

# TESTING THE WATERS

GVSC teams up with Wayne State University to better hydrate Soldiers in the field.

*by Heather B. Hayes*

Water may be “the driving force of all nature,” as Leonardo da Vinci once observed, but when it comes to people, the real necessity is water that is safe—both for drinking and other uses. And that reality can be a major dilemma for Soldiers working in the field, as well as civilians impacted by natural disasters, as there currently is no approved rapid capability outside of a lab to detect harmful levels of bacteria and chemicals in water sources.

That could soon change thanks to an education partnership agreement between U.S. Army Combat Capabilities Development Command (DEVCOM) Ground Vehicle Systems Center (GVSC) and Wayne State University. Their primary goal is to work closely together to innovate and create an accurate, effective and transportable water detection and treatment capability so Soldiers and other potential beneficiaries can have easier and continuous access to clean, safe water wherever they happen to be operating or living.

That GVSC chose to work with Wayne State on this project is not surprising. For starters, the university has a unique, highly collaborative engineering research and innovation center at its campus in Detroit, which is located just 30 minutes from Warren, Michigan, where GVSC has its offices and research facilities.

The Army also has a nearly 30-year history working on research projects with Wayne State. For example, Wayne State, through its participation in the Automotive Research Center, which is part of the U.S. Army of Excellence at the University of Michigan, has worked closely with GVSC to provide modeling and simulation of ground vehicle systems operating in harsh and uncertain scenarios.

### A NOVEL ARRANGEMENT

At a partnership signing ceremony held in December 2024, GVSC Chief Scientist David J. Gorsich, Ph.D., stated that the current water detection project is unique in that “it allows us to loan and share equipment and utilize resources together, and [it] also builds a special partnership in educating, training and mentoring, both on the GVSC side and with students and faculty at Wayne State.”

The arrangement enables the Army to leverage the expertise and resources of Wayne State to develop innovative solutions for water purification, while also providing a framework for collaboration and knowledge sharing, according to Jeremy Walker, Ph.D., division chief for Force Projection Technology at U.S. Army DEVCOM GVSC.

“Both the GVSC Fresh Water Test Facility and WSU's engineering labs will accommodate group research opportunities, allowing for real-time testing and evaluation of prototype advancements and actual testing on natural water sources using Army mobile water purification equipment,” he explained.

Walker actually knows a little something about the education, research and collaborative capabilities of Wayne State, having received his doctorate in civil engineering there in 2018 under the tutelage of Professor Shawn McElmurry, chair of the school's Department of Civil and Environmental Engineering.

“Wayne State brings novel ideas and expertise in water quality, biological and chemical contaminants of concern, fundamental knowledge of industry standard detection capabilities and the novel nano/MEMS [micro-electromechanical systems] technology area, which are all critical for developing rapid and effective field water quality detection capability to verify the different treatment processes utilized in the Army's mobile water purification systems,” he explained. “The university's research facilities and equipment will be used to support collaborative projects aimed at developing technology solutions for Army-identified capability gaps.”

### SOON TO BE READY FOR PRIME TIME

Given all the problems that modern technologies have managed to solve in recent decades, why is water testing out in the field



### TESTING IN TRAINING

GVSC water purification experts support the Marine Corps during the large-scale exercise training rotation of the Joint Pacific Multinational Readiness Center, October 2024, on Oahu, Maui and Hawaii Island. (Photo courtesy of the U.S. Army)



so complicated? It's really a question not of what, but where, the testing has to occur. According to Walker, current methods of "detecting biological and chemical contaminants down to the levels of drinking water standards requires sophisticated laboratory equipment that is complicated to operate and not suitable for use in the field."

While advancements in technologies like MEMS have enabled the miniaturization of bench-top analytical equipment typically used for analyzing water, he stated, "these technologies have not advanced to the point yet that they have been transitioned to the field or approved by regulatory agencies like the EPA [Environmental Protection Agency] or Army Public Health Command."

Succeeding at identifying and building an accurate and reliable mobile water detection capability promises numerous potential applications, including assisting victims in the aftermath of natural disasters like hurricanes, wildfires, floods and tornado strikes. The GVSC and Wayne State partnership will begin by focusing on the unique needs of the Soldier in the field, Walker

explained. That means finding ways to detect harmful bacteria and chemical agents in the field at two points: 1) Untreated source water to ensure that the most suitable source is selected; and 2) Treated product water to verify that the water is safe to drink.

The strategy will be to build on current research in academia, industry and other government labs to develop rapid technologies for identifying emerging contaminants in expeditionary water purification. For example, Walker explained, "The use of advanced membrane testing and evaluation, organic carbon analysis and novel techniques for continuous monitoring will provide a more effective and efficient means of detecting chemical and biological contaminants," which could include anything from nitrogen, metals and pesticides to bacteria, viruses and parasites.

Additionally, the project will tackle new threats, including Pharmaceuticals and Personal Care Products (PPCPs) and poly-fluoroalkyl substances (PFAS), "to ensure their removal and enable water reuse," Walker said.



## DISASTER RELIEF

Construction vehicles remove debris from a bridge damaged by Hurricane Helene near Chimney Rock, North Carolina on Oct. 10, 2024. The U.S. Army Corps of Engineers coordinates with a contractor to deliver generators provided by the Federal Emergency Management Agency at critical facilities, such as temporary shelters and water resource stations. (Photo by Michel Sauret, U.S. Army Corps of Engineers)

According to the EPA, PPCPs are emerging contaminants of concern “that are increasingly being found at low levels in surface water,” while PFAS are “widely used, long-lasting chemicals with components that break down very slowly over time.” Current scientific research shows that both of these contaminants, depending on the level of exposure, can lead to a variety of health impacts in both people and aquatic life.

### BUILDING AND ADVANCING

Although the partnership is clearly focused on coming up with technology breakthroughs and capabilities that can give Soldiers the safe water resources they need to thrive in the field and further the Army’s mission, there is also an educational component that officials of both GVSC and Wayne State hope will pay dividends in the future for both the military and the school—and the rest of society.

In fact, the water detection research was stimulated by previously funded research collaborations between the Army and Wayne State that focused on developing rapid detection technologies for biological and chemical agents, Walker explained. The new partnership builds on this existing relationship and also leverages the expertise of Wayne State professors, including previous research conducted by Professor Gregory Auner and new research efforts proposed by McElmurry and Professor Amar Basu to develop innovative solutions for water purification.

It helps that the two organizations have capabilities and resources that are different but complementary. Wayne State faculty “use an integrated approach to engineering in terms of how we can take digital tools, models, simulations and all the advanced technologies that are needed to really stay in front of that innovation curve,” Ezemenari Obasi, Ph.D., Wayne State’s vice president for research and innovation, said in a university article touting the new partnership. He noted that among other areas, the school is “pioneering research in integrated augmented technology, figuring out ways of using virtual reality and pairing new technologies with autonomous machinery.”

Meanwhile, as the DOD’s technology laboratory and engineering center of excellence for all ground vehicle advancement and development, GVSC has a number of unique focus areas, among them human machine integrated formations: Advanced manufacturing, modeling, simulation and prototyping, and survivability and protection.

As part of that mission, GVSC collaborates with various universities in a very hands-on fashion, relying on a quad structure made

up of four specific team members: A university faculty member, a graduate student, a GVSC member and an industry advisory member. This approach ensures that research aligns with the Army’s mission and is eventually transitioned for use by Soldiers; that industry will benefit through direct technology transition; and in this case, that Wayne State students gain a deep understanding of both the needs of the Army and industry and have the opportunity to work in GVSC laboratories during the course of the project.

“It’s exciting that our students will have an opportunity to meet and work with leaders in this field from the Army and engage in developing a solution for this real-world problem to benefit our military and civilians,” McElmurry said.

### CONCLUSION

The project is now moving forward quickly, Walker said. GVSC has already transferred key Army analytical equipment and test stands to Wayne State, which will enable the collaborative research projects to begin developing innovative solutions for detecting harmful bacteria and chemical agents, as well as novel treatment processes for PPCPs and PFAS.

As a result of this collaboration, Walker noted, both the Army and civil society will reap a number of benefits. Among these are “the development of innovative solutions for water purification, improved detection and removal of harmful bacteria and chemical agents, and enhanced protection of public health. The project will also contribute to the advancement of scientific knowledge and technology, with potential applications in a range of fields, from environmental monitoring to medical research.”

*For more information on DEVCOM GVSC, go to <https://gvsc.devcom.army.mil>.*

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