walker, PM Tactical Network, PEO C3T public affairs)

Army Program Executive Office for Command, Control, Communications-Tactical (PEO-C3T) is leveraging years of lessons learned from fielding tactical on-the-move network capability to Stryker formations to integrate new network capability set designs into both Stryker and armored formations. The intent is to enhance network mobility and situational awareness, while providing more options for units' primary, alternate, contingency and emergency communications planning, known as PACE.

EVOLVING AT MISSION SPEED

Integrated on a variety of tactical and combat vehicles to best suit mission requirements, the Army's traditional Tactical Network Transport On The Move, or TNT-OTM, leverages robust satellite communications and high-capacity line-of-sight capability to enable mobile mission command, a trusted real-time common operating picture, and global voice, video and data communications. The Army has been fielding and modernizing TNT-OTM integrated on Stryker platforms since 2014.

Most recently, the Army's Project Manager Tactical Network, assigned to the Program Executive Office for Command, Control, Communications-Tactical (PEO C3T), completed converting the 3rd Cavalry Regiment from TNT-At The Halt capability to TNT-OTM, in September 2021, Fort Hood, TX.

"As the Army transitions away from COIN-centric warfighting [to multi domain operations], maneuverability and speed translate to

survivability," said Maj. Christopher Drescher, signal officer (S6) for the 3rd Cavalry Regiment, during his unit's training. "If a unit doesn't have to stop and set up a satellite dish, if they can keep driving and pull data, it gives them an additional layer of survivability and lethality that they didn't have before."

TRAINING AT THE FOREFRONT

Following further hands-on use with the systems, 3rd Cavalry will leverage its new OTM capabilities during decisive action training rotation this spring at the National Training Center, at Fort Irwin, CA, to gain first-hand insight on the extent that the systems could support the unit in real-world large scale and multi domain operations.

"We are a cavalry regiment, but we are also a Stryker brigade combat team; we have the punch of a light infantry brigade and the speed of a motorized formation," Drescher said. "If these systems work as advertised, they will dovetail nicely with how Stryker brigade combat teams fight."

Drescher explained that his Stryker unit provides high mobility with combat effectiveness mainly derived from dismounted Soldiers. Missions include reconnaissance and surveillance, with squads rapidly moving far forward in the fight to "screen the battlefield and find the enemy," to pass data and situational awareness back to the fires units so they can engage, or to higher headquarters so decisions can be made on how to successfully move forward into the battle.



Project Manager Tactical Network conducts new equipment training for the 3rd Cavalry Regiment on these Stryker platforms, on August 9, 2021, at Fort Hood, Texas, as part of the Army's efforts to convert the unit from At The Halt (ATH) Tactical Network Transport (TNT) to On The Move (OTM) systems. (U.S. Army photo by Amy Walker, PM Tactical Network, PEO C3T public affairs)

ENHANCING TACTICAL NETWORK THRU NET MOD

Building on the network foundation laid by TNT-OTM Stryker integrations, the Army is currently integrating the 2nd Cavalry Regiment's Stryker platforms with new commercial systems from the first of its two-year iterative network modernization capability sets (CS), CS21. The unit is providing feedback on these CS21 capabilities as part of a Stryker characterization effort to inform CS23 designs.

CS21 provides new data radios, more expeditionary satellite communications gear, updated mission command applications and cross domain solutions/gateways to allow units to better communicate with coalition partners and across commercial and military networks. The CS23 network design informed by this integration effort will be focused on providing Stryker formations with better on-the-move communications, better linkages between mounted and dismounted Soldiers, and a variety of connectivity options for commanders through the new more flexible and expeditionary network capability known as Integrated Tactical Network (ITN).

The ITN approach injects new commercial components and network transport capabilities into the Army's tactical network environment to provide maneuver brigades and below with smaller, lighter, faster and more flexible communications systems. Adding mounted ITN capabilities allows commanders to maintain battalion-wide terrestrial voice and data network and enables Soldiers to operate over the Secure But Unclassified enclave while transitioning between dismounted and mounted operations. The Stryker characterization will enhance mounted, on-the-move and at-the-quick-halt ITN capabilities.

After-action review comments from 2nd Cavalry Regiment's participation in the Army's annual large-scale European Saber Junction exercise in September 2021, gathered by U.S. Army Operational Test Command and assessed by U.S. Army Evaluation Center, will inform the network characterization in preparation for follow-on testing in the form of the CS23 Technical Test and Operational Demonstration in fiscal year (FY) 2022. On the current timeline, the 2nd Cavalry Regiment Stryker characterization effort will conclude in FY22, marking the unit as the

first Stryker unit equipped with CS21 ITN.

Meanwhile, the Army is also leveraging lessons learned from traditional, TNT-OTM Stryker integration and the Stryker characterization effort to inform CS25, as it prepares for an upcoming pilot this winter to evaluate a variety of new and emerging commercial OTM network communications prototype solutions integrated onto select armored brigade combat team vehicle platforms. The Army is working side-by-side with industry partners and the pilot unit -- the 2nd Armored Brigade Combat Team, 3rd Infantry Division, at Fort Stewart, Georgia -- to evaluate potential solutions that could deliver resilient OTM network communications to these lethal formations.

ONGOING OPERATIONS-READY EVALUATION

Like the Stryker characterization effort, the Army will evaluate mature and emerging commercial network communications equipment leveraging an array of experiments, technical observations and Soldier touch points, and user feedback will be critical to the initial ABCT OTM solution set.

Throughout all capability set development efforts, the Army is using proven industry standards to conduct Soldier-driven experimentation to inform Soldier-centric network designs. This approach puts the warfighter at the center of the process, informs less prescriptive requirements, and allows for incremental insertion of capabilities that keep pace with emerging threats and IT technology trends.

"Building on lessons learned from previous platform network integrations, coupled with Soldier feedback and close working relationships with the S&T community and industry partners, we will deliver the advanced technologies Soldiers will need to achieve dominance in multi domain operations," said John Gillette, product manager for Mission Network, Project Tactical Network, which manages TNT-OTM fielding and the ABCT OTM pilot. "While we integrate current technologies, we will continue to look at emerging capabilities, such as multi-orbit satellite communications, to retain technological advantage over our adversaries."



John Gillette

ON-THE-MOVE COMMUNICATIONS VERSATILITY

The latest in small, lightweight, and cost-efficient intercom system technology extends mission capability for any land, air, or maritime platform.

By Anita Olsen, Product Marketing Director, INVISIO

The INVISIO Intercom system seamlessly integrates multiple communication radios or devices and users. This lightweight, small, and intelligent system is designed to be carried on-the-go or mounted directly onto any land, aircraft, or maritime platform. Users can connect and control communications with a full range of INVISIO control units and hearing protection headsets for both mounted and dismounted operations.

Flexible to Operational Needs Using INVISIO IntelliCable® technology, the system automatically detects and distinguishes between connected communication devices and connected users. IntelliCable® allows the system to easily flex between smaller vehicle platforms like the UTV or ISV and larger platforms like the Stryker, UH-60 Blackhawk, CH-47 Chinook, and from small to medium sized maritime vessels. The system is also compatible with existing or legacy intercom systems and capable of expanding the number of users connected to these networks.

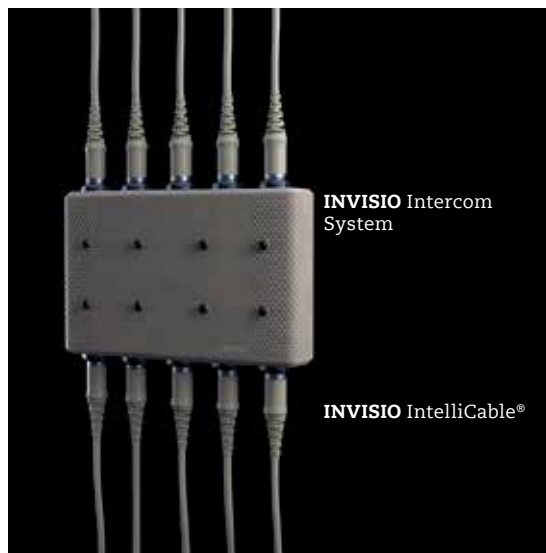
PORTABLE OR MOUNTED

The Intercom system can be carried in a backpack and used by a group during transport in mobility platforms. The portable Intercom system is fast and easy to deploy – even into vehicles that often lack radio or inter-crew communication capabilities. Requiring very low operating voltage, the system is powered via battery packs, AC or DC power sources or even via USB.

Rated to withstand the shock, vibrations, g-force and extreme climate conditions, the Intercom system can also be mounted as a more permanent solution on mobility platforms. The small and lightweight size of the INVISIO Intercom helps increase payload within the platforms.

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In addition to the physical products, INVISIO also provides their customers with the technology, tools, and training to ensure mission success. The INVISIO Configurator software allows for full customization of their intercom system and the way they want each user to communicate. This includes the ability to limit classified radio or device access to connected users or to perform system firmware or feature updates.



In addition to software solutions INVISIO also provides installation support, training courses, technical documents, system diagrams and e-learning tools for their customers worldwide. This allows users to maintain, diagnose and support the system wherever they are deployed.

“INVISIO body worn systems give users advantages in size, weight and capability,” said Nicholas Lafferty, VP of Mobility, INVISIO. “We applied the same metrics for the INVISIO Intercom system and are driving to set the new standard for on-the-move communications. On the ground, or in any mobility platform, users can easily control and effectively communicate using a trained and proven platform system.”

INNOVATION AND INDUSTRY

Innovations in technology and customer-driven product development have rapidly expanded INVISIO's product capability and flexibility. INVISIO works in close collaboration with industry-, other communication equipment and vehicle manufacturers to ensure optimal performance in any operating environment.

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MANAGING STREAMLINED INTEGRATION OF ADVANCED FORCE CAPABILITY

Michael D. Sprang leads the Joint Program Office, Joint Light Tactical Vehicles. Joint Light Tactical Vehicle (JLTV) is an Army-led Joint Family of Vehicles program designed to restore payload and performance that were traded from light tactical vehicles to add protection in recent conflict -- giving commanders an improved protected mobility solution and the first vehicle purpose-built for modern battlefield networks. Previously, he assumed the role of Acting Deputy Program Executive Officer in January 2018. In this capacity, he supported the Program Executive Officer in leading the development, integration, testing, acquisition, fielding, sustainment, and modernization of more than 250 diverse programs of record. This portfolio spans the Army's Transportation, Quartermaster, Ordnance, and Engineer portfolios, and includes the Joint Light Tactical Vehicle, Mine Resistant Ambush Protected vehicles, Army watercraft, contingency basing, robotic & autonomous systems, and numerous other key force enablers.

He served as the Deputy Project Manager for Joint Program Office – Joint Light Tactical Vehicles (JPO-JLTV) since November 2014. Before becoming the deputy PM, he led Engineering Manufacturing & Development-Team Alpha (PD EMD-A) within the JPO-JLTV. As the Product Director EMD-A, he had overall program management responsibility for one of the three EMD JLTV contractors.

From 2009 to 2012, Mr. Sprang served in Product Manager – Light Tactical Vehicles as the Assistant Product Manager (APM) for HMMWV Production & Sustainment and APM for HMMWV Modernization, where he oversaw the continued production and sustainment of the High Mobility Multi-wheeled Vehicle and its modernization program.

From 2004 to 2009, he was assigned as APM for Crew Protection with Project Manager – Tactical Vehicles. In this role, he had technical and managerial purview over all aspects of the Add-on Armor program for the U.S. Army with an operating budget of approximately \$1.2B. The Add-on Armor program provided significant and rapid solutions on all tactical vehicles operating in Operation Iraqi Freedom and Operation Enduring Freedom.



Mr. Michael Sprang

Project Manager
Joint Program Office
Joint Light Tactical Vehicles

Mr. Sprang: The Joint Light Tactical Vehicle program is an Army led Joint program. The JLTV family of vehicles is designed to restore payload and performance that were traded from light tactical vehicles to add protection in recent conflict -- giving commanders an improved protected mobility solution and the first vehicle purpose-built for modern battlefield networks. The JLTV's speed and off-road mobility keep pace with modern combat formations in rapid, high-intensity conflicts; its ample payload and power host varied mission packages; and it also sports major automotive performance and sustainment improvements over its predecessors. In short, Soldiers and Marines need a reliable and transportable protected mobility solution that reduces their logistics and sustainment demands, restores payload capacity, enhances occupant protection, and improves connectivity with current and future battlefield networks. JLTV is that solution.

To date, the government has awarded an estimated \$6.5 billion on the current JLTV contract. The average cost per vehicle is approximately \$375,000. This includes vehicles, trailers, operator and maintainer training, spare parts, and field service representative support. The Army currently anticipates purchasing approximately 49,000 vehicles, and the

Armor & Mobility spoke recently with Mr. Michael Sprang, Project Manager, Joint Program Office, Joint Light Tactical Vehicles, regarding the state of fielding of DoD's Joint Light Tactical Vehicle (JLTV) and lessons learned since the Army and Marine Corps took their first deliveries in 2020.

A&M: Please provide some background on the Army's need for the Joint Light Tactical Vehicle (JLTV) capability, initial order delivery numbers, and date of first JLTVs to service.



The JLTV provides Soldiers and Marines with protection similar to the base MRAP All Terrain Vehicle; payload capacity similar to the M-ATV without losing protection, all while gaining maneuverability; performance improvements offering greater speed over terrain, acceleration, reliability and fuel efficiency than legacy vehicles; transportability by CH-47, CH-53, and inside amphibious transports; and connectivity as the first light tactical vehicle purpose-built for battlefield networks. (Oshkosh Defense photo)

Marine Corps up to 15,390 vehicles spread across two variants and four mission package configurations: General Purpose, Heavy Guns Carrier, Close Combat Weapons Carrier, and a Utility vehicle.

As of the most recent accounting (mid-August 2021), 12,678 vehicles and 992 trailers have been delivered and accepted at time of interview, including multiple fieldings to our first Foreign Military Sales customers.

The Army's First Unit Equipped was the 1st Brigade Combat Team, 3rd Infantry Division, and its initial operating capability was complete in Fiscal Year 2020. JLTV fieldings have been made in all Army components: Active, Reserve, and National Guard.

The program has been lauded with two David Packard for Acquisition Excellence Awards as well as DoD Should-Cost and Innovation Awards.

A&M: Can you explain how the JLTV represents an improvement over HMMWV mobility and protection?

Mr. Sprang: The JLTV family of vehicles is designed to restore payload and performance that were traded from light tactical vehicles to add protection in recent conflict -- giving commanders an improved protected mobility solution and the first vehicle purpose-built for modern battlefield networks. The JLTV's speed and off-road mobility keep pace with modern combat formations in rapid, high-intensity conflicts; its ample payload and power host varied mission packages; and it also sports major automotive performance and sustainment improvements over its predecessors.

Specifically, JLTV provides our Soldiers and Marines with:

- **PROTECTION** substantially greater than the High Mobility Multi-Wheeled Vehicle (HMMWV) and similar to the base MRAP All Terrain Vehicle (M-ATV), yet at two-thirds (2/3) of the M-ATV's weight—improving mobility and transportability.
- **PAYLOAD** capacity similar to the M-ATV without losing protection, but while gaining maneuverability.
- **PERFORMANCE** improvements that offer greater speed over terrain, acceleration, reliability and fuel efficiency than legacy HMMWVs.

- **TRANSPORTABILITY** by CH-47, CH-53, and inside amphibious transports. While legacy HMMWVs can be transported in this manner, M-ATVs are both too large and too heavy for any rotary wing transport.
- **CONNECTIVITY** in the first light tactical vehicle purpose-built for battlefield networks.
- **SUPPORTABILITY** designed into the system, including integrated Driver's Smart Display Unit and Health Management System (HMS) systems that continuously monitor vehicle conditions—predicting and diagnosing faults and improving overall sustainment.

A&M: In terms of lessons learned from initial real-world operations, what are some key positives and improvement points that brigade combat team integration has realized?

Mr. Sprang: At every step in the process, the JLTV program has sought and incorporated warfighter feedback on requirement achievability, technological maturity, and associated impacts to cost, schedule, and performance—making warfighter involvement a centerpiece of efforts to translate requirements into capabilities. It would be most appropriate for the program office to defer to operational units equipped with these trucks for comments on their performance in real-world operations.

A&M: What is the general timeframe for expected further investment in JLTV in terms of additional delivery to service and slated upgrades?

Mr. Sprang: The JLTV trailer is slated to begin fielding to Army and USMC units in Fiscal Year 2022. The Joint Program Office remains on schedule to release the first Full Rate Production competitive Follow-On Contract Request for Proposal with a planned contract award in September 2022. The competitive strategy leverages an already capable platform, and through focused design upgrades and competition, bring new capabilities to the Soldiers and Marines. The JLTV Follow-On Contract is based upon a new A2 variant of the Family of Vehicles, which includes several technology insertions in the areas of powertrain, electrical architecture, noise reduction, and stowage improvements.

The pending competition also includes significant incentives for competitors to propose additional technology enhancements in the areas of fuel efficiency, corrosion, upgraded vehicle architecture, and driver assist capabilities, while keeping the JLTV affordable. These technology advances on a proven system, that currently has growth and modularity capability in weight, power and available kits, make the JLTV the optimal platform for the Light Tactical Vehicle mission in a Multi-Domain Operational environment.

A&M: Feel free to address any additional challenges/goals going forward.

Mr. Sprang: The Joint Program Office remains on schedule to release the first Full Rate Production Competitive Follow-On Contract Request for Proposal with a planned contract award in September 2022. The Government has robustly engaged with industry every step of the way to communicate as effectively as possible by holding multiple industry days and follow-on one-on-one engagements with prospective suppliers to relay its Follow-On Contract acquisition strategy.

PROJECTING FORCE POTENCY THROUGH SCALABLE PROTECTION

Ms. Moore serves as the Program Manager Light Tactical Vehicles within Logistics Combat Element Systems, Marine Corps Systems Command. She provides program management leadership for all efforts within the light tactical fleet including the Joint Light Tactical Vehicle (JLTV) family of vehicles, High Mobility Multipurpose Wheeled Vehicles (HMMWVs), Light Tactical Trailers and the Family of Ultra-Light Tactical Vehicles. Previous civil service positions included the Product Manager, Light Legacy Fleet, within Program Manager Light Tactical Vehicles (PM LTV), Program Executive Officer Land Systems (PEO LS), Assault Amphibious Vehicle (AAV) Foreign Military Sales acquisition team lead, PEO LS, and Deputy Command Information Officer, Marine Corps Systems Command. Prior to her civil service career, Ms. Moore fulfilled a variety of information technology and project management positions with Hewlett Packard for 15 years.

Ms. Moore maintains certifications as a Project Management Professional through Program Management Institute, Program Management Level Three and Information Technology Level One through Defense Acquisition University and the Defense Chief Information Officer certification through National Defense University. Ms. Moore graduated from University of North Carolina Wilmington with a Bachelor of Science in Management Information Systems and from American Military University with a Master of Business Administration. During her federal service career, Ms. Moore received the Navy Meritorious Civilian Service award.



Ms. Jennifer Moore

Program Manager
Light Tactical Vehicles
U.S. Marine Corps Systems Command

Armor & Mobility spoke recently with Ms. Jennifer Moore, Program Manager for Light Tactical Vehicles, Marine Corps Systems Command, regarding the state of fielding and lessons learned since the U.S. Marine Corps took first delivery of the Joint Light Tactical Vehicle (JLTV) in early 2019.

A&M: Please provide some background on the USMC's need for the Joint Light Tactical Vehicle (JLTV) capability, initial order and delivery numbers, and date of first JLTVs to service.

Ms. Moore: The JLTV is the first vehicle purpose-built for the evolving battlefield and provides increased readiness for 21st century warfare. The JLTV will fully replace the Corps' High Mobility Multipurpose Wheeled Vehicle (HMMWV) fleet. The JLTV Family of Vehicles (FoV) comes in four different variants (General Purpose, Utility, Close Combat Weapons Carrier and Heavy Guns Carrier) with multiple mission package configurations, all providing protected, sustained, networked mobility that balances payload, performance

and protection across the full range of military operations. The Marine Corps fielded the first 55 JLTVs to Marines at the School of Infantry West in February 2019. The first infantry battalion to receive the JLTV were Marines from 3rd Battalion, 8th Marines, 2nd Marine Division, in July 2019. The program office reached IOC shortly afterwards in August 2019.

A&M: From an initial implementation and integration perspective, give a general look at how the JLTV's role improved on previous HMMWV mission sets as it relates to mobility and protection?

Ms. Moore: The JLTV provides improvements in the balance of payload, performance, and protection over the HMMWV FoV. In addition, the JLTV provides increased reliability and maintainability. Some of the advantages the JLTV offers over the HMMWV include increased network connectivity, modular vehicle configurations and protection to meet specific mission requirements. The vehicle incorporates an auto-leveling suspension system and multiple



A Joint Light Tactical Vehicle, following a demonstration at the School of Infantry West, Marine Corps Base Camp Pendleton, CA. The JLTV is the first vehicle purpose-built for the evolving battlefield. It provides increased readiness for 21st century warfare and provides protected, sustained, networked mobility that balances payload, performance and protection across the full range of military operations. (U.S. Marine Corps photo by Ashley Calingo)

operating and transportation heights. The JLTV also possesses a flexible open system architecture, for example, the ability to plug and play multiple radio configurations.





A&M: In terms of lessons learned from initial real-world operations, what are some key positives and improvement points that USMC integration has realized?

Ms. Moore: Scalable armor has allowed MEF commanders the flexibility to trade levels of protection for additional increases in mobility based on their mission. Increased mobility has allowed the operating forces to employ the JLTVs across terrain and areas where HMMWVs have difficulty operating. The JLTV's scalability is what will set it apart on the battlefield. Another key aspect is the vehicle's ability to reduce impact fatigue to the occupants and driver. Its suspension system and integrated cabin construction drastically reduces driver's fatigue that is routinely encountered in ground tactical wheeled vehicles. Marines are able to sustain mobility operations much longer than before, ultimately enabling a combat reach that is only limited by the range of the vehicle.

A&M: What is the general timeframe for expected further investment in JLTV in terms of additional delivery to service and slated upgrades?

Ms. Moore: The Marine Corps will continue fielding JLTVs for several more years. During fielding, integration of existing capabilities (migration from HMMWV) and new capabilities are planned as well as underway. The Fleet Marine Force (FMF) will continue to submit universal need statements (UNS) for additional capabilities requested for integration onto the JLTV FoV. Once the UNS transition to requirements and are appropriately funded, they have the opportunity to be developed and integrated on fielded as well as future JLTVs.

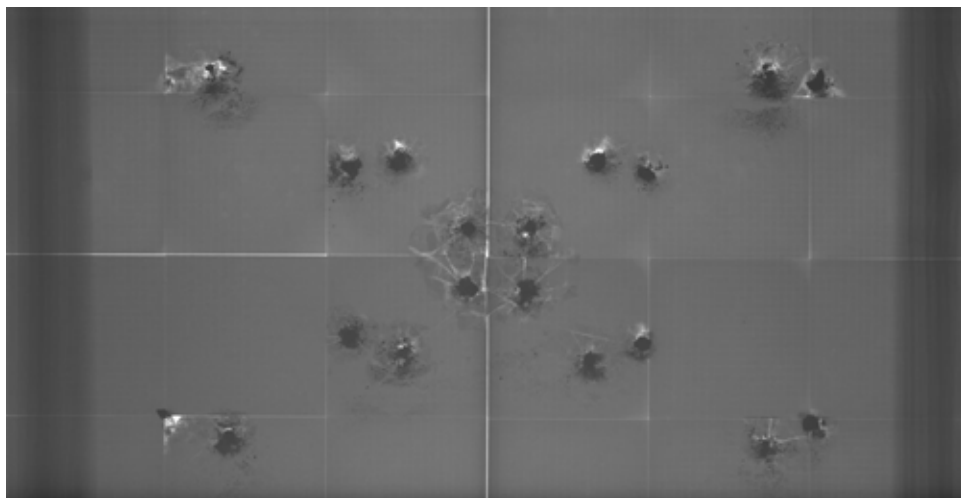
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BALANCING PROTECTION AND LIFE CYCLE SUSTAINABILITY

A privately-owned, Virginia-based company, capable of producing a wide range of armor solutions at very competitive prices, Advanced Armor Research Group, LLC (AARG) is an American manufacturing company focused on the supply of lightweight, passive armor systems engineered and tailored for private security, law enforcement, and military requirements.

By Michael J. Arlen, Ph.D., Director of Research and Development, Advanced Armor Research Group



AARG Shield based high temperature resin/S2 glass structural armor solution demonstrating AARG Shields' superior damage tolerance. (AARG LLC)

AARG's engineered armor system technology delivers superior multi-hit and threat defeat against a wide range of threats from NIJ Level III small arms to cannon level KE threats, up to STANAG 4569 level VI. Ongoing internal research and development efforts focus on emerging technologies for armor weight reduction, improved performance, and life cycle cost reduction through material selection and process innovation. Using a variety of hard-face materials and composites, the company strives to achieve balance between cost, weight, and performance in achievement of the most aggressive anti-ballistic objectives.

MULTI-LAYERED DESIGN FUNCTIONALITY

AARG engineered armor systems use a functionally graded design approach incorporating advanced strike face technologies, maximizing penetrator defeat to achieve the multi-hit objective for any required threat. We utilize a range of advanced ceramics to meet our client's objectives and have mastered the armor system fabrication processes. In addition, AARG has mastered the chemical reactions necessary to create an exclusive cermet-based Shield product. Shield demonstrated significant multi-hit capability and superior anti-ballistic damage tolerance when compared to ceramics. In addition, our engineered armor systems utilize a variety of composites in conjunction with various ceramic strike face materials, and we are continually testing and developing new composite technologies to improve our armor system performance.



AARG Shield structural armor solution for STANAG 4569 Level 3+ demonstrating performance against the 7.62x51mm M993 and 0.50cal FSP. (AARG LLC)

AARG's next-generation armor systems utilize proprietary high-temperature resin systems in combination with S2 Glass, as part of the system to create structural armor, that meets or exceeds all environmental requirements. Armor solutions using these composite systems have been tested at accredited testing laboratories and have successfully demonstrated anti-ballistic performance in the temperature range of -40F to 165F. In addition, we have developed new processing methods using these resin systems to produce nearly void-free composite backing substrates. These improvements and void reduction improve the composite mechanical properties (toughness, modulus), leading to increased anti-ballistic performance compared to similar armor types. Our manufacturing process ensures the quality control necessary for these next-generation armor systems to deliver consistent performance throughout the entire life cycle. Additionally, the AARG fabrication process reduces manufacturing waste, making this process much more environmentally-friendly compared to many traditional processes.

FACILITIES UPGRADE TO SUSTAIN CUTTING EDGE PRODUCTION

AARG is currently completing a state-of-the-art, 35,000 square foot armor production facility to bring the aforementioned structural armor systems to market in 2022. Our team continues to be at the forefront of research and development by incorporating emergent technologies into superior armor systems for military, tactical, law enforcement vehicles, and structures around the world. Our in-house engineering staff will work closely with you to define your anti-ballistic and life cycle requirements to deliver the perfect balance of price, weight, and performance to meet your application requirements.

If you are seeking an armor supplier with the knowledge and resources to produce advanced armor solutions in an efficient, repeatable, and cost-effective manner – visit www.aargusa.com to see what we can do for you.

PERFORMANCE THAT STANDS APART!

Greater Threats Demand Stronger Defenses:

Armor solutions must undergo constant improvement to combat newer, more deadly threats. AARG focuses on emergent material technologies and manufacturing process innovation to reduce weight and improve performance against a wide range of threats.

Expedited Development:

Our internal anti-ballistic database and rapid design/build/test cycles result in tailored solutions designed, validated, and integrated to meet your toughest multi-hit and threat defeat requirements.

Repeatable Quality:

AARG stands alone in our understanding of engineered armor and our ability to provide consistent, reliable solutions through advanced material selection and precise fabrication methodology.

Improved Durability:

Our functionally graded structural armor components deliver superior performance, proven through rigorous ballistic and environmental testing to maintain performance throughout the entire life cycle.



the **FUTURE**
of **ARMOR**

**Practical lightweight armor
solutions from small arms to
artillery at every point of the
cost/weight/performance triangle.**

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- Workshops: November 18
- Conference Sessions: November 16-17

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CALENDAR OF EVENTS

Oct 11 - 13
AUSA Annual Meeting
Washington, DC
Meetings.ausa.org

October 18 - 20
TechConnect World Innovation Conference & Expo
National Harbor, MD
Techconnectworld.com/World2021

October 19 - 21
EastSec
W. Springfield, MA
Easteconline.com

October 26 - 28
SOUTHTEC
Greenville, SC
Southeconline.com

November 16 - 19
AeroDef Manufacturing
Long Beach, CA
Aerodefevent.com

December 9 - 10
MILCON Contracting Summit
Washington, DC
Usdlf.org/milcon-contracting-defense-summit

January 18 - 22, 2022
Shot Show
Las Vegas, NV
Shotshow.org

February 7 - 10
AMSUS - in person
National Harbor, MD
Amsus.org

February 8 - 9
Air Force Contracting Summit
Miramar Beach (Destin), FL
Usdlf.org/air-force-contracting-summit

February 20 - 25
AMSUS - Virtual
Amsus.org

SAVE THE DATE

AMSUS Annual Meeting

7 - 11 February 2022

National Harbor, MD

A hybrid event with in-person and virtual opportunities

www.amsus.org



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Also extremely effective for pain and itch associated with:

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- Sand Flea and Sand Fly Bites
- Bee, Wasp and Hornet Stings
- Fire Ant and Black Ant Bites
- Other Insect Bites and Stings

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Net Wt. 1/8 oz (3.6g)

(actual size)

Packet 1/8oz = Single dose

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- NSN #6505-01-674-8248 (Case of 500)

Great for Hospital and Battalion Aid Station Settings!



Get Troops Back in the Field in 3 Minutes!

Tube 1oz = 15 doses

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- NSN #6505-01-611-2071
- NSN #6505-01-679-1559 (Case of 12)

For more information:

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ZAN348



The image shows two AeroVironment aircraft flying over a rugged mountain range under a clear blue sky. In the foreground, a JUMP 20 aircraft is shown from a low angle, highlighting its long wings and four propellers. In the background, a T-20 aircraft is visible, showing its unique V-shaped wing structure. The overall scene conveys the capability of these aircraft to operate in remote, high-altitude environments without the need for a runway.

T-20™

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JUMP® 20

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