

ARMOR & MOBILITY

FALL 2024

Tacticaldefensemedia.com

DIGITAL EDGE

**TRANSFORMING SYSTEMS
FOR THE OPERATIONAL FUTURE**



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PUBLISHER'S NOTE

The world of digital software continues to evolve and revolutionize what civil business leaders can apply to maximize production and military commanders can implement to better accomplish objectives through a greater accessibility to data at the speed required for successful situational decision making. Challenges to digitalization across military applications posed by limitations in the upgradeability of legacy hardware are pushing greater network integration to streamline systems operation for enhanced mission capability. The Fall 2024 edition of *Armor & Mobility: Digital Edge* sheds light on how the U.S. Army's Digital Transformation, in particular, aims to ensure sustained capabilities overmatch today while preparing the force for a multi-domain operations future.

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POWERING MOBILITY WITH ADVANCED ENERGY

The U.S. Army is positioning secure tactical advanced mobile power, or STAMP, as a force multiplier for enabling command, control, communications, computers, cyber, intelligence, surveillance, and reconnaissance (C5ISR).

By CW03 Sean McClenachan, Samuel Gwinn, and Joseph McFillin



ARMY DIGITALIZATION: A FOUNDATION FOR THE FUTURE FIGHT

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By Christian Sheehy



Armor & Mobility interviewed MG John Cushing, Commanding General, U.S. Army Combat Capabilities Development Command (DEVCOM) regarding DEVCOM's current and ongoing focus efforts to support Army Transformation through the employment of concept-driven science and technology.



INTEGRATING SENSORY PRECISION WITH FIRE CONTROL

The U.S. Army's Integrated Battle Command System (IBCS) integrates sensors and effectors onto its Integrated Fire Control Network (IFCN) to enhance air missile defense (AMD) effectiveness.

By Michael Whetston

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ARMOR & MOBILITY

DIGITAL EDGE

Armor & Mobility ISSN: 2151-190x

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POWERING MOBILITY WITH ADVANCED ENERGY

The U.S. Army is positioning advanced power distribution as a force multiplier through a Joint effort called Secure Tactical Advanced Mobile Power, or STAMP, for enabling command, control, communications, computers, cyber, intelligence, surveillance, and reconnaissance, or C5ISR.

By CW03 Sean McClenachan, Samuel Gwinn, and Joseph McFillin, U.S. Army DEVCOM



A 15-person component of the Army's 11th Air Defense Artillery Brigade carried out an operational assessment of Secure Tactical Advanced Mobile Power (STAMP) last August at Fort Bliss, Texas. STAMP technology allows multiple vehicles to network their electrical systems together as a microgrid. Lightweight and fast-forming, STAMP aims to rapidly increase U.S. forces' fight and sustainment capability when engaged forward (U.S. Army photo).

Think about the last time your command needed mobile power in the field. This probably required the servicing, maintenance, dispatching, and recovery of an Advanced Medium Mobile Power Source (AMMPS) generator. The AMMPS generator in tow behind the family of medium tactical vehicles (FMTVs) provided the unit with power for everything from tactical operations centers (TOCs) to radio battery charging stations and life-support systems.

Over time, both the AMMPS generator and the FMTV require additional maintenance due to regular operational usage and the additional load burden of the pintle-mounted rolling stock. But what if there were a way to provide safe, reliable, advanced power for unit operations while reducing the demand of the tow-behind generator?

CENTERS-SUPPORTED POWER MODULATION

Two of the centers subordinate to the U.S. Army Futures Command (AFC) Combat Capabilities Development Command (DEVCOM), namely, the Ground Vehicle Systems Center (GVSC) and the Command, Control, Communications, Computers, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center, have demonstrated advanced power through a joint capability technology demonstration (JCTD) called Secure Tactical Advanced Mobile Power, or STAMP. The STAMP JCTD showcased a highly mobile microgrid using a variant of FMTVs called the high-power

variant (HPVFMTV), capable of exporting significantly more power than a single tow-behind generator. When employed in microgrid mode, two connected STAMP HPVFMTVs can produce roughly the power consumption of a maneuver division TOC by harnessing power directly from the powertrain of the FMTVs. The HPVFMTV microgrid requires no additional batteries, no energy storage capacitors, and no tow-behind generators, yet can replicate the power supply production of up to eight AMMPS generators.

DEVCOM and Army sustainment teams involved in developing the STAMP capability and vehicle microgrid technologies proved the ability to provide power to the warfighter during multiple events. In August 2023, during the STAMP JCTD operational demonstration, Soldiers from the 11th Air Defense Artillery Brigade, Fort Bliss, TX, provided power to both ground-based loads and simulated bed-based loads. Following four days of new equipment training, the unit demonstrated the flexibility and mobility of vehicle-based generation. "The JCTD demonstrated Soldiers could stop the vehicles, form a two-vehicle microgrid in roughly two-and-a-half minutes, then pack up the system and depart in less than 60 seconds," stated Dean McGrew, the DEVCOM GVSC Powertrain Electrification branch chief, whose team supported the JCTD with vehicle systems integration and power systems development.

Following the STAMP JCTD operational demonstration, the STAMP HPVFMTV system participated in additional experimentation during

AFCC's capstone event, Project Convergence Capstone 4 (PC C4), both at Camp Pendleton and the National Training Center (NTC). During PC C4, the vehicles provided operational power to multiple units in disbursed locations. Supported elements benefitted from the ability to rapidly reconfigure a tactical microgrid from two co-located STAMP HPVFMTVs or dispersed into two systems. The individual STAMP HPVFMTV vehicle microgrids provided power to several static displays and activities in two footprints about a half mile apart. During experimentation at the NTC phase, the split STAMP HPVFMTV system simultaneously supported the TOC footprint of the 101st Brigade Support Battalion, 1st Infantry Division, and a Canadian Forces command post roughly a mile away. The STAMP HPVFMTV team recorded the ability to provide a foreign partner with advanced power distribution as a first for this system, despite some challenges. During pre-execution inspections, DEVCOM engineers identified and quickly resolved physical cabling mismatches between the two elements, enabling coalition power integration.

MOBILITY EFFICIENCY THROUGH CAPACITY DISTRIBUTION

Advanced power distribution supports operational fuel savings through maximization of load sharing among power sources. Although a single vehicle alone does not reduce fuel consumption compared to a single generator, the advanced power distribution technology behind STAMP allows it to replace multiple stand-alone generators, consolidate demand, and reduce reliance on Class III during operations. A single generator for a single load results in generator underuse and the passage of unburned fuel to the exhaust system, or wet stacking conditions. The STAMP HPVFMTV leverages the advanced power distribution techniques used by microgrids to consolidate loads and increase fuel efficiency overall.

The experimentation at PC C4 proved these concepts, with data showing a nearly 50% reduction in fuel usage using the STAMP HPVFMTV in both stand-alone and microgrid modes, compared to between three and six underused stand-alone generator sets employed by the units. Tactical units integrating vehicle power sources into mission planning will realize higher fuel savings when compared to using tow-behind generators alone, especially where mobility plays a significant factor in mission success.

STAMP and the vehicle microgrid capabilities work by harnessing energy from the FMTV powertrain and distributing it through a universal power gateway (UPG) to the load that requires power. To harness this energy, technicians modify the transmission, which is currently the drop-in standard on the FMTV, on mine resistant ambush-protected vehicles and on Stryker vehicles, with a generator integrated in the bell housing unit. The transmission inline generator creates variable voltage and variable frequency alternating current (AC) power that is internally conditioned to distribute direct current (DC) power from the vehicle's power distribution unit (PDU) to the DC microgrid or directly to the external UPG. STAMP's advanced power distribution systems, the UPG, and the vehicle PDU, allow units using tactical microgrid technology to employ their organic power generation assets more efficiently.

The UPG serves as a bi-directional power converter that bridges DC to AC, providing both DC-to-AC and AC-to-DC conversion. Through the UPG, DC power can be used to power AC external loads that comply with the Tactical Microgrid Standard (TMS; MIL-STD-3071), or legacy AMMPS PDUs and Power Distribution Illumination System Electrical equipment. This technology allows the STAMP HPVFMTV to provide power to an external power load, such as a TOC or life-support equipment, at the point of need.

MULTI-SYSTEM NEED WITH MULTI-USE OUTPUT

A driver of STAMP and vehicle microgrid technology is adherence to the vendor-agnostic TMS, which was published in January 2023. TMS specifies how power sources, distribution devices, loads, converters, and storage devices communicate with one another and how control protocols are established within a microgrid. At the most basic level, TMS enables plug-and-play microgrids to seamlessly integrate power generation sources, energy storage systems, feeder systems, distribution systems, control systems, loads, and power converters into a coordinated, resilient power network. This microgrid can be used in any application where there is a demand for mobile power.

The TMS also allows the microgrid operator to interface with the microgrid for health, status, and control requests via either a standalone dashboard or an application programming interface to a command-and-control information system. This ensures that STAMP and follow-on capabilities remain aligned to the Army's continuous transformation objectives to enable seamless C2 interaction while remaining flexible to adapt to future requirements. The TMS dashboard, developed by the DEVCOM C5ISR Center for the STAMP JCTD, gives the operator information, warnings, alarms, and system information from fuel levels to power usage. It also provides a means to control the microgrid and enables automated efficiency of multiple power sources. The TMS intelligent microgrid control supports reduced fuel consumption by automatically starting and stopping external power sources to adapt to ever-changing operational needs and optimizing generator output for efficient fuel consumption.

STREAMLINING POWER ACCESS OF TOMORROW

The future of the STAMP HPVFMTV system, and of other highly mobile power generation and distribution technologies, relies on the continued experimentation, capability development, and ultimately, fielding of the UPG and other TMS-compliant equipment, where the need is the greatest. "Our power foundation for the future fight is spelled U-P-G," said Michael Gonzalez, the branch chief of the DEVCOM C5ISR Center Expeditionary Power and Environmental Control Branch. Experimentation with the current STAMP HPVFMTV system will inform the development and planned transition to the Vehicle Integrated Power Kit, which will incorporate not only the technology to power external loads, but also advanced anti-idle technology, similar to auxiliary power in passenger vehicles.

Experimental data has already proved that consolidating loads and generators into smart microgrids will drastically reduce Class III consumption and generator maintenance hours. Future experimentation with advanced power systems will include vehicle-centric on-the-move power and anti-idle technology in operations at-the-halt. These technologies will eventually allow the commander to continue directing a dynamic fight from a mobile tactical command post without stopping to set up and maintain a tow-behind generator.

Additionally, as the Army reduces the presence of large, forward operating bases, which are easily targetable in conflict, the need for reliable power will remain a constant. Forward arming and refueling points, air defense sites, and forward logistics bases will still need TMS-enabled intelligent power systems provided by the STAMP HPVFMTV, UPG technology, and TMS-compliant emerging load capabilities. Leveraging advanced power distribution systems will reduce Class III consumption in contested logistics arenas, build decision space for commanders, and serve as a force multiplier during combined and joint operations.

ARMY DIGITALIZATION: A FOUNDATION FOR THE FUTURE FIGHT

The U.S. Army today is formalizing a vision for how digital transformation can help the service reach milestone Waypoint 2028/29, while identifying priorities to resource, and outlining an integrated pathway to synchronize and better integrate fully digital-based operability.

By Christian Sheehy, A&M Managing Editor



Two Soldiers participate in Project Convergence, a Joint Force experiment focusing on speed, range, and decision dominance to achieve overmatch and inform the Joint Warfighting Concept and Joint All Domain Command and Control. A campaign of learning, it leverages a series of joint, multi-domain engagements to integrate artificial intelligence, robotics, and autonomy to improve battlefield situational awareness, connect sensors with shooters, and accelerate decision-making timeline. (U.S. Army photo)

A big part of the U.S. Army's Force Modernization Strategy is the Army Digital Transformation Strategy (ADTS), established by the Office of the Army Chief Information Officer (CIO). A capstone concept, ADTS represents a shift in operations and culture that fundamentally changes how an organization delivers value through the adoption of advanced technologies such as cloud, data, and artificial intelligence (AI), and cybersecurity operations. Army Waypoint 2028/29 provides a framework for force interoperability without compromising overmatch capabilities moving forward. Proactive adaption to changing threats and threat levels means setting the conditions for multi-domain operations (MDO) readiness to address a Joint large-scale combat operations (LSCO) dictated future. Digitalization of force-wide systems architecture, as outlined by Army Futures Command Aimpoint 2035, is at the fore of this requirement.



ENGINEERING A DIGITALIZED FUTURE

In response to a 2024 U.S. Department of Defense Digital Engineering Directive, a current and ongoing Army push toward digital engineering across open-ended systems architecture is witnessing the increasing use of advanced modeling, simulation, and data analytics to design, analyze and optimize capability lifecycles. "The goal of this effort is to prioritize, mature, and scale ongoing data management efforts to leverage data for

decision making across all echelons," said Christine Wormuth, Secretary of the Army. "Leveraging the Enterprise Decision Analytics Framework/Enterprise Architecture (EDAF/EA) to validate interoperability across modernization programs that will support MDO through data standards and integrated operational, system, data, security, and technical architecture." The Army expects to adopt a "cloud smart" approach that supports the migration of enduring applications in existing Army Enterprise Data Centers (AEDC) and Installation Processing Nodes (IPN) to the Army's cloud (cArmy) in achieving cost savings, interoperability, and information sharing across applications. To attain these goals, the Army is prioritizing cases to support Project Convergence and MDO including tactical cloud pilots, threat capability red teams, and prototyping efforts as appropriate with coalition and allied nation partners.

"The number one priority we have today is our network which enables command and control. As such, a clear imperative is to turn hardware problems into software problems because they are faster and more agile, allowing you to compete at a pace that is unprecedented," stated General James Rainey, Commanding General, U.S. Army Futures Command,

in a recent interview conducted by the Center for Strategic & International Studies. "Our next generation of command and control is moving toward data-centric warfare." This will undoubtedly be dependent on the Army's ability to continue software enhancements while maintaining an open systems architecture approach to capabilities development.

DIGITALIZING FORCE OPERABILITY AND BEYOND

What General Rainey refers to in software evolution is the use of technologies such as artificial intelligence (AI) and multi-cloud environments which lend themselves directly to force modernization beyond just digital engineering. Future AI will be seen in the automation and optimization of brigade combat team command and control, unmanned ground and aerial systems interoperability, and countless numbers of split-second decision scenarios made by sensory-driven diagnostics applications that will monitor the lifecycle health of the Joint Force on land, sea, in the air, and in space. Scalability, flexibility, and resilience offered by cloud computing also ensures redundancy and availability in systems, providing partnering industry ways to maximize innovation and cost-effectiveness by leveraging AI and multi-cloud environments to drive modernization of legacy systems to produce a sustainable U.S. military technological advantage on the battlefield well into the future.

FUELING CONTINUOUS TRANSFORMATION THROUGH CONCEPT-DRIVEN S&T

Major General (P) John M. Cushing is a third-generation Soldier, an armor officer by trade and a graduate of the United States Military Academy at West Point, Class of 1993. He has held numerous command and staff assignments during his 30-year career and recently served as the deputy commanding officer for operations at the United States Army Recruiting Command. Today, MG Cushing serves as the commanding general of the U.S. Army Combat Capabilities Development Command, known as DEVCOM. In this role, he leads more than 10,000 civilian scientists and engineers who provide Army Futures Command with the S&T expertise necessary to transform our Army and ensure war-winning future readiness.



MG John M. Cushing

Commanding General

U.S. Army Combat Capabilities Development Command
Aberdeen Proving Ground, MD

Armor & Mobility had the opportunity to speak with MG John Cushing, DEVCOM Commanding General, regarding key focus areas supporting parent organization Army Futures Command in the year since he has taken charge.

A&M: You have been on the ground at DEVCOM for just over a year. How have your impressions of the command changed in that time?

MG Cushing: Before I even arrived at DEVCOM, I knew the command's workforce was talented. But in the year I've had the honor of serving as the commanding general of this organization, the term "expert" doesn't seem to come close to covering the depth and breadth of knowledge possessed by the professionals who comprise DEVCOM. Every day, I am in awe of their passion, ingenuity, attention to detail, and expertise.

I tell this story often, but shortly after I arrived, I had the opportunity to meet a young scientist whose focus area was obscurants, or what most of us would call smoke. To be honest, I had not given much thought to the science behind smoke – I just knew well enough to not be downwind of it. She proceeded to educate me on cutting-edge research into obscurants, including whether we can use obscurants to protect not only our visual signature on the battlefield, but obscure our electromagnetic signature and disrupt the spectrum for our adversaries.

Not only was this scientist's technical expertise astounding, but her passion and energy about such a niche specialty was contagious. You could not help but be inspired by her and what she hoped to achieve on behalf of the Soldier. She represents one of thousands of experts within DEVCOM we have across a diverse set of competencies all dedicated to solving complex problems and rapidly developing next-generation military technologies.

I have also grown to appreciate how engrained this command is within the entire scope of the Army Futures Command enterprise. We are the largest subcomponent of AFC, and we are at the center of a global ecosystem of technological innovation and scientific exploration – whether we are leading the research or collaborating with industry, academia or our allies to develop mutually beneficial technologies.

You would be hard-pressed to find a piece of Army Transformation, particularly within AFC's mission space that DEVCOM does not contribute to in a meaningful way.

A&M: What do you see as DEVCOM's role within Army Transformation efforts led by Army Futures Command? What value does DEVCOM bring to that team?

MG Cushing: AFC's priority is to work with teammates and partners to implement Continuous Transformation to ensure war-winning future readiness. We approach Army Transformation through the lens of three time periods: Transformation in Contact over the next 24 months, Deliberate Transformation tied to the POM cycle 2-7 years out, and Concept-Driven Transformation with implications for 2030 and beyond. These three time periods are inextricably linked because decisions about one have implications for the others.

As GEN Rainey has said, Army Transformation is not a relay race – there is no baton to pass off between technology developers, then to acquisition or logistics and sustainment. There is and must be constant feedback, and no one Army command truly owns the entirety of one step in the process.

For DEVCOM, that means there is no point within capability development or the materiel lifecycle where we can wipe our hands of a project and say 'our work here is done.' The DEVCOM enterprise spans one foundational research laboratory and seven applied research and development centers that also provide lifecycle engineering support. DEVCOM collaborates with our partners in AFC's Futures and Concepts

Center to help ground Army concepts in scientific reality based on our foundational research.

We work alongside AFC's Cross Functional Teams, as well as the Army Applications Lab to transition developing technologies to programs of record and enable the realization of Army Modernization Priorities. DEVCOM engineers work extensively with the Program Executive Offices to address technological and engineering challenges during the acquisition and experimentation processes. And our research and development centers also provide a significant amount of lifecycle engineering to rapidly respond to emerging operational needs and support currently fielded equipment.

Meanwhile, our analysis center provides critical systems assessments in lethality, operational impact, risk, vulnerability, and user acceptance analysis that informs better decision-making across the materiel lifecycle.

That is why I really do think DEVCOM serves as the Army's leader and integrator within a global ecosystem of technological innovation and scientific exploration; we're intricately tied to AFC's efforts to get after Army Modernization, and now Transformation.

At the end of the day, DEVCOM provides science, technology, engineering and analytical expertise that underpins Army Transformation from concept development to materiel sustainment.

A&M: As the Army operates and maintains overmatch across all domains – land, sea, air, space, with the growing need for force modernization to address a dynamic threat environment affecting security in all phases of the lifecycle, how is DEVCOM embracing a necessary digital transformation to win decisively in the Large Scale Combat Operations of a Multi-Domain Operations future?

MG Cushing: When it comes to digital transformation, we're looking at it primarily from the perspective of how will our S&T work support the digital transformation of our operational Army to give them the edge against our adversaries? We must explore ways to improve existing tools and develop new capabilities that will help Soldiers make sense of the nearly unfathomable amount of data coming in from thousands of sensors on the battlefield. This includes how we integrate artificial intelligence and machine learning into our systems, that will help take some of the cognitive burden off Soldiers and help them quickly process all that data in meaningful ways.

We're leaning hard into Next Generation Command and Control because the Army's #1 priority when it comes to transformation is the network. We need a robust network capable of keeping up with the vast amounts of data that need to be processed to enable commanders to make faster decisions and adapt in complex and continuously evolving operations. Our work in this space includes software, hardware, and a larger data-centric C2 architecture that is truly a team effort across AFC and our industry partners. There's certainly little point in creating a network architecture capable of enabling Next Generation C2 if we can't protect that network from increasingly sophisticated adversaries. We have a lot of talented engineers working in the cybersecurity and electronic warfare spaces to ensure we can protect our network, manage our use of the electromagnetic spectrum and detect and exploit adversary vulnerabilities.

A&M: What are some of the biggest challenges facing the Army S&T community?

MG Cushing: It is no secret our Army and our society are facing some

very real threats – from adversaries who do not necessarily play by the same rules that we do and others who don't look like a typical nation-state adversary. Army S&T must keep pace with a rapidly changing global technological landscape. Never have bad actors had such easy access to weapons of war or the ability to conduct digital warfare.

It is our job to ensure American Warfighters never enter a fair fight and we provide them with combat capabilities so formidable, our adversaries will not entertain the risk of entering conflict with us.

Earlier, I mentioned Concept-Driven Transformation. For DEVCOM, this is where we are focusing on research with far-term applications. In this space, we need the benefit of risk acceptance and agility. Researchers must have the trust and ability to rapidly pursue emerging technologies and pivot just as quickly as technology evolves or does not pan out in the way we expected. We need to be able to fail early and fail cheaply in the process, rather than continue to put resources into a project simply because too much has already been invested.

Part of this ability to pivot, really comes down to fiscal agility, and GEN Rainey has talked about this quite a bit. The Army must develop requirements documents – which is where funding dollars follow – for capabilities rather than specific systems. This would work particularly well for smaller scale systems with overlap in the commercial sector.

There are developments going on in the commercial sector that are moving so fast and with such impact that the traditional way the Army funds R&D can never keep pace. By the time a promising technology was identified, the requirement was approved and funded, and we completed the multiyear effort necessary to develop, test, and start fielding a military-grade version of the system, the original technology would be well on the way to obsolescence. Our adversaries are not operating within a system like that, and simply put, we cannot afford to do that either.

We must transform how we do business, to funding a capability portfolio rather than individual technologies that meet one specific requirement. This gives us the agility to invest our S&T dollars in ways that support various capability goals, enable us to pivot to keep pace with technological change, and more importantly, maintain the battlefield advantage for our Soldiers.

This fiscal agility will have impact across all Army S&T work and Army Transformation. For example, equally important is how Army S&T approaches Transformation in Contact, or how we drive real capability change for Soldiers right now. And as GEN Rainey says, it is about not letting perfection get in the way of good enough. S&T, and the larger Army, needs to get comfortable with identifying existing technologies that are worth fielding right now, rather than waiting for years of R&D them to advance further. In many cases, this not only gives Soldiers a vastly improved capability over what they currently have, but it provides us with real-world feedback on a newer capability to determine how to invest in its further development in ways that will have larger capability impacts based on the evolving operational environment.

Finally – I spend a lot of time thinking about how we protect the great ideas our Army S&T experts are developing. And I will say, this challenge is not unique to Army S&T, agencies across the federal government are grappling with how to balance collaboration with security, as are many private companies.

At DEVCOM, we know innovation is a team sport – it does not happen in silos. It requires constant collaboration with a diverse set of partners across a global ecosystem of innovators. Whether it is the defense industry, professors and students, small businesses, or our allies, we place great value in that network of partners – we

could not accomplish our mission without them, nor would we want to, because we know our ideas are made better with the insights of others.

But we also recognize that opening our labs, opening our projects, sharing our intellectual property – it can also make us vulnerable to our adversaries. We must find a balance, to ensure the benefit of collaboration outweighs the risk of our IP ending up in the wrong hands.

We'll find that balance by remaining flexible, continuously evaluating how we vet our partners and remaining vigilant in terms of what information we are willing to share and when in the technology development process.

A&M: How does DEVCOM ensure the capabilities it develops are operationally relevant and something Soldiers in the field will need and understand how to use?

MG Cushing: This is a great question, because DEVCOM has some remarkable responsibilities in the Army S&T space. We are exploring truly groundbreaking, emerging science that might not have an obvious military application to the untrained eye. We are working diligently to advance research that will provide the Army with new, war-winning capabilities. And we are engineering solutions and incremental improvements to currently fielded equipment. How we determine what is operationally relevant and user-friendly will vary slightly depending on where we are within that timeline.

It starts with an incredible relationship we have with the Futures and Concepts Center and their experts who work to develop concepts and requirements. We have worked hand-in-hand with FCC to develop Concept-Required Capabilities (CRCs) that will align to the new Army Warfighting Concept currently being drafted by our AFC partners.

The CRCs will summarize critical new and modified activities that future Army forces, Army formations, and the Institutional Army must be able to do to achieve future objectives as part of a Joint and multinational force that can dominate the land domain. For the team at DEVCOM, it will really help us better frame our research and development efforts in a way that ensures they support the way the Army anticipates it will fight on the future battlefield.

Looking at this through another lens, we also continue to invest in programs that directly connect DEVCOM scientists and engineers with our end user – the Soldier. Catalyst Pathfinder is a great example of this. Since 2021, Catalyst Pathfinder works to connect Soldiers, DEVCOM experts and our critical partners in academia to expedite our ability to develop solutions to problems identified by Soldiers themselves, at the point of need, which is extremely innovative.

Through this program, we have the opportunity to hear in real-time the operational challenges Soldiers are facing, work alongside them to develop prototypes for new capabilities and garner critical insights that help us refine our work to develop emerging technologies in support of Army modernization priorities.

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INTEGRATING SENSORY PRECISION WITH FIRE CONTROL

The U.S. Army's Integrated Battle Command System (IBCS) is the materiel solution for the Army Integrated Air and Missile Defense (AIAMD) enterprise. This system integrates sensors and effectors onto the Integrated Fire Control Network (IFCN) and compounds overall air missile defense (AMD) effectiveness by dramatically enhancing the ability to identify, track, engage, and defend against diverse threats.

By Michael Whetston, Air and Missile Defense Cross-Functional Team

As one of the key signature efforts supporting the Army's Air and Missile Defense (AMD) community, Army Integrated Air and Missile Defense (AIAMD) is the cornerstone of AMD modernization within the U.S. Army. As part of Project Convergence Capstone 4 (PC-C4), which occurred in February and March 2024 at locations along the west coast, the Air and Missile Defense Cross-Functional Team (AMD CFT) participated in experimentation to transform how the Joint forces fight in the future.

According to Chris Wehmeier of the AMD CFT, "Project Convergence is the ideal environment to experiment with, and grow, AMD capabilities in the years to come." Wehmeier went on to say that this is the third experimentation capstone event in which IBCS has participated. "PC 21 saw IBCS expand into the realm of Joint interoperability. By linking our integrated fire control network with our joint partners' composite tracking networks, we learned that technology is catching up to concept, creating an expansive, effective, and robust air defense capability that leverages the best of all services."

TACTICAL SENSORY-CENTERED BATTLEFIELD EVOLUTION

In PC 22, experiment design expanded the distances between sensors and shooters to extend the battlespace, added additional nodes to the network to increase the load, and used tactical communications systems rather than commercial systems to provide greater realism. PC-C4 continued to increase the scope and scale of the network to produce data that can be used to inform future experiments as well as future acquisition and development decisions.

AIAMD combines current and future AMD sensors and weapons into a common integrated fire control capability that allows the warfighter to fully integrate AMD capabilities across all echelons. AIAMD replaces multiple disparate command and control systems, enabling better coordinated engagements, positive control of sensors and weapons, friendly protection, and shared situational understanding. AIAMD enhances battlefield awareness contributing to improved command and control and integration of systems to produce desired effects. The system's improved awareness and performance combine to provide Soldiers and formations that are more lethal and survivable.

"This is the greatest and most complex modernization of our air and missile defense capability since the Cold War, centered on connecting sensors, shooters and a common mission command system," said BG Bill Parker, Director of the Army Futures Command's Air and Missile Defense Cross Functional Team. "Ultimately, it is about giving our warfighters capabilities sooner and increasing the options available in order to keep pace with our adversaries, making their challenges more complex."

EXPANDING FIRE CONTROL BEYOND NODE-BASED TARGETING

IBCS is envisioned as the direct replacement for the mission command nodes for the Patriot weapon system, the Terminal High Altitude Area Defense (THAAD) weapon system, Army Air and Missile Defense Command (AAMDC) Headquarters, Air Defense Artillery Brigade Headquarters, and Air Defense Airspace Management (ADAM) cells. It enables rapid convergence of sensors, shooters, and mission command components on an integrated fire control network.

Integration efforts of both legacy and developmental sensors/shooters will provide the force with capabilities to defeat emerging threats in a variety of scenarios. These capabilities allow the force commander to form operational air defense task forces, tailored to a specific mission profile and able to integrate with joint and multinational partners. IBCS achieved Initial Operational Capability and was approved for Full-Rate Production in early 2023.

"Achieving IOC for AIAMD/IBCS was a team effort and represented both an accomplishment of monumental magnitude for the Army and a first critical achievement in transforming Army integrated AMD forces to support joint and multinational forces in future operations," according to Parker.

MULTI-LEVEL DEFENSE THROUGH INTEGRATED COMMAND AND CONTROL

Once fully fielded, IBCS will allow AMD forces to be tailored and scaled appropriately to meet the given threat. The quantity and mix of capabilities can be dynamically re-tasked into a formation with an inherent, integrated mission command system to build tiered and layered defenses. This approach is aligned with the Army's efforts to provide flexible network and command and control capabilities with access to cloud applications, enabling tactical formations to be faster, lighter, and more lethal.

The program will field common mission command nodes for Army AMD forces to defend against manned aircraft, unmanned aerial systems, air-to-ground missiles, tactical ballistic missiles, cruise missiles, and rocket and mortar attacks. IBCS will operate with air surveillance and fire control capabilities across Army, multiservice, and multinational AMD capabilities throughout all echelons.

"Going forward, the Air and Missile Defense Cross-Functional Team, teaming with our military and industry partners, continues to build momentum for AIAMD through testing as part of the Integrated Fires Test Campaign in 2024 and beyond," Parker noted. "AIAMD/IBCS is more than just a mission command node, it is an integral component of AMD weapon systems. It remains our top AMD priority."



Chris Wehmeier



BG Bill Parker