DefenseNews

THE CHALLENGES OF GROUND VEHICLE MODERNIZATION

Sponsored by:

GORE

U.S. Army Soldiers from Delta Company, 1st Battalion, 66th Armored Regiment, 3rd Brigade Combat Team, 4th Infantry Division conduct mission rehearsals and a walk through with their vehicles for an upcoming mission at the National Training Center in Fort Irwin, Calif.

THE CHALLENGES OF GROUND VEHICLE MODERNIZATION

By: Andrew Welsh-Huggins

Modernizing the Army to defend against and prevent unforeseen enemy attacks gives an advantage to U.S. soldiers on any battlefield.

One of the most important parts of the Army's modernization program is ground vehicles, because of their robust mobility and defensive capabilities. The Army is currently undertaking several modernization programs, including efforts to develop the M1E3 main battle tank, which will comply with Modular Open Systems Approach (MOSA) guidelines, part of the future of military asset development.

In addition to operational capabilities, ground vehicle modernization must focus on data capabilities. Collecting and sharing data is critical to the U.S. military's plans for the future and ensuring that vehicles have the technical capabilities to not only do so when they are first put into service, but also maintain those capabilities and be able to expand them over time will be an important component of modern ground vehicles. Hand in hand with maintaining data capabilities is the military's embrace of artificial intelligence.

The field of land vehicles is emerging from a long period that didn't see a lot of investment on the technology side of things, said Brian Tallman, global marketing leader for W.L. Gore & Associates, a Delaware-based materials science company focused on discovery and product innovation.

More recently, the geopolitical situation along with advances in technology and electronics has created opportunities to implement new systems, new technologies, and new platforms, said Tallman, whose company, founded in 1958 and today with a footprint spanning five continents, works on a wide variety of materials science projects, including a recent partnership with CarbonCapture Inc. to create cutting-edge materials for removing carbon dioxide directly from the atmosphere.

"So I would say there's a kind of a transition happening in terms of what's been fielded and what's going to be fielded in the future," said Tallman.

Epitomizing this change is the development of the XM30 Mechanized Infantry Combat Vehicle (MICV), previously known as the Optionally Manned Fighting Vehicle (OMFV). The XM30 is at the forefront of the U.S. Army's plan to replace the M2 Bradley tank, an infantry fighting vehicle that has been an Army workhorse since its

SGT. CHARLES PROBST/ U.S. ARMY; COVER: PVT. BROOKE DAVIS, OPERATIONS GROUP, NATIONAL TRAINING CENTER/ U.S. ARMY development more than four decades ago. Last June, the Army awarded its prototype contracts for the XM30 Mechanized Infantry Combat Vehicle to General Dynamics Land Systems Inc. and American Rheinmetall Vehicles LLC. The Army's hope is to bring the XM30 online on a similar timeline as the M1E3 Abrams Main Battle Tank.

"I think that there would be real goodness for the Army if M30 combat vehicles and M1E3 tanks could be fielded simultaneously to an [armored brigade combat team]," Brig. Gen. Geoffrey Norman told Defense News in May. "I think the Army senior leaders are going to push us to try to align those schedules, and whether that can be done is an open question right now."

In essence, the Army has arrived on a new development platform to be used as a "clean sheet" for an armored vehicle design, Tallman said.

"One of the things they realized is that, as they do designs, it gives them a chance to use what they keep talking about as a digital model," he said.

The Next Generation of Ground Vehicles

Developing the XM30 combat vehicle using digital engineering was a hot topic at the annual Ground Vehicle Systems Engineering & Technology Symposium (GVSETS) in Novi, Michigan, in August. Digital engineering involves extensive use of computer simulations in production and design. Digital engineering is also being used on the Army's Future Long-Range Assault Aircraft (FLRAA) initiative.

"We can ensure that things are being done correctly, in the best way, before anything ever goes to manufacturing, saving a lot of costs upfront," Lt. Col. Michael Keathley, product manager of prototype development within PM-XM30, Program Executive Office, Ground Combat Systems (PEO GCS), said at the conference.

Developing the M1E3 Abrams tank is part of the Army's focus on equipment improvements needed to operate on the battlefields of 2040 and beyond, the Army said last year. Meanwhile, the M1A2 tank has reached its capacity given the need for more modern components.

"The Abrams Tank can no longer grow its capabilities without adding weight, and we need to reduce its logistical footprint," Maj. Gen. Glenn Dean, Program Executive Officer for Ground Combat Systems, said in September 2023. "The war in Ukraine has highlighted a critical need for integrated protections for Soldiers, built from within instead of adding on." The development of the M1E3, expected to come online in the early 2030s, will comply with the latest MOSA standards to allow for quicker technological upgrades while using fewer resources.

"We appreciate that future battlefields pose new challenges to the tank as we study recent and ongoing conflicts," said Brig. Gen. Geoffrey Norman, director of the Next-Generation Combat Vehicle Cross Functional Team. "We must optimize the Abrams' mobility and survivability to allow the tank to continue to close with and destroy the enemy as the apex predator on future battlefields."

Doing this requires overcoming a traditional challenge for updating military assets, namely the phenomenon known as "vendor lock," whereby the use of a proprietary system—in this case, electronics systems—limits the ability to update vehicle capability. As Tallman puts it: "As electronics change and software changes, they're unable to keep up with the pace of technology because they become tied to proprietary technologies within the network that can no longer communicate."

Global Growth in Ground Vehicles

Globally, the market for military land vehicles such as the XM30 is projected to reach $40.5 billion in six years, according to a new report by Research and Markets. Fast-moving technological developments in vehicle protection systems and other technologies, along with many countries' growing defense budgets spurred by rising geopolitical tensions, are driving the increase, according to the research company.

In July, the German Armed Forces (the Bundeswehr) announced the awarding of a contract to KNDS Deutschland to modernize the Fennek three-crew member reconnaissance vehicle to meet updated reconnaissance and observation standards. Elsewhere in Europe, the Common Armoured Vehicle System (CAVS) was formed in 2021 to develop an armored vehicle system based on common requirements of the countries in the pact, including Estonia, Finland, Latvia, and Sweden.

In Ukraine, soldiers attached to the Azov 12th Special Purpose Brigade of the National Guard recently tested the Inguar-3, a new armored vehicle produced in Ukraine. For its part, Russian firm Remdiesel in August unveiled its new MGTT-LB (based on the MT-LB platform), a new all-terrain, multi-purpose tracked armored vehicle that is meant to replace the increasingly outdated MT-LB, a vehicle used by the Russian Armed Forces since the 1970s.

MOSA is now the Department of Defense's preferred approach for doing design work independent of hardware. MOSA is part of an ongoing transformation in how military equipment is being designed and sustained into the future, in sync with the planning ahead approach provided by digital engineering. The DOD is employing MOSA in the life cycle activities of both its Major Defense Acquisition Programs and Major Automated Information Systems. (Beginning in 2013, the Defense Department mandated the incorporation of the principles of Open Systems Architecture within the requirements for procurement of defense software and hardware.) Other open systems approaches embraced by the Department of Defense and falling under the MOSA initiative include the Sensor Open Systems Architecture (SOSA), the Future Airborne Capability Environment (FACE), and Vehicular Integration for C4ISR/EW Interoperability (VICTORY).

MOSA, which at its core requires an open business model, incorporates several requirements, including the employment of a modular design that uses modular system interfaces between major systems, major system components, and modular systems, according to the DOD. MOSA, "allows the Department to incrementally acquire warfighting capabilities, including systems, subsystems, software components, and services, with more flexibility, competition, and innovation," the Defense Department says. In addition, MOSA should be subject to verification, and use "a system architecture that allows severable major system components at the appropriate level to be incrementally added, removed, or replaced throughout the life cycle of a major system platform to afford opportunities for enhanced competition and innovation," according to the military.

For example, connectivity between computers and sensors is a continuously evolving capability, according to a paper presented by W.L Gore associates at GVSETS last year. Making specific interconnect technology choices, for example, had a positive impact on an issue with the MH-47 Chinook rotorcraft under the aegis of 160th Special Operations Aviation Regiment (SOAR), according to the paper, "Ensuring MOSA Success: The Interconnect Technology Beyond The Box." By replacing routinely failing cables with an alternative cable designed for the environment, SOAR saw improved reliability in aircraft reliability systems (ASE).

The M1A2 Abrams Main Battle Tanks from 3rd Battalion, 8th Cavalry Regiment, 3rd Brigade, 1st Cavalry Division, line-up in roster number order on the Blackwell Multiuse range on Fort Hood, Texas.

BY SPC. MARCUS A. FLOYD, 7TH MOBILE PUBLIC AFFAIRS DETACHMENT/ U.S. ARMY

"This improved cable reliability reduces maintenance downtime and associated costs while ensuring system performance for the men and women flying demanding, highly critical missions," the paper noted.

At the heart of the flexibility provided by MOSA is the understanding that by the time a capability is designed and developed, the threat has transformed, the paper explained.

"Advanced tools, such as artificial intelligence (AI) and machine learning are being developed to reduce time to reaction; however, they will still need the interconnect infrastructure to support them," the paper said.

In short, for W.L. Gore, "What this all ties to is, we want to have scalable systems that allow for multiple vendors to work together over time in the system, integrating electronics," Tallman said.

Applications of MOSA

Initially, the expectation is that MOSA applies mainly to Army ground systems and land vehicles. But in fact, the elements of MOSA tie into everything from Future Vertical Lift (FVL)—the plan to develop a services-wide cadre of military helicopters—to additional programs run by the Air Force and Navy. This leads to what Tallman calls the fundamental question of what steps are necessary for implementing MOSA. First and foremost is the ability to interconnect and interoperate systems over time.

"Because of the tie to digital modeling, it starts out with making sure you understand what the inputs and outputs are of a given system," Tallman said. He added: "You want to make sure that you've identified which data is important and how that data gets transmitted into the network, and then it's reliably transmitted into the network." One issue is the perennial problem of data latency, or the lag in the sending of data and that data accomplishing its purpose, and then looking for ways to address that. And when it comes to data identification, it's vital to validate and verify that compliance systems are truly interoperable.

As Gore associates pointed out in the GVSETS "Ensuring MOSA Success" paper, "As aircraft are upgraded, the requirements for data will increase exponentially, and planning ahead will keep legacy and enduring fleet aircraft and vehicles ready for upgrades without costly re-wiring efforts."

Similarly, ground vehicles are one of the areas being examined as the Army doubles down on efforts to incorporate artificial intelligence into operations. "We are doing things now so we can accelerate that adoption," Young Bang, Principal Deputy Assistant Secretary of the Army, Acquisition, Logistics, & Technology (ASA(ALT)), said at GVSETS in August.

One of the vehicles Tallman points to in explaining the future of systems interoperability is the XM30, and how lessons learned from the technology placed in that vehicle can be applied to the M1E3 tank, including things such as sensors, vision systems, and Forward-looking infrared (FLIR) cameras. As Tallman put it, "As that work gets done, to define what's the reliable state-of-the-art technology the Army is looking to put that onto M1E3 and its future upgrades."

The XM30 represents the Army's push for digital modeling from the beginning, as opposed to doing things after the fact, Tallman noted. That includes preliminary design reviews and more formal design reviews, meaning fabrication milestones are established early on.

At the center of much of this modernization movement is data and the ability to safely deliver it, since today's electronics and their requirements all come down to more data. The question then, is how best to take advantage of data including establishing networks that are reliably able to deliver the information.

For example, as Tallman says, to make the sensors on a vehicle work means ensuring there aren't any transmission data errors. And seeing to that issue "is one of the key challenges in the data transmission world," Tallman said. The real-world experience of ground vehicles can include vibration and electromagnetic interference and other occurrences that can change how data is transmitted. "So you need to think ahead about how is the system actually going to perform as installed, not in a lab, not in a bench top?"

Preparing for Future Needs

Hand-in-hand with designing for real-world use is taking advantage of MOSA to build in "headroom" to avoid being data-constrained in the future. For example, deciding to install a system that can transmit 40 gigabytes of data a second, even though current requirements might only be 10 gigabytes of data a second. "So make sure you put in the extra, and then when you put in the extra, make sure it's actually delivering what networks are looking for," Tallman said. On top of that is ensuring that the headroom allows for in-the-field demands.

"It's one thing to say transmit 40 gigabytes, it's another thing to say, transmit 40 gigabytes with a vibration profile X or Y," Tallman said.

Illustrating this urgency to look forward and plan ahead is the war in Ukraine and the lessons emerging from those battlefields. What was used as a successful countermeasure three months ago, for example, is being quickly updated and changed. Items as small but as crucial as cable and connectors must be adaptable to future needs and technology. "Do you have something that you can reliably source?" Tallman said. "Can you reliably deliver and obtain the connectors that allow new systems?" In this regard, enter another type of compatibility measure under the MOSA umbrella: Sensor Open Systems Architecture (SOSA), a Department of Defense-mandated approach to reducing project development costs and timelines, while at the same time maintaining the security needed for what are known as the C4ISR systems: Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance.

In the end, interconnect challenges remain within the context of incorporating MOSA and Open Architecture Systems design into future vehicle development. But success is possible by building in room for cable and connectors from different vendors that are intermateable, according to Tallman. Or, as Gore associates put it in their "Ensuring MOSA Success" paper, "Providing a highly reliable, future-proof interconnect architecture will ensure that service men and women in the line of duty can effectively maintain the highest performing systems and execute the most demanding missions." DN

About Defense News:

Defense News is the authoritative, independent, professional news source for the world's defense decision-makers. In print and online, we provide the global defense community with the latest news and analysis on programs, policy, business and technology. To stay informed, visit defensenews.com.

About W. L. Gore & Associates:

W. L. Gore & Associates is a global materials science company dedicated to transforming industries and improving lives. Since 1958, Gore has solved complex technical challenges in demanding environments — from outer space to the world's highest peaks to the inner workings of the human body. Gore develops products and technologies that address complex product and process challenges in a variety of markets and industries, including aerospace and defense. Gore enables customers to design their products and processes to be safer, cleaner, more productive, reliable, durable and efficient across a wide range of demanding environments. www.gore.com/start-with-gore-defense