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PREPARE TO JUMP

Soldiers with 1st Stryker Brigade Combat Team, 2nd Infantry Division prepare to move the command post during the Command Post Integrated Infrastructure (CPI2) Validation Exercise on July 26, 2023, at Joint Base Lewis-McChord, Washington. The CPI2 program provides mobile command post capabilities by integrating network and communications technologies into a family of medium tactical vehicle platforms for on-the-move command post capabilities. (Photo by Kathryn Bailey, PEO C3T)

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COMMAND & CONTROL ON-THE-MOVE

Future combat operations require a unified network that gives commanders assured voice and data exchange, common operational picture and access to offensive and defensive digital fires.

by Lt. Col. Herb Gamble, Dan Ghio and Kathryn Bailey

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he Army expects future large-scale combat operations to be fast-paced and complex, with forces combating a variety of harsh terrains and environments, under constant enemy observation and attack.

Two intertwined capabilities underpin a commander's ability to overcome the demands of such chaotic conflicts: the network and the command and control (C2) systems that run on it. Together they provide commanders and their maneuver formations with the assured voice and data exchange, common operational picture and access to offensive and defensive digital fires needed to combat rapidly changing operational environments.

To be survivable in future dynamic large-scale combat operations, instead of tethered to large, static, equipment-laden command posts, commanders and their C2 systems need to be on-the-move.

"If you watch the news and [look at] the lessons learned from all the operations we're assigned to, [it's apparent that] we can't continue to have this huge command post and be survivable," said Brig. Gen. Marne Sutten, deputy chief of staff G-6, Army Forces Command, during the latest Army Technical Exchange Meeting (TEM) with government and industry partners. "Commanders want a command post that they can utilize at the time of their choosing ... to give them the flexibility" they need to conduct different missions.

During the December 2023 TEM 11 in Savannah, Georgia, Army leaders discussed current efforts to design a network architecture that addresses the ever-increasing need for C2 on-the-move. They stressed the importance of aligning technology, people and processes to achieve the overarching unified network needed for resilient data exchange. The goal is also to make network and C2 systems more intuitive and easier to use, while reducing footprint and lowering electromagnetic signature.

"[To be] survivable, we need to be transport agnostic," said Col. Rob McChrystal, commander of the 2nd Cavalry Regiment, during TEM 11. "I'm talking about redundancy and maximum options, whether it's transport from the terrestrial layer to multiple types of low Earth orbit to medium Earth orbit to geosynchronous Earth orbit [satellite communications]. We need to have those options, and ultimately, we want to get to the point where that's automated, and we're able to auto transition when they fail."

McChrystal emphasized several key characteristics he needs for his formation to fight mobile and dispersed. These include enhancing survivability through a transport-agnostic network design that maximizes and automates numerous signal transport options; and smaller, more flexible systems that can adapt to different missions. Interoperability with joint and multinational mission partners plays a critical role, he said, as well as the need to be data-enabled, with a nonproprietary, easily integrated data fabric. Looking forward, predictive data to support commanders' decision-making—leveraging capabilities such as human-machine teaming, automated running estimates and simulations—will be imperative to a future fight against a peer or near-peer adversary, he said.

"This is important because of the pace of technological change," McChrystal said. "That means we have to understand faster; we have to understand risks; we have to understand opportunities faster and we have to make faster decisions."

The Army is looking to its industry partners to help it reach its C2 on-the-move network goal and will welcome both programmatic and technical input to help design capabilities that increase survivability, provide flexibility and deliver network resiliency for commanders to fight disaggregated or collected regardless of geographic or mission constraints.

REQUIREMENTS

The Army command post directed requirement describes command and control on-the-move as moving or rapid halts in minutes. To meet these requirements, the service must integrate C2 information systems and physical infrastructure to execute core C2 functions. C2 on-the-move systems need to be modular and adaptable based on the different needs of each echelon, formation type, mission and operational environment.

"The command post is just the physical space in which the commander and staff conduct the functions or command and control and doesn't have to be any specific ... location," said Col. Charles Ford, Army capability manager for mission command/ command posts within the Mission Command Capability Development Integration Directorate. "It doesn't always have to be in the vehicle. It might be in a garage, it might be in a farmhouse, it might be just dispersed on a city block. We want to be modular and adaptable."

The goal is the continuity of command and control, to ensure a resilient network transport that can rapidly recover from signal loss and degradation, and maximize both effectiveness and survivability, Ford said. "We often hear this false dichotomy: If you're survivable, you're not effective. If you're effective, you're static. We need to balance them, so they can both grow together."

REPEATABLE PROCESS

Integrating on-the-move technologies onto vehicles takes time, but that does not mean the Army must wait for the physical vehicle integration to begin designing and prototyping the system. A series of pilot and experimentation efforts provide the Army with the systematic feedback it needs to ensure the network performs as designed for mobile operations. Also, the on-the-move design must be compatible and interoperable with the existing unified network capabilities and a series of verification and validation events are needed.

"The first priority is to ensure the network design supports all types of units, including mounted, dismounted, aviation or sustainment," said Matt Maier, project manager for interoperability, integration and services, under the Program Executive Office for Command, Control, Communications – Tactical (PEO C3T). "Everyone is trying to use the same network and talk to each other, so the preliminary network design has to perform across all unit types and be operationally suitable, survivable, effective and safe."

From there, lab-based risk-reduction efforts provide information on which network components work in an on-themove configuration; the need for high throughput, low latency bandwidth; and the ability to function in a dispersed environment, while minimizing electromagnetic signature, he said.

A system-of-systems command and control on-the-move kit can then be integrated into a limited number of vehicles and fielded in small quantities to an operational unit to support further field-based risk reduction efforts, before putting the vehicles into an operational evaluation or larger Soldier touch point. The last piece of the process puts the integrated vehicles in an active Army unit that can assess the



LESSONS LEARNED

The Army is using lessons learned from initial Command Post Integrated Infrastructure experiments and tests to integrate new command post capabilities onto a JLTV variant. The integrated JLTV is serving as the tactical vehicle platform for a fire support prototype command post design and pilot, which will determine the ability of forward observers to initiate a call for fires missions to the command post headquarters. (Photo by Erika Jordan, U.S. Army Test Command)

operational effectiveness at a combined training center rotation, followed by insertion into real-world operations.

"We're really trying to get after this kind of repeatable process for any type of C2 on-the-move effort," Maier said. "These series of events happen concurrently, with some units participating at various stages, to allow for the insertion of up-andcoming technologies that we keep in our C2 on-the-move incubator."

The Command Post Integrated Infrastructure (CPI2) program implemented this process by partnering with the 1-2 Stryker Brigade Combat Team (1-2 SBCT), under 7th Infantry Division at Joint Base Lewis-McChord, Washington. In 2023, the 1-2 SBCT was the first unit equipped and fielded in the Army with CPI2 capability, which provided modular command post capability that integrates network and communications technologies into a family of medium tactical vehicle platforms, replacing existing tentbased command post capability.

These vehicle-based command posts enabled the unit to displace and then emplace the command post and its supporting command post functions into the operational environment, demonstrating the first step in enabling future command and control on-the-move technology designs that work in mobile command groups and tactical vehicles such as Strykers, Armored Multi-Purpose Vehicles (AMPV), and now the Joint Light Tactical Vehicle (JLTV), which features a prototype command post design and is part of a pilot to determine the ability of forward observers to initiate a call for fires missions to the command post headquarters. The Army plans to assess the JLTV prototype in a Soldier touch point with an operational unit this year.

"Based on the unit, you get a formation-appropriate and mission-appropriate command post kit for a variety of vehicle platforms," Maier said.

MISSION COMMAND ON-THE-MOVE

Two new mission command components are expected to help modernize command and control on-the-move and optimize the capabilities focused on large-scale combat operations: the Mounted Mission Command-Software (MMC-S) and the Mounted Mission Command Transceiver (MMC-T). As a replacement to the Joint Battle Command-Platform software, MMC-S is an open software platform tactical assault kit, which allows developers to add new functions over time. Last spring, the 82nd Airborne Division conducted C2 on-the-move using the MMC-S during a successful operational test.

"Soldiers appreciated the software for its simplicity, intuitiveness and common look and feel," said Col. Matt Paul, project manager for mission command, under PEO C3T. The biggest critique from Soldiers was that they did not wish to be tethered to the platform, which developers used to innovate and port the software into a commercial tablet, he said.

"We built in the ability for the tablet to connect to any network point of presence in the formation, such as tactical radios, Wi-Fi and upper TI [tactical internet] local area network," which provides Soldiers with a dismounted common operating picture and chat function that is available any time during the fight, Paul said.

Developers also ported the software into a cloud environment, which will be evaluated in a future Soldier field assessment to inform requirements and acquisition strategies.

For the hardware, the MMC-T will replace the current legacy receiver to provide multiple transport capabilities such as low Earth orbit, geosynchronous Earth orbit and line-of-sight waveforms, which are critical to the large scale combat operations contested and congested environments. The MMC-T is moving into low-rate production in 2025.

In addition, many of the C2 technologies today will integrate into the C5ISR/Electronic Warfare Modular Open Suite of Standards Mounted Form Factor. C5ISR/ Electronic Warfare Modular Open Suite of Standards will make use of a common chassis that will accept "cards" that are embedded with capabilities such as positioning, navigation and timing, electronic warfare technology, mission command applications and radio waveforms, which will enable the Army to reduce size, weight and power restrictions and keep pace with the speed of technology as it evolves to help outpace the threat.



SOFTWARE TEST

Soldiers with the 2nd Brigade Combat Team, 82nd Airborne Division conduct an operational test using Mounted Mission Command Software (MMC-S) Version 3.1 in May 2023 at Fort Cavasos, Texas. The MMC-S provides on-themove accurate digital command and control and situational awareness. (Photo by Mark A. Scovell, U.S. Army Operational Test Command)

C2 OTM: ENHANCING ARMORED FORMATION SURVIVABILITY

In light of the critical need to enhance C2 on-themove (OTM) to outpace the enemy in future large scale combat operations, the Army is setting the stage for the second phase of its Armored Formation Network OTM Pilot. The first phase of the pilot was held in February 2022 at Fort Stewart, Georgia. During Phase II, which is expected to begin later in 2024, the service will further evaluate new and emerging commercial OTM line-ofsight and beyond-line-of-sight network transport and baseband technologies to be integrated onto select armored vehicles. The Army will also evaluate small quick-halt terminal solutions that can be pulled off the back of the platform and set up in minutes when additional bandwidth is needed.



REMOTE COMMUNICATION

During the first phase of the pilot in February 2022, 1st Lt. T.J. Allen, the communications and network officer assigned to 2nd Armored Brigade Combat Team, 3rd Infantry Division, communicates with the brigade headquarters from inside his network-integrated tracked vehicle at a remote location at Fort Stewart, Georgia, in February 2022. (Photo by Amy Walker, PEO C3T Public Affairs) This OTM network equipment set will provide armored formations with the data and communications commanders need to make and execute rapid informed decisions in both offensive and defensive operations. "We understand clearly that in future large scale combat operations, remaining static in one location will threaten the safety of our Soldiers," said Col. Stuart McMillan, project manager for Tactical Network, at PEO C3T. "In response, we're building that resilient, transport agnostic, on-the-move network needed to enable data exchange, C2 and decision dominance in future fast-paced conflicts against more advanced adversaries."

The Armored Formation Network OTM design will be modular and standardized, enabling systems to be integrated across various platforms for mobile upper tactical transport network communications and C2 OTM. Because of the modularity, units will be able to quickly install, replace or add components that pertain to their particular missions. Considerations for C2 node survivability include mobility, resiliency, dispersion and electromagnetic signature, as well as size, weight and power to accommodate armored vehicle space limitations.

Phase II of the Armored Formation Network OTM Pilot will validate OTM solutions for production and integration and inform decisions on the integration of new technologies on Strykers, AMPVs and JLTVs. However, for the pilot itself, the Army may integrate systems on legacy platforms that are more readily available and less disruptive to unit operations. Phase II will inform and recommend a family of OTM solutions, enabling units to select capabilities from the available options to meet the requirements of each echelon and mission. "We want to reduce complexity for our Soldiers, and increase the agility and flexibility needed to fight and communicate on the move in any combat scenario," McMillan said.

Some of the Armored Formation Network OTM Pilot Phase II technologies to be evaluated include high throughput, low latency, multi-orbit satellite communications and more resilient waveforms and line-of-sight capabilities. It will also include automatic primary, alternate, contingency, emergency (Auto-PACE) bandwidth diversity capabilities, which automatically choose the best signal pathways for congested network traffic or reroute signals when a single transport option is down or is contested, such as enemy jamming.

The pilot will evaluate a near-term solution but continue to identify and assess emerging technology that can be incorporated into future iterations. To lay a strong foundation for future modernization and easy integration of emerging technologies, the Army will own the Armored Formation Network OTM design, steering away from proprietary solutions whenever possible. Following the pilot, the system integrator will deliver the technical data package to execute a competitive contract of existing indefinity delivery/indefinite quantity contracts (which provide an indefinite quantity of supplies or services during a fixed period) for procurement and integration of follow-on system fielding, McMillan said.

"Command and control on-the-move is critical to survivability and lethality, whether the unit is fighting disaggregated or collected," McMillan said. "We have to provide our commanders the ability to access the data they need to make rapid informed decisions; and this is especially true for our armored formations—the Army's most lethal force."

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CONCLUSION

The Army is enabling command and control on-the-move through rapidly configured, transport agnostic and persistent data services, providing flexible on-the-move access to core capabilities at echelon.

"For on-the-move we need something that's smaller in form factor, even in a Stryker unit," McCrystal said. "We need to adapt to take a [Soldier] out of a Stryker and put him into the basement of a building. That's what's going to give us the capability to [operate] dispersed."

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