U.S. ARMY

2024 YEAR IN REVIEW

DEVCOM CBC

U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND CHEMICAL BIOLOGICAL CENTER

The U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) is aligned under the U.S. Army Futures Command (AFC), which transforms the Army to ensure war-winning future readiness. DEVCOM, a major subordinate command of AFC, is a team of world-class scientists, engineers, analysts, technicians, and support staff who are fully focused on empowering our Soldiers today and in the future. DEVCOM CBC provides innovative chemical, biological, radiological, nuclear and explosive (CBRNE) defense capabilities to the Joint Warfighter and uses a hands-on approach of research, engineering and operations in the development of CBRNE defense solutions. DEVCOM CBC is headquartered at Aberdeen Proving Ground—Edgewood Area, Maryland. The DEVCOM CBC 2024 Year in Review is an authorized publication for members of the Department of Defense. The contents of DEVCOM CBC 2024 Year in Review are not necessarily the official views of, or endorsed by, the U.S. Government or the Department of the Army. Editorial content of this publication is the responsibility of the DEVCOM CBC Office of Public Affairs. References to commercial products or entities in this publication do not constitute endorsement by the U.S. Army of the products or services offered.

U.S. ARMY

For more information about DEVCOM CBC, or to contact us, visit us on the Web at ***https://www.cbc.devcom.army.mil/***

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Front Cover: DEVCOM CBC engineer Sean Feiss shows a chemical specialist from Nevada's 455th Chemical Brigade how to operate a Black Hornet drone during a chemical agent detection exercise at Aberdeen Proving Ground, Maryland.

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DIRECTOR'S MESSAGE

2024 - DRIVING INNOVATION TO SUPPORT ARMY TRANSFORMATION

2024 was a year of innovation, collaboration and growth at DEVCOM CBC. We continued to provide excellent customer service while enhancing existing partnerships and developing new ones. Our stakeholders are critical to our success. Our common goals and unified missions enable us to tackle hard problems, and the past year was no different. The Center remains committed to providing the best chemical, biological, radiological, nuclear and explosives (CBRNe) defense research and engineering solutions to keep our warfighters and nation safe. This Year in Review showcases the unique capabilities of our workforce and the innovation driving us into the future.

At DEVCOM CBC, our technical expertise touches every phase of the acquisition lifecycle: from basic and applied research; to concept and product development; to chemical and biological surety and non-surety product testing; to system development and engineering; to prototyping, production and sustainment of CBRNe systems.

The unique chemical-biological (CB) defense mission of the Center is led by a workforce of world-renowned scientists, specialists, engineers, technicians, and support personnel. We also know that CB defense is a collective effort—when we work together with others, it increases our efficiency and scalability of the solutions we produce and field. We collaborate with other government agencies, industry, academia and international partners to advance and integrate science and technology.

One area where we made significant gains in 2024 was in biotechnology. In June, DEVCOM CBC cut the ribbon on a newly renovated and expanded Army Biomanufacturing Facility. The facility helps to support the nation in the ability to create new materials for national defense without relying on foreign suppliers. It will have a great impact on the Baltimore region, as well as bring value to the Chemical Biological Defense Program and our national defense. I am very proud of the hard work that went into establishing this facility and I am excited for us to continue leading the country in the biomanufacturing effort.

2024 was also a year of reflection and recognition of important milestones for DEVCOM CBC. We celebrated the tenth anniversary of the historic destruction of the Syrian declared chemical agent stockpile aboard the Cape Ray. The ceremony offered the opportunity to showcase our chemical agent destruction technologies and highlight the advancement that has taken place over the last ten years. We inducted two individuals into the DEVCOM CBC Hall of Fame – the James Michael "Mike" Cress and the late George Collins. In November, we buried the DEVCOM CBC time capsule, which contained items from over the last 100-plus years representing the Center's history as well as its future.

I'm proud of the work we have done this year to drive transformation and innovation. We have developed technologies; cultivated partnerships; participated in exercises and demonstrations; and continued our STEM outreach to grow the next generation of scientists and engineers. 2025 will bring new opportunities and I know DEVCOM CBC is prepared to rise and succeed. We are dedicated to meeting the needs of the warfighter and our nation today, while also creating long-term change for the Army.

Sincerely,

Michael Bailey
Director
U.S. Army Combat Capabilities Development Command
Chemical Biological Center

CENTER OVERVIEW

The U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) is the primary Department of Defense (DoD) technical organization for chemical and biological defense. It is aligned under the U.S. Army Futures Command (AFC) and U.S. Army Combat Capabilities Development Command. The Center's mission is to provide innovative CBRNE defense capabilities to enable the joint warfighter's dominance on the battlefield and interagency defense of the homeland. Its vision is to be the Army's premier research and engineering center generating CBRNE solutions for the Army, DoD, the nation, and our allies. At DEVCOM CBC we specialize in research, development and engineering combined with testing, training, and field operations to develop innovative, effective CBRNE defense solutions. We integrate a hands-on approach to science and experimentation, partnering with other government agencies, industry, and academia. CBC develops, tests, and applies technologies for the protection of warfighters, first responders, and the nation from chemical and biological warfare threats. The Center is developing and refining enhanced capabilities to improve safety and accuracy in the detection and decontamination of chemical and biological materials. DEVCOM CBC is also developing a new generation of technologies to counter future and unconventional threats and spearheading efforts related to biomanufacturing and synthetic biology to scale-up materials production. DEVCOM CBC's multifaceted workforce is comprised of a team of problem-solvers and innovators, including scientists, specialists, engineers, technicians and subject matter experts. Our people, along with our unique infrastructure and partnerships, allow us to conduct joint CBRNE defense research and development efforts in support of the nation's defense technology needs and goals.

Mission

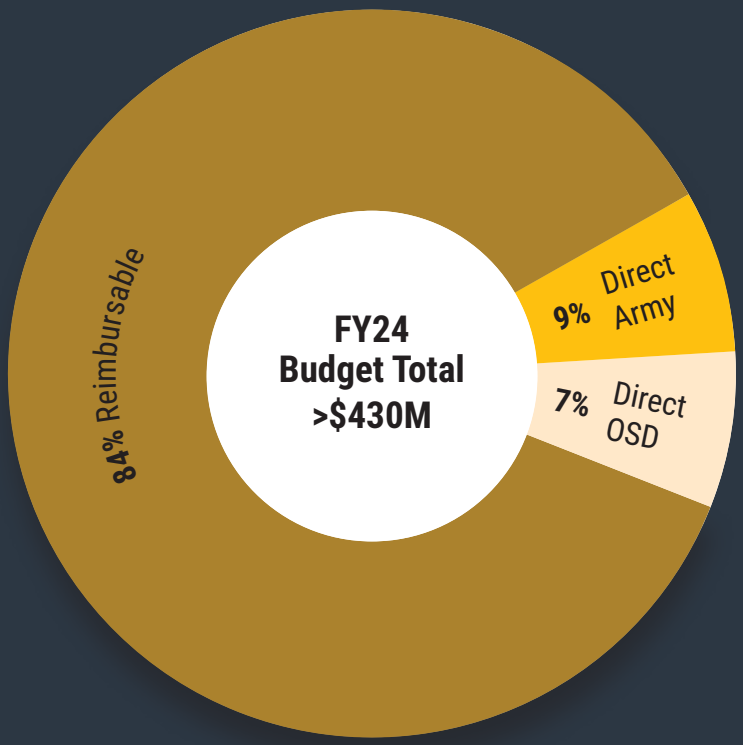
Provide innovative chemical, biological, radiological, nuclear and explosive (CBRNE) defense capabilities to enable the Joint Warfighters' dominance on the battlefield and interagency defense of the homeland.

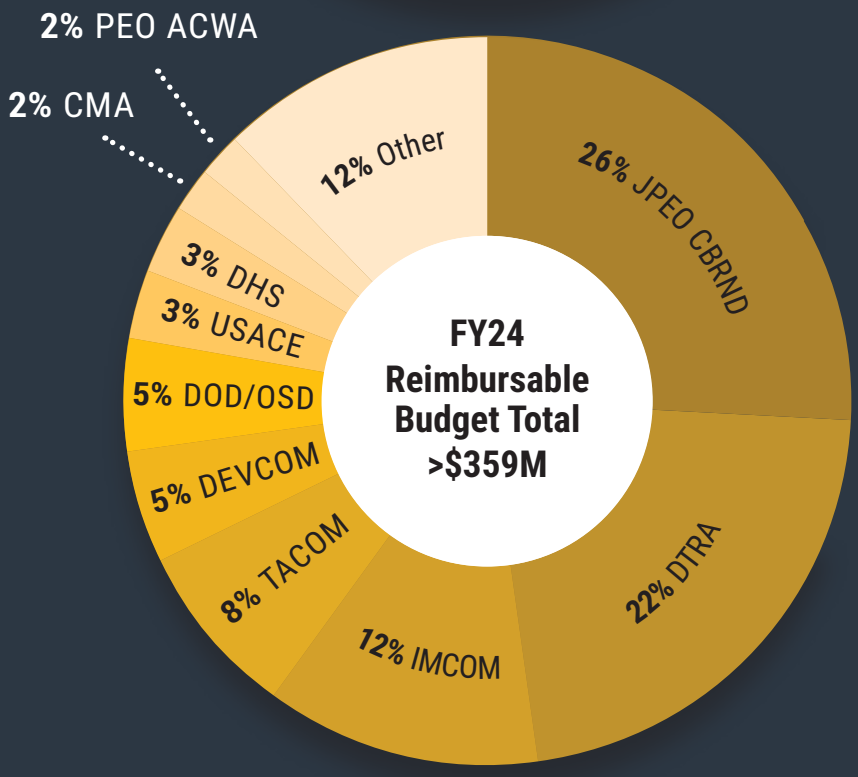
Vision

To be the Army's premier research and engineering center generating CBRNE solutions for the Army, DoD, the Nation, and our Allies.

ANNUAL REPORT

Budgetary Information





>$3.6M

DEVCOM CBC researchers received in funding through the FY24 In-House Laboratory Independent Research (ILIR) and Chemical Biological Advanced Materials and Manufacturing Science (CBAMMS) programs.

86%

of DEVCOM CBC's programs were funded by external customers using a fee-for-service model, distinguishing the Center from other Army laboratories in FY24.

>$423K

was invested into seedling research projects, which are smaller-scale exploratory basic research projects with a high potential for future funding opportunities.

2024 By The Numbers

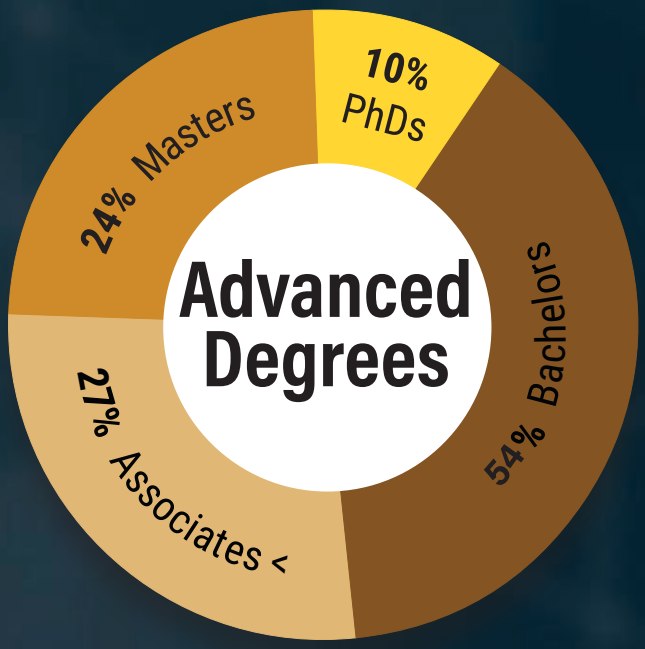
$4.2M
in funding from Testing and Cooperative Research and Development Agreements

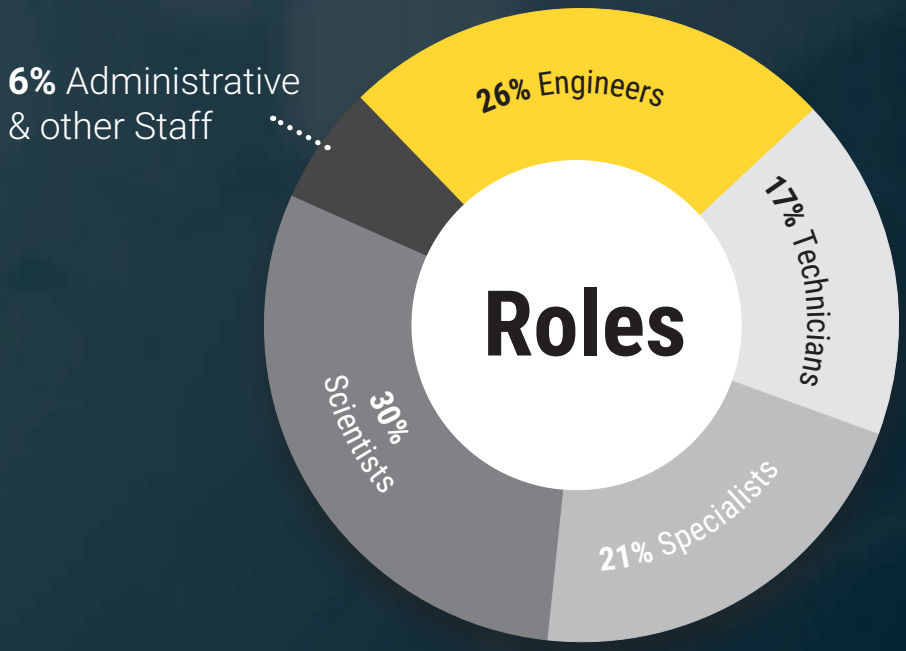
11
patents awarded in 2024

113
students and trainees grew their skillsets at DEVCOM CBC

31
peer-reviewed publications (FY24)

Workforce Information





OUR WORKFORCE

DEVCOM Chemical Biological Center biologist Priscilla Lee evaluates 3D-printed human dermal fibroblasts on plate designed to hold bioprinted skin.

DEVCOM CBC Scientist Uses Seed Money Grant to Launch Artificial Skin Research

Skin. It is the largest organ in the human body and the first line of defense against chemical agents. With that in mind, Priscilla Lee, a DEVCOM CBC bioengineering researcher, wanted to see if skin could be 3D printed for research purposes.

She knew she needed to find a research partner with the right equipment and prior experience in this highly specialized area. That is where serendipity, and keeping up with the news came in. Her division chief, Dr. Kyle Glover, read an article in The Wall Street Journal about how researchers at the University of Delaware were 3D-printing lung cells. As a University of Delaware alumnus, Glover arranged for Lee to travel to the Chemical and Biomolecular Engineering Department to meet professors Dr. April Kloxin and Dr. Cathy Fromen and a Ph.D. candidate working on the project, Bree Huntington.

Inspired by the visit, Lee applied for a seedling grant under DEVCOM CBC's QUEST Program which stands for 'Quick Empowerment leads to Successful Tomorrows.' Projects of any size from $5,000 to $100,000 are considered, so long as they relate to the Center's mission. Lee's project received a $40,000 grant.

Lee reached out to Kloxin and Huntington, who agreed to collaborate on research to 3D print skin. DEVCOM CBC's Technology Transfer Office started a joint work statement for a cooperative research and development agreement with the University of Delaware.

The University of Delaware used a highly advanced 3D printer known as a Rastrum made by Inventia Life Science. They taught Lee how to use the printer and how to blend the ingredients that go in the printer. They are dermal fiberblast that forms the cellular architecture, much like using two-by-fours to frame a house, plus a bio-anchor material called bioink that fixes the cellular material inside that framing, followed by cell simulants provided by a commercial vendor.

The result was not actual human skin, but a small sheet of tissue with many skin-like characteristics that when exposed to chemical agent, can provide valuable research results. Lee brought these skin models to the DEVCOM CBC research campus at Aberdeen Proving Ground where they could be exposed to mustard agent to closely observe and measure its actual blistering effect at the cellular level.

Lee plans on comparing her findings from this project with the large repository of historical exposure data at the Center using actual skin data from the 1940s and 1950s.

With these results, she has performed what the QUEST Program was created to do, allow Center scientists with a good idea to use seed money to achieve a proof of concept. Having done that, she was able to pursue further research with the Johns Hopkins University Applied Physics Laboratory using a more complex skin model. Her results also led to her receiving more internal funding for researching 3D printing of skin and eyes using the Center's In-House Laboratory Independent Research program, in collaboration with other scientists and engineers in the R&O directorate.

In addition, she has received funding from the Defense Threat Reduction Agency to incorporate immune cells into bioprinted skin and lung models, which continues the collaboration with the University of Delaware. She also plans to explore opportunities for collaboration with Wake Forest University, a long-time Center partner in organ-on-a-chip research.

DEVCOM CBC Team Earns Top Honors in Army Acquisition Writing Competition

For the second year in a row, employees from DEVCOM CBC were recipients of the Army's 2023 Major General Harold J. "Harry" Greene Award for Acquisition Writing in the category of "Acquisition Reform." The honor was awarded for an essay on the Center's Warfighter Innovation Leveraging Expertise and Experimentation (WILE-E) Pilot Program that was co-authored by three CBC employees.

Established in 2014, the purpose of the writing competition is to encourage the sharing of ideas, insights and experiences for improving Army acquisition. Winning submissions are selected for publication in the Army's AL&T Magazine and the authors are recognized during the Army's Annual Acquisition Awards Ceremony held at the Pentagon.

The winning trio from DEVCOM CBC consisted of research chemist and principal technical lead for the WILE-E program Dr. Alan Samuels, public affairs specialist Dr. Brian Feeney, and research toxicologist and WILE-E team lead Dr. Jennifer Sekowski. The group's integration on this effort proved to be a natural fit. Each member effectively worked off one another's strengths and found inspiration while working with the WILE-E team.

The WILE-E program began in 2018 as a way to introduce technology that is currently under development to the warfighter very early on in the process to get real-world practical feedback to help guide requirements. WILE-E's methodology employs a small, cross-functional, multidisciplinary team that applies design thinking principles to develop solutions to complex challenges. The WILE-E program has been an innovative asset specific to the Center and reached its third iteration in the last year.

Sekowski served as the team lead for the program's third iteration, known as WILE-E 3.0. Samuels served as a technical lead on the project, supplying expertise in the subject matter of the problem statement and an extensive network of technical and operational contacts to enable the development of technology solutions. Sekowski's leadership and Samuels' expertise culminated in a highly successful WILE-E cycle, supplying compelling content for the winning essay.

DEVCOM CBC public affairs specialist Dr. Brian Feeney, research chemist Dr. Alan Samuels, and research toxicologist Dr. Jennifer Sekowski received the Army's 2023 Major General Harold J. Greene Award for Acquisition Writing during the Army's Annual Acquisition Awards Ceremony held at the Pentagon on January 9, 2024. The awards were presented by the Honorable Douglas R. Bush, Assistant Secretary of the Army for Acquisition, Logistics and Technology, and Lieutenant General Robert M. Collins, Principal Military Deputy to ASA (ALT).

Dr. James Watson Inducted into SES Corps

Dr. James "Jim" Watson was formally inducted into the Senior Executive Service (SES) Corps and recognized as Director of Engineering for DEVCOM CBC in a ceremony at Aberdeen Proving Ground's Edgewood campus on Jan. 18.

As the Center's Director of Engineering, Watson oversees a staff of roughly 500 engineers, scientists, logisticians, and other highly skilled professionals who work to design, build, test and sustain Chemical, Biological, Radiological and Nuclear (CBRN) capabilities for the joint warfighters and other customers.

Watson joins more than 8,000 other members in the Senior Executive Service (SES) Corps, which was established in 1978 to be a corps of executives to serve in key governmental positions not filled by top presidential appointees. It is the highest rank of civilian service in the government.

Watson's position was made official during a pinning ceremony where he was joined by friends and colleagues, both in person and virtually. DEVCOM's Deputy to the Commanding General Dr. Eric L. Moore officiated the ceremony. During his remarks, Moore shared Watson's contributions to the Department of Defense (DoD) as a whole and highlighted the value of Watson's leadership and expertise in the field. "Jim has worked on many assignments and did amazing work to make programs successful," Moore said. "He's very passionate about what he does and, most of all, he takes care of people. We are very pleased to have him, and I look forward to seeing him succeed in this role."

Watson has served in the DoD in the chemical biological defense field as a scientist and leader for more than 12 years. Prior to entering his current position, Watson was the Deputy Program Executive Officer for the Assembled Chemical Weapons Alternatives (PEO ACWA) headquartered at Aberdeen Proving Ground. There, he was responsible for assisting the Program Executive Officer with the oversight of all aspects of operations at the Pueblo Chemical Agent-Destruction Pilot Plant in Colorado, the Blue Grass Chemical Agent-Destruction Pilot Plant in Kentucky, and PEO ACWA's Anniston Field Office in Alabama. Under Watson's leadership, the PEO ACWA team destroyed the last munition in the U.S. declared chemical weapons stockpile.

Dr. Eric Moore presented Dr. James Watson with the SES certificate during Watson's SES Induction Ceremony held at DEVCOM CBC on January 18, 2024, recognizing him as the Center's newest Engineering Director.

DEVCOM CBC Employees Recognized as Visionaries by Northeastern Maryland Technology Council

Three members of the DEVCOM CBC workforce were recognized for their outstanding achievements during the Northeastern Maryland Technology Council's (NMTC) Visionary Awards.

DEVCOM CBC Biologist Priscilla Lee, Research Biologist Dylan Fudge and Branch Chief of Rapid Technology and Inspection Rick Moore attended the council's Visionary Awards gala at the Water's Edge Event Center to be recognized for this honor. The NMTC Visionary Awards, held on February 29, celebrate neighbors, colleagues, family, and friends for volunteer efforts that contribute to building the area workforce in science, technology, engineering, and mathematics (STEM) education while advancing technology and innovation for children and protecting national security.

Over the past 13 years, 180 professionals have received the Visionary Award which is comprised of five award categories. Recipients are recognized for being visionaries, leaders, innovators, mentors, and rising stars.

Lee was awarded the Rising Star Award which recognizes individuals who demonstrate the potential to be excellent, long-term contributors to building the STEM workforce or advancing innovation and technology.

Fudge, who also serves as mentor and doctoral advisor to Lee, received the Mentor Award which is for individuals who consistently go above and beyond in volunteering their knowledge, experiences, and wisdom to inspire students, teachers, and emerging technology businesses.

Moore received the Leader Award recognizing individuals who contribute to the STEM workforce while inspiring others to accomplish shared goals.

The NMTC connects member companies, organizations and individuals to their peers and influential decision-makers through networking, workshops, technology, and other events.

The Center's involvement with the council helps open doors for employees. The NMTC and The Visionary Awards serve as a platform that encourages CBC employees to serve, mentor, enhance their own career and the careers of those around them."

DEVCOM CBC Biologist Priscilla Lee, Research Biologist Dylan Fudge and Branch Chief of Rapid Technology and Inspection, Rick Moore received NMTC Visionary Award during the Visionary Awards Gala on February 29, 2024.

DEVCOM CBC Microbiologist Wins STEM Achievement Award

For the second year in a row, an employee from DEVCOM CBC received the Joseph D. Wienand STEM Excellence Award at the National Defense Industrial Association (NDIA) CBRN Conference & Expo held at the Baltimore Convention Center, Maryland.

Sarah Katoski, a DEVCOM CBC microbiologist, received the CBRN Division award for her outstanding contributions to innovation within various CBRN defense programs. The award's name is in honor of Joseph D. Wienand, former director of DEVCOM CBC (then known as the Edgewood Chemical Biological Center) from 2010-2014.

This award specifically targets individuals in junior to mid-level positions who contribute to the STEM aspects of CBRN defense.

Katoski, who brings with her 20 years of military background, was selected based on her pioneering work in the microbiology field as well as her work on multiple projects at the Center. In her time at DEVCOM CBC, she has significantly impacted CBRN efforts and has helped train the next generation of STEM professionals.

Katoski's innovative work includes a congressionally funded effort to evaluate a commercially available handheld UV-C device working with an industry partner. She also led an initiative that evaluated decontamination efficacy and worked in parallel with the Department of Agriculture and NASA as they developed detection capability within the same device.

Katoski also strives to leave an enduring legacy in STEM fields and the CBRN industry by participating in community outreach events such as the Aberdeen Proving Ground STEM Day, the annual Magic of Science Fair and Family Festival and the grand opening of the Discovery Center at Water's Edge. She is a mentor at the Science and Mathematics Academy at Aberdeen High School, guiding students on their way to becoming the next generation of scientists.

U.S. Army Brigadier General (retired) William King, Chairman of the National Defense Industrial Association (NDIA) CBRN Division, presents Sarah Katoski with her Joseph D. Wienand STEM Excellence Award at the NDIA CBRN Conference & Expo held at the Baltimore Convention Center, Maryland.

Center Buries Time Capsule to be Opened in 2067

DEVCOM CBC senior leaders along with DEVCOM Deputy to the Commanding General Dr. Eric Moore led a ceremony Nov. 6 to bury a time capsule containing more than 100 items representative of the Center's recent research and development of protective technologies. It will be opened in 2067, the Center's 150th anniversary.

The time capsule was lowered into the ground next to the Center's iconic statue of a warfighter and a scientist standing together in front of a double helix in the Center's Centennial Circle at its Aberdeen Proving Ground, Maryland research campus. The statue was designed as part of the Center's 100-year anniversary celebration in 2017 and bears the inscription Cum Scientia Defendimus -- Latin for With Science We Defend.

Moore was the DEVCOM Chemical Biological Center's director during its 100th anniversary year and in remarks at the ceremony he reflected on the symbolic significance of the time capsule. "I looked back on that centennial year and at the things Center researchers have been doing in the seven years since, things such as training dogs to sniff COVID, growing lung organoids on chips, biomanufacturing, better protective vehicle coatings, and you've been doing a lot of very important things to protect the warfighter and the nation."

In his remarks, current DEVCOM Chemical Biological Center Director Michael Bailey pointed out the continuity of research process. "Just as we stand on the shoulders of the hundred plus years of past researchers' work today, when the time capsule is opened in 2067, those researchers will appreciate that they stand on your shoulders."

Research and Operations Director Frederick Cox added, "There are a lot of memorials around Aberdeen Proving Ground; this one is in recognition of your work. This completes the centennial celebration begun in 2017 and I am very proud to close it out in this way."

At the conclusion of their remarks, the Center directors and Moore locked the capsule together. It was then sealed and lowered into the ground followed by the leaders tossing the first shovelfuls of dirt into the hole. The event was followed by a fall festival of pumpkin painting, corn hole and refreshments.

DEVCOM CBC Director Michael Bailey, R&O Director Dr. Rick Cox, CBC director during the 100th anniversary and now Deputy to the DEVCOM Commanding General Dr. Eric Moore, and Engineering Director Dr. James Watson tossing the first shovelfuls of dirt into the hole containing the time capsule.

Members of the workforce enjoying a corn hole competition in a fall festival held after the burial ceremony.

The family of the late George Collins gathered at DEVCOM CBC's Hall of Fame display following his induction ceremony in May 2024.

DEVCOM CBC Honors Newest Inductees to Hall of Fame

The U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) honored its 2024 inductees to the Center Hall of Fame in two separate ceremonies this year.

During the most recent ceremony in August, James Michael "Mike" Cress, former liaison officer at Center, was inducted. This ceremony followed the induction in May of the late George Collins, the Center's former director of safety. Both individuals made monumental contributions to the Center's mission of developing and delivering capabilities to the warfighter.

During Collins's induction in May, several of his former coworkers shared stories about how he dedicated his life to fostering a work culture and attitude centered on improved safety. His policies, which emphasized protocols for chemical repositories, hazardous waste storage, personal protection, and chemical agent monitoring for local and international customers, were instrumental in protecting lives.

"He cared about people; that's why he was in safety and human resources," said Joseph Wienand, former director of DEVCOM CBC, or Edgewood Chemical Biological Center as it was known at the time. "He was patient, too. Whenever he'd offer nuggets of wisdom, he'd say, 'Have you considered...' and that's when you'd pay attention. He just loved all the people here."

Collins held dual leadership duties for the Center as the deputy director of chemical biological integration and director of safety. His chemical and biological risk management expertise was invaluable for the Army, DoD, and the nation.

"He was simply the gold standard – he made deliberate decisions and recognizable influences on everyone he met. He taught and cared for absolutely everyone," said Nancy Carter, CBC's chief operating officer and former mentee of Collins.

In the most recent induction ceremony honoring Mike Cress, members of the workforce shared their thoughts and reflections on how, for nearly 50 years, Cress was a positive influence, spurring innovation and providing leadership to the chemical, biological, radiological, and nuclear (CBRN) enterprise and DEVCOM CBC.

Cress, a lifelong contributor to the Center's and the nation's successes, joined the Army in 1966, serving two tours in Vietnam with the 101st Airborne Division and as an instructor at the U.S. Army Infantry School. After retiring with the rank of lieutenant colonel, he continued his passion for lifelong learning and educating others by becoming a trusted expert in tactical CBRN operations, shaping future strategies of the CBRN warfighter through his role as a liaison officer. Cress was a key contributor to the Chemical Reconnaissance, Explosive Screening System (CRESS) program. He holds multiple patents and won the 2022 MG Harold J. Greene Acquisition Writing Competition.

Though he retired in 2021, Cress continues to serve the Center as a part-time annuitant, working with DEVCOM CBC's Engineering Directorate on strategic initiatives and new projects.

A number of former colleagues spoke on Cress' behalf, including Dr. Eric Moore, former DEVCOM CBC director; DEVCOM CBC Scientists Dr. James Jensen and Janet Jensen; DEVCOM CBC Deputy Director of Engineering Lowry Brooks; and DEVCOM CBC Liaison Officer David Glynn.

"I am entirely confident that five minutes is not enough time even to come close to describing Mike's impact over the decades he has dedicated to our Nation, and I'm proud to call him my close friend," said Glynn, Cress' protégé before his retirement. "I cannot emphasize the profound leadership and mentorship that Mike has provided to those he has come into contact with throughout his career."

DEVCOM CBC Director Michael Bailey and newly inducted DEVCOM CBC Hall of Fame member James Michael Cress at Cress's induction ceremony in August 2024.

Following these remarks, Cress joined DEVCOM CBC Director Michael Bailey onstage for his awards and official induction before taking the podium himself to thank all those who impacted his career and reflect on what it means to support the warfighter.

"You don't get where you are today without overwhelming support from your family," said Cress. "A big aspect of this job is learning. We have a huge technical library here, and that extends to the people. The many wonderful researchers I've worked with over the years were eager to share their knowledge. Those bits and pieces made my career what it was."

Collins and Cress join Dr. Jim Baker and Dr. Harry Salem (both inducted in 2018), and William "Bill" Klein (2022) as members of the DEVCOM CBC Hall of Fame.

"This organization, in one form or another, has been here for over one hundred years," Bailey said during the August Hall of Fame induction ceremony. "It's safe to say that there have been tens of thousands of people who have passed through these doors. Out of that massive pool, only four have been inducted into our Hall of Fame. Today, we add our fifth."

IN THE FIELD

DEVCOM CBC biologist Priscilla Lee discusses a chemical agent response scenario with Marine Staff Sergeant Dalton Louks.

Developers, Warfighters Come Together at DTRA CBRN Technology Demonstration

Every year since 2018, the U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) has helped the Defense Threat Reduction Agency (DTRA) plan and execute an in-the-field user assessment of chemical, biological, radiological and nuclear (CBRN) technology in an event called Chemical and Biological Operational Analysis (CBOA). This year, CBOA was held at Camp LeJeune, North Carolina from April 13 to 18, and DEVCOM CBC was in the thick of it.

CBOA is funded under the Chemical Biological Defense Program and executed by DTRA's Joint Science and Technology Office. It brings technology developers from government agencies, industry and academia together with warfighters in order to put new technologies into warfighters' hands. Warfighter feedback provides vital input to technology developers, enabling them to make improvements and correct shortfalls.

At Camp LeJeune, warfighters put these protypes through their paces in realistic field scenarios in which warfighters used them to interrogate mock unknown CBRN weapons caches. After running through each scenario, the warfighters gave the technology developers very specific feedback on what worked, what did not and how they could be improved.

That feedback is often simple but important, such as, "The labeling of the buttons on the chemical agent detection device is confusing." It can also lead to new innovations, such as, "Can I mount the device on my helmet so that my hands are free?" Feedback can also include how warfighters are taught to use the new equipment, such as "Most of the people in my unit are visual learners, can you make a video version of the user's manual?"

Clare Hamilton, a DEVCOM CBC program analyst, has supported CBOA since its inception. This year, she managed the Concept Tent during the CBOA event where technologies under development but not mature enough to use in the scenarios were displayed. Starting last October, she helped evaluate all the candidate technologies submitted by the technology developers and coordinated their participation in the Concept Tent. Of the 19 technologies displayed on tabletops in the tent this year, five were developed by DEVCOM CBC.

Some of the tasks DEVCOM CBC personnel took on were highly technical. David Glynn, a DEVCOM CBC liaison officer to the U.S. Army Maneuver Support Center of Excellence at Fort Leonard Wood, Missouri, assisted as a "lane walker" at one of the scenario locations. It is a role that requires a keen knowledge of both CBRN technology and the way the scenario was designed.

"It was my responsibility to ensure that the warfighters participating in the scenario were trained in the proper use of the assigned new technology. I also ensure all

> **At CBOA we get to see early science and technology that will pay off in time. Many technologies we and others have brought over the years have been licensed to industry for production and are now fielded...**

users were at the right location at the right time in order to start the missions," said Glynn. "While conducting missions, I made sure that every technology was used in the manner it was designed to be used. I also ensured the right simulants were in place in order to properly trigger a response form the technology."

DTRA organizers have used lessons learned over time to steadily improve CBOA's value to both technology developers and warfighters. This year's event included two full days of warfighter training on the prototype technologies before the actual scenario run-throughs.

There were six scenarios in all, spanning chemical, biological, and pharmaceutical-based agents, as well as radiological threats. The scenario participants, 110 in all, included U.S. Special Forces, Marines, Soldiers, Airmen, Coast Guard, and Custom and Border Patrol members. At the end of each scenario, warfighters shared their evaluations of the new CBRN technologies in both face-to-face discussions and by filling out detailed questionnaires. As the DTRA project manager for the event, Markham Smith, put it, "We want technology developers to make their improvements while the clay is still wet."

DEVCOM CBC Director Michael Bailey attended the event and was pleased with what he saw. "At CBOA we get to see early science and technology that will pay off in time. Many technologies we and others have brought over the years have been licensed to industry for production and are now fielded," he said. "CBOA is able to do this because of the wide range of organizations it brings together, agencies like the Department of Homeland Security, defense research laboratories, the services and many different technology developers from industry. That makes CBOA a big contributor to the nation's CBRN defense. I appreciate that DTRA uses our help for this extraordinary event every year."

A warfighter uses new technology to identify an unknown agent simulant during a field trial scenario.

DEVCOM CBC industrial engineer Stella Lee hands out ID bracelets to warfighters to test a prototype at CBOA24 held at Camp LeJeune, North Carolina April 13-18.

Director of the Joint Science and Technology Office Dr. Robert Kristovich, Deputy Assistant Secretary of Defense for Chemical and Biological Defense Dr. Ian Watson, and CBC Director Michael Bailey learn about an Individual Water Treatment System in the CBOA24 Concept tent.

Soldiers of the 1st Armored Division provide feedback to the Autonomous Equipment Decontamination System development team after spending several days using the system.

Soldiers Test Drive Autonomous Equipment Decontamination System at MSPIX 24

The best way to find out if a new car is right for you is to take it for a spin. When it comes to a new way to decontaminate military vehicles using mobile robotic technology, the same holds true. Take a seat at the computer, operate the system's remote controls and see what feels right and what doesn't.

That is exactly what four Soldiers from the U.S. Army's 1st Armored Division did at this year's Maneuver Support and Protection Integration eXperiments event, or MSPIX, held at Fort Leonard Wood, Missouri, May 6 to 23. The robotic system they were operating was the DEVCOM CBC's Autonomous Equipment Decontamination System.

The CBRN Soldiers spent four days operating the system, followed by face-to-face feedback with the technology development team on what they liked about it and what parts of it can be improved.

The Autonomous Equipment Decontamination System consists of a camera mounted on an unmanned ground vehicle (UGV). The camera scans the entire vehicle surface as it circles around it, transmitting the contamination data back to the system operators seated at a computer safely in the rear. A robotic manipulator arm then uses that data to spray a decontamination slurry developed by DEVCOM CBC on only those chemical agent hotspots, conserving decontaminant and saving time.

Marc Schwarzkopf, a DEVCOM Ground Vehicle Systems Center support contractor and member of the Autonomous Equipment Decontamination System development team, teaches Sgt. First Class Laura Zietz of MS CDID how to use the system for unmanned chemical agent decontamination in the field.

The best way to find out if a new car is right for you is to take it for a spin. When it comes to a new way to decontaminate military vehicles using mobile robotic technology, the same holds true. Take a seat at the computer, operate the system's remote controls and see what feels right and what doesn't.

Soldiers from MS CDID examine DEVCOM CBC's Autonomous Equipment Decontamination System at MSPIX 24 held at Fort Leonard Wood, Missouri, May 6 to 23.

The Autonomous Equipment Decontamination System team received valuable feedback that they will use to refine the technology. The Soldiers pointed out the challenges encountered by the robotic platform while navigating around and manipulating the odd shapes and hard to reach surfaces of some military vehicles. The Soldiers also noticed simple things, such as adding right click functionality to the mouse on the computer interface to add more user capability. Finally, the Soldiers wanted to have a manual override for the applicator arm in case they find that not all the hot spots are being reached in autonomous mode.

Autonomous Equipment Decontamination is a multi-year cooperative project led by DEVCOM CBC. In addition to DEVCOM Army Research Laboratory support in designing the system's robotic arm, DEVCOM Ground Vehicle Systems Center supports the computer interface and UGV operations. Industry partner Teledyne FLIR supports the development of software for the system's camera.

Currently, it takes a team of 20 to 30 Soldiers in full protective gear 45 to 60 minutes to decontaminate each vehicle exposed to chemical or biological hazards. Soldiers must perform this task close to the point of exposure and may be vulnerable to enemy fire. The process takes more than 500 gallons of water and 50 gallons of decontaminant per vehicle.

DEVCOM CBC explosives chemistry expert Joseph Domanico explains to a group of West Point cadets how smoke obscurants are used on the battlefield during a field trip on June 4.

West Point Cadets Benefit from Half Century of Explosives Experience

Five West Point cadets traveled to DEVCOM CBC's Aberdeen Proving Ground research campus in Maryland to learn about pyrotechnics and explosives chemistry from 50-year pyrotechnics and explosives research and development veteran Joseph Domanico on a June 4 field trip. Instruction included a lecture by Domanico followed by tours of the Center's Obscuration Research and Chamber Test Facility and the Energetics Prototyping Facility followed by a smoke/obscurants and incendiary device demonstration on an Army test range.

The United States Military Academy (USMA) at West Point and DEVCOM CBC have enjoyed a collaborative relationship for more than 30 years. It started with summer internships and has expanded to cadets performing collaborative research with DEVCOM CBC scientists during the academic year using laboratories at the USMA Department of Chemistry and Life Sciences while receiving guidance from DEVCOM CBC mentors. These collaborations have included chemical warfare agent degradation strategies, battery development, agent and explosives detection, energetics, additive manufacturing capabilities, and propellant development.

Domanico's enthusiasm for the subject and his humor shone through on this visit. There was no PowerPoint, instead, using models, he simply spoke from his experience about a wide variety of smoke obscurant, incendiary and nonlethal munition devices he helped develop over the years. His talk included many colorful stories dating back to when he first arrived at APG to do pyrotechnics and explosives research as a lieutenant in 1974.

National Training Center Visit Inspires Army Scientist

After visiting the National Training Center (NTC), a scientist from the U.S. Army's Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) was inspired to improve her work for the Center's end-customer—the warfighter.

Dr. Danielle Kuhn, Acting Branch Chief of the Center's Smoke and Target Defeat branch, visited the NTC in Fort Irwin, California, along with DEVCOM Command Sergeant Major Brian Haydt and personnel from other DEVCOM laboratories, to witness a live fire demonstration using obscuration and smoke that simulated a battlefield environment.

The U.S. Army created the training center in 1981 to train armored brigade combat teams, develop the best readiness with the most lethal fighting force in the world, and enhance and equip the warfighter with the best skills to be successful on the battlefield.

In February, Kuhn and the visiting group watched maneuvers in which artillery rounds containing white phosphorus were fired. They generated smoke clouds that were a part of the tactical strategy to execute their maneuver. Kuhn noted, "It was wonderful to see everything in scale."

Kuhn was selected to attend the NTC after demonstrating DEVCOM CBC's smoke obscurant capabilities for DEVCOM leaders. "We were impressed by her presentations on smoke, and she had never seen her work used in real-time," Haydt said. "So, we invited her to the training center, and we thought it would be great leader development to go out and see the work and talk to some of the warfighting professionals and see how they can take their experiences to the next level."

The purpose of the week-long visit was to exemplify the collaborative spirit between Army scientists and warfighters. It provided an opportunity for scientists like Kuhn to engage with warfighters, witness some of their research and development work in real-world scenarios, ask questions about their capabilities, and offer recommendations for modernization and improvement. "I had open dialogues about the warfighter's needs and wants and what's realistic. They answered my questions, and it was helpful to them to explain a little about smoke and obscuration and some of its possible capabilities. It was an awesome two-way conversation," Kuhn said, highlighting the sense of unity and shared purpose that permeated the visit.

In the future, Kuhn envisions further modernization of DEVCOM CBC's obscuration efforts by incorporating bi-spectral capabilities. "White phosphorus is incredible when it comes to obscuring visually, but utilizing anything that possesses thermal or infrared vision, you would be able to see through the cloud," she said. "Bispectral capability, the ability to cover visual through far into the infrared is imperative."

After the visit, Kuhn's perspective on her work and the Center's mission was profoundly transformed. "This experience was life changing. What I saw was so incredible—so humbling, and it really put things into perspective about who our customer is," she said. "It makes me ask myself how I can do better to protect the warfighter. It just made me want to be better for them."

Dr. Danielle Kuhn, Acting Chief of DEVCOM CBC's Smoke and Target Defeat Branch, visited the National Training Center to witness obscurant demonstrations and engage with the warfighter.

> **"What I saw was so incredible— so humbling, and it really put things into perspective about who our customer is."**

ACHIEVEMENTS AT A GLANCE

Center Researchers Provide Capabilities for Warfighter Protection

The Protection Division of the DEVCOM CBC Research and Operations Directorate has a complex mission that focuses on research and development of superior technologies for chemical and biological protection, filtration, decontamination, obscuration, and nonlethal target defeat, along with providing training and operational reach-back support to Joint Chemical, Biological, Radiological and Nuclear, or CBRN, units and organizations.

In 2024, the division continued to rely on its expertise to provide unique capabilities to a broad base of customers and worked to continue academic research relationships that will help sustain the Center and the Army in the coming years.

For any given piece of Soldier equipment contaminated with chemical warfare agent and decontaminated, methods to quantify the potential exposure risks of using the equipment once it is decontaminated are vital to the division's work. Innovation in this area was demonstrated by the Protection Division in 2024. The test configuration, a simple shim panel, is used to replicate agent retained in the smallest areas of equipment, such as screw threads, holes, seams, weather stripping and other small gaps. The team's implementation of the shim panel methodology for assessment of chemical decontamination efficacy is now coupled with a new data analysis capability that translates laboratory results to operational health risk levels. This new capability helps simplify the complex reality of decontaminating something with many small parts and gaps and achieving an understanding of the results quickly.

The Protection Division collaborates frequently with academia and awarded two Congressionally directed appropriations efforts. Northwestern University in Evanston, Illinois is conducting research with high throughput materials synthesis and characterization while the University of Delaware in Newark, Delaware is exploring reusable polymer technologies. The division also hosted a group of Cadets from United States Military Academy to demonstrate how pyrotechnics and explosives experts perform research, development, prototyping and testing of novel energetic payload materials and the devices that employ them.

The team also initiated the Agile Design of Adsorbent Processes and Techniques, or ADAPT, effort to investigate alternative chemicals for carbon-filter performance testing. Active carbon is the most commonly used adsorbent and is particularly suited to the removal of chemical agents and acid gasses. ADAPT seeks to improve testing performance and ultimately help ensure warfighter safety.

The division also completed two successful rounds of Lot Acceptance Test (LAT) qualifications for sensitive site protection items, and they completed work identifying a catalyst with enhanced oxidative capabilities to decompose chemical warfare agents.

A warfighter wears layers of protective gear so that he is ready for any CBRNe scenario on the battlefield.

A soldier demonstrates the use of decontamination slurry, a paint-like substance that can decontaminate an entire vehicle with very little water.

Biomaterials, Sensors Support Operations on Future CBRN-Compromised Battlefields

Biological and chemical threats are a critical point for the defense of our nation as well as being the underpinning of the entire Center. The workforce behind the research and capability execution of the Sensor Technologies & Biomaterials Division are the ones who are strengthening and supporting the ability to operate in a CBRN-compromised warzone. They are the teams that research and create the tech that detects threats, thereby impacting decision making for the joint forces and generating material to equip the next generation of warfighter defense.

Culture media is added to a mini bioreactor to be used in the AMBR 250 12-Way Bioreactor system by DEVCOM CBC research biologists Jessica Paradysz and Nathan McDonald.

Following this year's ribbon cutting ceremony of the pilot-scale biomanufacturing facility, DEVCOM CBC is now poised to expand on collaborations across the tri-service while focusing on building the next generation of trained biomanufacturing professionals.

Across the division, the unique infrastructure and subject matter expertise to characterize biological threats, whether viral, bacterial or toxin, coupled with their engagements and leadership within NATO activities, positions the organization to be ready to defend against chem-bio threats with precise detection.

Looking back on their 2024 accomplishments outside of the new state-of-the-art facility, the division's resume includes efforts such as the CBAMMS-funded IronDog, which looks to research and improve upon military working dogs' abilities to detect illicit substances under exercise and duress. Their testing of the Autonomous BioAerosol Collection for Universal Sampling (ABACUS) project, funded by DTRA JSTO, assessed the aerosol collection capabilities of miniature autonomous vehicles to sample and determine locations where particles accumulate during a threat.

For 2025's docket, the division is looking to expand on efforts such as the expansion of AI detection capabilities to expand the CBRNE AI/ML mission to mobile laboratories, as well as support fielding of far-forward sequencing technology (F-FAST) and adding infectious disease sequencing capabilities to this future-fielded system. Finally, they will continue to remain involved in the recent upskilling effort between the Department of Energy and the Advance Biofuels and Bioproducts Process Development Unit (ABPDU) to help develop skills within the DoD workforce related to biomanufacturing process development.

Center Provides Critical Analysis Across Spectrum of Chemical Warfare Materials

The Threat Agent Science Division provides the United States and the Chemical Biological Defense Program with the critical information needed to prevent surprise and maintain operational readiness to respond to any chemical warfare materials threat. The Threat Agent Science Division has one-of-a-kind expertise and infrastructure to conduct experiments on highly hazardous materials in order to assess the risk of traditional, non-traditional and future chemical threats faced by the joint force.

The division performs synthesis and determination of physical and chemical properties of organophosphorous and biologically active compounds using highly specialized instruments including high-performance liquid chromatography mass spectrometry (HPLCMS), high-performance liquid chromatography multi-angle light scattering (HPLC/MALS), gas chromatography mass spectrometry (GC/MS), gas chromatography electron capture detector (GC/ECD) ion chromatography (IC) and capillary electrophoresis (CE) for structure elucidation. The division also performs separation of optically active isomers using chiral column chromatography and resolution techniques.

They also study environmental toxicity and ecotoxicology effects of chemicals in the environment using an operational greenhouse to evaluate various matrices for chemical warfare material fate.

Another area is performing studies characterizing atmospheric and agent properties in an aerosolized state. These methods are scalable and include glove box, large chamber and field assessments.

A long-term project is growing micro-physiological systems using organ-on-a-chip technologies in addition to silico programs for software estimates of chemical toxicity. It performs electrophysiology using patch clamp technology, and it performs physiological based pharmacokinetic modeling and simulations. Finally, the division is pioneering bioprinting technology.

The division hosts the Center's connectivity into the Army Persistent Experimentation eNvironment (APEN), the collaborative environment for Army Futures Command (AFC) simulation-aided experimentation system. APEN is being used by AFC to develop Army Modernization strategies through simulation with the Battle Labs and the DEVCOM R&D Centers.

Their researchers are proficient with R, MiniTab, JMP, MATLAB, Conversations in Python. The division members are experienced developers and users of stochastic and Markov Chain Monte Carlo (MCMC) methods and use the following externally developed simulations: OneSAF (combat simulation), EASEE (sensor placement tool), HPAC (atmospheric transport and dispersion), HPAC Analyst (detailed cloud visualization/analysis), Plume Tool (allows HPAC plumes to be used by OneSAF), and Individual Protection System Performance Model (IP SPM).

They also possess internally developed tools for disease spread modeling (EDDIS), detector test technical evaluation (Chem AVOID), and other

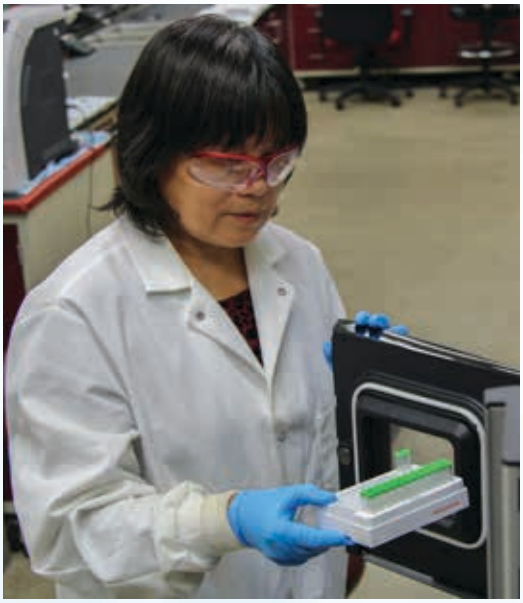
special use models and simulations. Finally, division researchers can perform Small Business Innovation Research (SBIR) technology reviews in each of its areas of expertise.

The NBC Battlefield Integration Branch within the division creates customizable solutions for battlefield integration such as NETT Warrior/TAK software applications. It offers integrated sensor data for enhanced command and control support and CBRN tactical radio networking. Solutions the branch offers its customers are unique and customized to their specific needs, and they better prepare customers for a rapidly changing CBRN threat environment.

The Forensic Analytical Analysis Branch collects and analyzes samples for the presence of chemical warfare related materials plus toxins, explosives, or pesticides. In addition, the branch is capable of conducting thorough chemical analysis on samples in diverse matrices including both environmental (e.g. soils, flooring, clothing) and biomedical (e.g. whole blood, plasma, urine).

The branch performs on-site and laboratory analysis using techniques such as gas chromatography liquid chromatography (GC/LC), mass spectrometry (MS) (low and high resolution), nuclear magnetic resonance (NMR), isotope ratio mass spectrometry (IRMS), elemental analysis with inductively coupled plasma mass spectrometry (ICPMS), scanning electron microscopy, X-ray diffraction (XRD) and various hand-held detector technologies such as Fourier transform infrared (FTIR) and Raman spectroscopy.

The branch is capable of rapid off-site deployable missions involving handheld detector interrogation, sample preparation, and GC/MS analysis, training and expert consultation services, and analyses on ultra-trace level, pure materials or any concentration in between.



DEVCOM CBC Research Chemist, Dr. Li Kong, analyzes samples from an in-vitro metabolic stability and biotransformation study using a Thermo Fisher Scientific Vanquish TM UPLC system coupled to an Orbitrap Fusion Tribrid mass spectrometer.

2024 Accomplishments

Members of the Agent Fate Branch completed initial small-scale testing and constructed a larger scale test chamber for the evaluation of pyrotechnic and small explosive dissemination of smoke candles containing pharmaceutical-based agents (PBAs). They also evaluated colorimetric test kits against various ratios of adulterated PBAs in acetaminophen under different environmental conditions, and they completed environmental fate testing of PBAs in soil and water.

Members of the Agent Chemistry Branch responded to multiple urgent requests for the Chem Bio Defense program by identifying synthesis routes for chemicals of interest and producing critical quantities that support multiple projects across the Center

Members of the Operational Toxicology Branch continued research on human estimates of toxicity that are reviewed by the Threat Agent Toxicological Standards Advisory Group. Their updated Carfentanil values were reviewed and accepted in 2024. Operational Toxicology continues to support multiple DARPA programs including PPB, Focus Pharma and Panacea.

Branch members worked to establish bioprinting capability using two new bioprinters, the Cellink BioX, which has multiple extrusion nozzles amenable to printing stratified skin tissue layers, and the Rastrum, which is a high throughput printer capable of printing 96 tissue scaffolds in one hour. This experimentation was performed in collaboration they with the University of Delaware.

They also began work on two DTRA-funded research projects, increasing the complexity of organ chip models by including immune components and medical countermeasures toxicity profiling using predictive toxicology framework.

Finally, they brought on the Maxwell artificial intelligence software system to establish neural networks, and brain and cardiac organoids on microelectrode arrays.

Modeling and Simulation Branch members participated in a modeling, simulation and analysis research initiated in collaboration with the Naval Post-Graduate School (NPS), and the US Environmental Protection Agency (EPA) for additions to the R software package httk, which is software authored by EPA for extrapolating human exposure models from high-throughput in-vitro toxico-kinetic data. Through the JPEO-CBRND Analytical Framework (AF), the branch supported the CBRN enhancements to the combat simulation, One Semi-Automated Forces (OneSAF) version 12.1 which was released in FY24. OneSAF is the Army's primary brigade and below combat simulation for training and analysis. A team of branch members and Chemical Security Analysis Center (CSAC) personnel supported the JSTO Joint Science and Technology Institute East (JSTI-East) STEM outreach event held at Towson University, Maryland. These mentors provided a two-week research project called Math Modeling Mania which introduced the mathematics and simulation techniques used at the Center.

The NBC Battlefield Integration Branch helped DTRA JSTO Strategic Engagements Division, Experimentation Branch (CBWE) plan and execute the Tenacious Dragon 2 Advanced Technical Demonstration at Camp Bullis, Texas in July 2024. The experiment was part of the Integrated Layered Defense campaign and technologies across the Understand, Protect and Mitigate areas were integrated together for Warfighters across six Services and employed four CBRN-focused scenarios. In February 2024 the branch also participated in Patriot South exercise for the DTRA Nuclear Technologies Division (NTD) to demonstrate NTD sponsored sensors integrated with Command and Control capabilities. The scenarios were built to demonstrate NGB, USAF and civilian responses to nuclear facility damage from a hurricane that made landfall near Camp Shelby, Mississippi.

The Center's Forensic Analytical Center (FAC), a part of the division, completed two proficiency tests conducted by the Organisation for the Prohibition of Chemical Weapons (OPCW) in 2024 and FAC continues to maintain its high success rate with perfect scores in the 55th environmental Proficiency Test and the 9th Biomedical Proficiency Test. The FAC is one of fifteen labs worldwide designated by the OPCW to analyze both environmental and biomedical samples.

A Center scientist from the FAC integrated into the U.S. Army's 1st Area Medical Laboratory (1AML) to participate in Precise Response 2024, a multinational NATO chemical, biological, radiological, and nuclear live-agent exercise held at Canadian Forces Base Suffield in Alberta, Canada. Operating out of their mobile facilities, the 1AML participated as the exercise's chemical laboratory. The DEVCOM CBC scientist served as the subject matter expert while 1AML Soldiers received, extracted, and conducted field confirmatory analysis on live chemical agent samples taken by the NATO Sampling and Identification of Biological, Chemical and Radiological Agents (SIBCRA) teams.

For 2025, the division will continue to deliver critical data on emerging threats using its cross-functional capabilities and teams for field exercises such as Tenacious Dragon III. It will provide test evaluations for customers and provide direct support of a range of DARPA programs. It will also continue to build relationships with the U.S. Intelligence Community and establish regular exchanges and working groups.

Identification, Destruction Technology Testing Highlights Year for CBARR

The Chemical Biological Application and Risk Reduction Business Unit is the operational component of the DEVCOM CBC Research and Operations Directorate that is most routinely referred to in the Center, the U.S. Army and even among Defense Department and international partners simply as CBARR. With a broad mission to perform global chemical and biological operations in a safe, secure and environmentally sound manner, and a team that consists of nearly 200 field-deployable scientists, engineers, technicians and operators located at Aberdeen Proving Ground, Maryland and Pine Bluff Arsenal, Arkansas, CBARR is the recognized leader in providing integrated chemical and biological solutions for customers worldwide.

CBARR continued to expand its capabilities and expertise in 2024 through its mission as the Capability Developer for the Office of the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs, Threat Reduction and Arms Control (OASD (NCB/TRAC)) Chemical and Biological Weapons Elimination (CBWE) Directorate. This work allows CBARR to test and develop technologies that assist in assessing and destroying chemical weapons on the ever-changing global defense stage.

In 2024, CBARR facilitated and supported chemical agent testing at the Aberdeen Proving Ground test range for the ATOMICA (Analytical Threat Observation, Materialistic Identification, Classification and Attribution System), a next generation neutron spectroscopy non-intrusive identification technology. Argonne National Laboratory and the Naval Undersea Warfare Center – Keyport are the developers and integrators of this technology. This testing is a continuation of data collection testing on chemical agents that was initiated in 2023 and has been sponsored by the OASD (NCB/ TRAC).

The initial testing of Thermite Bag technology commenced in July 2024 with the successful completion of pre-testing preparations, including a detailed test plan, standing operating procedures, a pre-operation safety review, and environmental documentation. In November 2024, the Thermite Bag prototype was showcased at the U.S. Special Operations Command Research, Development, Acquisition, Experiment, event, enabling CBARR to provide end-users with hands-on experience. Additional trials are scheduled, followed by procurement of new materials to support further testing in 2025 with simulants and chemical agent.

DEVCOM CBC operations personnel from the Center's Chemical Biological Application and Risk Reduction unit conduct a routine operation.

Additionally, CBARR will continue efforts in the development of the Compact Rapid Chemical Agent Neutralization System (CRaCANS) that is more rapid and flexible than what is currently used for large stockpile bulk agent neutralization. The technology has reduced logistical support requirements and is transportable, rugged and easy to operate enabling it for use in small-scale response and tactical elimination of bulk agents. Another technology CBARR is developing, Blackdog is the result of a joint industry call from the U.K. Ministry of Defence and the U.S. Department of Defense to solve the need to respond to small caches of chemical agent found in munitions or laboratories. CBARR is supporting two U.K. companies to develop this chemical agent destruction system that combines access and neutralization technologies in a field portable configuration. Finally, the Waterjet System is a transportable technology designed to access, disable, and irreversibly destroy chemical and biological weapons, munitions and improvised explosive devices. With support of CBARR personnel, an improved Waterjet prototype system was demonstrated in 2024 while testing with simulants and chemical agent is expect in 2025.

Beyond the technology evaluations and growth in 2024, CBARR team members deployed to Dover Air Force Base during the hottest summer on record to successfully destroy four recovered 75mm munitions, two of which were filled with the chemical agent mustard. CBARR support included equipment operations, air monitoring, laboratory analysis, health and safety oversight, and waste handling and disposal. The team overcame the intense heat and related challenges to carry out the mission and render the munitions safe for disposal. The successful mission completed the twelfth deployment of the EDS technology to Dover AFB to destroy items recovered from the Atlantic Ocean. CBARR has served as the sole EDS operator since its first operational deployment to Rocky Mountain Arsenal in 2001.

In addition to working with and consulting with U.S. Army and Defense Department stakeholders domestically, CBARR continued its international missions in 2024. Working with the Combatant Commands and other government agencies, CBARR has supported U.S. allies and partner nations in both Europe and the Middle East to recognize capability gaps in their chemical and biological defense programs and support the mitigation of those identified risks. CBARR continues work with the North Atlantic Treaty Organization, Ukraine, Georgia, Moldova, the United Arab Emirates, Kuwait and Saudi Arabia to strengthen their chemical and biological defense programs.

Software Engineering Capability Supports Center, Customers

The Software and Integration Division was activated on October 1, 2024, as one component of a comprehensive Engineering Directorate reorganization. It comprises three branches: Knowledge and Data Management; Software Engineering; and Interactive Software and Visual Media. The division is a focal point for the Center's customers seeking services for CBRNE defense-related software; digital media and training; artificial intelligence and machine learning, development, hosting and maintenance of custom-built web-based applications; concept drawings; and print media. The division's capabilities span the full lifecycle of digital support services for programs and projects. From initial conceptualization to completion and support for the life of the product or service, the Software and Integration Division is committed to providing expert service to customers across the Chemical Biological Defense Program. The division has three branches.

Members of the DEVCOM CBC Software Integration and Acquisition team, Ben Conrad and Ray Zayas, work with CBC warfighter touchpoint, Major Slone, to test the hardware and software components of a standoff detector.

The Software Engineering Branch serves as an in-house software development capability for DEVCOM CBC. As part of an multidisciplinary organization comprised of other engineers, scientists and technicians, branch personnel co-develop software solutions collaboratively and in parallel with chemical biological defense hardware solutions. Through these close partnerships, the branch is capable of applying custom software solutions using specialized chemical biological defense knowledge and experience. Accomplishments for 2024 include:

The branch established and developed a new capability to support development and testing of systems communicating in the Integrated Sensor Architecture (ISA) standard. That effort included creating a development environment for software and a testing/integration environment for hardware. In addition to being able to generate ISA data from a simulated sensor to be read by a local ISA controller, the branch also set up an Android environment for development and testing of custom Android Tactical Assault Kit (ATAK) capability. As a result of this effort, the Software Engineering Branch now has the capability to support development of custom tools in ATAK that warfighters can use to capture live data from networked sensors for situational awareness and decision making.

The branch developed a new prototype capability to assess warfighter health effects resulting from prolonged exposure to an agent plume. DEVCOM CBC's Decontamination Sciences Branch asked the branch to do prototyping in a commercial game engine, called Unreal Engine, that allows for simulated Soldiers to walk through a threat cloud produced in a separate modeling tool. The health-effects-based assessment produced provides an effects modeling method for the Defense Threat Reduction Agency and Fort Leonard Wood's aneuver Support Capability Development Integration Directorate programs.

It also supported critical hardware-software integration for DEVCOM CBC's mechanical engineering and electrical engineering teams in their continued development of deployable microsensors. As stand-alone hardware systems become more complex and are networked together into a broader system-of-systems capability, the branch keeps up with the need for increased and more sophisticated software integration as required to create an "internet of battlefield things." Branch software specialists connected the system components to a common network, got them to speak a common language, and to display their data in a consumable format and platform to support situational awareness and decision making.

In 2025, the branch anticipates growth in the synthetic and digital training support for CBRN systems. The branch additionally predicts further mission support in software development for integrated electronic sensors, networks, and systems to better enable a CBRN common operating picture.

The Knowledge and Data Management Branch (KDM) develops web applications for the U.S. Army and Department of Defense (DoD) to support their role in the nation's Chemical Biological Defense Program. This includes creating highly precise cradle -to-grave inventory systems for agents and developing software that tracks acquisition and sustainment of CBRNE defense products.

The Biological Select Agent and Toxin (BSAT) Inventory, a key responsibility of the branch, is hosted within the Joint Acquisition CBRN Knowledge System (JACKS). It is the system of record for Biological Select Agent and Toxin (BSAT) inventory for all DoD BSAT laboratories. It enables accountability for every DoD BSAT laboratory by recording inventory sample history, sample tracking, destruction and inactivation. In that role, it also helps these laboratories to fulfill their regulatory reporting requirements, DoDD 5101.20E, 50 USC 1527 and DoDI 5210.88, Army Directive 2016-24, and Select Agent Regulations in the Federal Select Agent Program for BSAT inventory. This tool was implemented in 2016 when DoD designated the BSAT Biorisk Program Office (BBPO) as responsible for oversight of DoD BSAT facilities with database management and process automation enabled through services provided by DEVCOM CBC.

The Joint Acquisition CBRN Knowledge System (JACKS) is a web-based DoD knowledge management system for business process support and information distribution. It is customized to track acquisition and sustainment of CBRNE defense products. JACKS provides an authoritative, comprehensive and centralized set of tools ranging from acquisition analytics to direct warfighter interactions, spanning many unique user groups throughout the CBRNE community. No other single system in the DOD has the breadth of CBRNE information in a single location.

Typical users of JACKS data include unit CBRNE specialists, Logistics Assistance Representatives, Special Operations personnel, Item Managers,

Service Representatives, Program Analysis and Integration Office personnel, chemical officers and laboratory scientists. JACKS is maintained by the Knowledge and Data Management Branch under the direction of the Joint Program Executive Office for Chemical Biological Radiological Nuclear Defense (JPEO-CBRND) Joint Project Leader for Integration (JPL I).

The system met multiple milestones in 2024, most notably the return to pre-pandemic user activity levels. This included surpassing 90,000 total JACKS user accounts created since the 2004 site launch, with over 5,800 new users and over 13,500 active JACKS user accounts in 2024. Also in 2024, the branch integrated equipment data from the JACKS Master Analytics Portal, which contains more relevant and up-to-date data than the predecessor source system. In addition, the branch initiated planning for a JACKS refresh, resulting in collection of user survey results to help determine the main focus areas and path forward for the JACKS interface.

In 2025, the KDM branch will implement three critical initiatives to enhance collaboration, streamline processes, and modernize key systems. The first, called TeamWork Cloud, will be deployed to JPEO users to improve collaboration and model management. The second will be a DoD BSAT Database restructuring to enhance usability, reporting capabilities, and process efficiency. The project includes

The Interactive Software and Visual Media Branch (ISVM) provides professional, creative services that assist CBRN scientists and engineers in actualizing the products that our warfighters depend on. From concept illustrations to cinematic 3D animations, ISVM's design team offers a range of visual output for explanation and operational demonstrations. Their use of VR and AR technologies provides realistic training experiences without needing to be physically in the specific environment, and the full-service print lab is outfitted to generate posters, tri-fold brochures, spiral bound books, vinyl graphics, and sign/display fabrication. Some highlights from 2024 are:

The branch provided support to the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND) Sensors by designing custom wall graphics for display in the E-2800 Building lobby at Aberdeen Proving Ground, Maryland. The design effort was focused on highlighting the JPEO-CBRND's mission through the use of bold, colorful graphics featuring current and future sensor technologies. The new design is intended to immerse visitors and on-site staff in JPEO-CBRND 's vision for the future.

The branch collaborated with CBARR to produce preliminary design concepts for the Royal Saudi Land Forces of what a future CBRN defense facility could look like. These concepts conveyed complex layouts and requirements to the Saudi Military Delegation prior to an onsite tour. As a result, the tour was extended to see what other multimedia, animation, and training services the branch could provide. This effort highlights the advantages of having visual designers co-located with world leading CBRN experts.

JPEO-CBRND Protection requested a concept of operations video for one of their latest expeditionary collective protection capabilities. The videos the branch developed highlight the "whats," "whys," and simplified "hows" of the new Structure Kit Improvement system JPEO-CBRND Protection developed and fielded. These videos were designed to be easily understood by a large and varied audience using a four-minute format which covered the background of why collective protection systems are important, what makes the Structure Kit Improvement unique, and an overview on how to set up and operate the system. This was the second video ISVM created for the JECP Family of Systems as a way to familiarize users, trainers, and trainees on the system before in-depth instruction. In 2024, ISVM also filmed and edited a selection of maintenance tasks for various JECP components.

For 2025, the ISVM branch anticipates expanding its support of visualizing the future of CBRN defense as well as playing a significant role in modernizing training and troubleshooting tools.

Sustainment of CBRNE Solutions Critical to Mission Readiness

Putting the most state-of-the-art CBRN defense tools into the hands of our Soldiers cannot happen without the longevity and logistical support needed to deliver and maintain a steady operational lifecycle. Whether it entails the necessity for more integration manpower or the expert know-how regarding manufacturing costs and product delivery hurdles, Sustainment's personnel will be ready to solve any operational hurdle that presents itself.

DEVCOM CBC's Sustainment Division is responsible for integrating and implementing engineering and logistics support functions for CBRN Defense materiel at all stages of planning, as well as execution in the acquisition lifecycle. The primary goal of the division is to ensure that the systems, equipment and infrastructure used by the warfighter are designed, developed, and maintained to achieve optimal operational availability, reliability and performance throughout their lifecycle.

DEVCOM CBC Technical Writer, William Conway, works with Private Martinez to perform a technical manual verification to ensure that the manual accurately reflects the design and functionality of the technology without any missing information or errors.

With these distinctive and exclusive goals within the Center's operational scope, the Sustainment Division has their sights set to improve upon all challenges presented to the team this year. Recently, 16 new prototype agreements and over 84 funding modifications on existing agreements were awarded by the Cornerstone Other Transaction Authority (COTA), resulting in a total ceiling increase of $935M and new funding of $676M for those agreements. Prototype agreements such as these improve capabilities across a wide range of technologies.

The division also successfully conducted a Logistics Demonstration (LD) for the M1135 Stryker Nuclear, Biological, and Chemical Reconnaissance Vehicle (NBCRV) Sensor Suite Upgrade (SSU). The LD for the NBCRV SSU covered troubleshooting, preventative maintenance checks and corrective maintenance procedures. The purpose of the LD was to evaluate the adequacy of the support products ensuring the user units have the logistical capability to achieve initial operational capability.

Sustainment works behind the scenes to ensure that the technology DEVCOM CBC creates or improves upon will always be supported, mission-ready and correctly maintained throughout its operational lifecycle. Though often not seen, their teams' impacts reach every corner of the Center to ensure each technology is up to the task of defending our warfighters.

Fabrication, Industrial Experts Bridge Gap Between Bench, Battlefield

Bringing together innovation, expertise and unique skillsets, the Advance Manufacturing Division encompasses everything pertaining to the fabrication and industrial process side of accomplishing the mission. For those who have the requirement to build and synthesize the items that go into the Center's forefront technology, AMD is there to bridge that gap with their expertise in additive technology, traditional manufacturing and integration prowess.

AMD's prime directive is to equip their experts with the tools required to prototype, integrate, engineer and then physically innovate, design, and build what is being asked for the warfighter's utilization through their MakerSpace Lab or traditional manufacturing capabilities at Aberdeen Proving Ground, Maryland. Using some of the most advanced tech in the advanced design space (e.g. 3D printing), the division uses their capabilities to their fullest potential, whether that be leveraging their staff's CAD modeling skills or identifying the "art of the possible" to best support their customer's requirements. AMD's ability to model and design equipment used in the repair of equipment downrange or showcase new technologies during live exercises has been a unique CBC capability.

DEVCOM CBC Engineering Technician, Rashad Scott, brushes away powder to reveal a plastic part created through a type of advanced manufacturing called mult-jet fusion, or MJF.

Their Design, Engineering and Test facility at Rock Island Arsenal, Illinois, supports the PM CS and CSS (Program Manager Combat Support and Combat Service Support). One such effort was a redesign of the Forward Repair System (FRS) which integrated a new crane, military standard generator and revised tool load into a flat rack shelter design. Transferred across the battlefield by the Palletized Load System or Load Handling System, the FRS M7A1 provides a capability to remove, repair and replace Army based weapon system power packs. This among other forward repair and maintenance kits was supported across the Division and puts forward facing technologies in the Warfighters toolkit.

AMD's 2025 is set to rival their previous year's accomplishments. Amongst the shortlist, they anticipate partnering for the design, integration and prototyping of the 3k Tactical Water Purification System (WTPS), an effort with future collaborative partner Pine Bluff Arsenal that will result in a government designed and manufactured system. Also on the horizon is their continued partnership with the Joint Manufacturing and Test Center at Rock Island, the Army's center of excellence in additive and advanced manufacturing.

With their concise mission space, AMD is prepared to assist Soldiers, stakeholders and the Center in the pursuit of the DEVCOM mission.

Testing Assures CBRNE Equipment Performs as Required

DEVCOM CBC's Test Division conducts the full range of chemical and biological agent testing required by the DoD's Chemical Biological Defense Program to ensure the safety of the warfighter and the nation. This includes testing with chemical and biological select agents, emerging threat agents and toxins as well as toxic industrial chemicals and simulants as needed for surety and bio-safety testing, lifecycle testing and technology development.

This testing is conducted under a variety of environmental conditions in highly specialized and unique facilities and state-of-the art laboratories with engineering controls for chemical surety, biosafety, glove boxes, large-scale test chambers and outdoor test ranges. In addition to laboratories and chambers, the BioTesting Dugway group at Dugway Proving Ground, Utah has access to the installation's vast array of testing infrastructure including 798,000 acres of encroachment-free terrain with 27 instrumented ranges, grids, test sites and impact areas.

Many organizations outside of the DoD rely on the Test Division's unique facilities and expertise. They include including the Department of Homeland Security, the Environmental Protection Agency, the FBI, the Department of Agriculture and the Intelligence Community plus various National Laboratories and research Universities.

In January 2024, division personnel completed the final two six-hour permeation tests in support of the Uniform Integrated Protective Ensemble Family of Systems (UIPE FoS) Glove-as-a-Glove (GaaG) Program. This test completed the Program of Record testing for the worn and unworn glove tests. Joint Program Manager Protection (JPM P) used the data collected in this test to determine how well the gloves protect the warfighter both new from their packaging and after being used to perform standard activities.

In February 2024, division personnel completed dimethyl methylphosphonate gas life Production Lot Testing (PLT) on General Purpose (GP) and M61 filters for Avon Protection Systems, Inc.

DEVCOM CBC Lead Engineering Technician, Justin Geldof, attaches a tube to a prototype gasmask to test its airtight seal.

This PLT represents the government required testing, by a government lab, for approval of this filter lot, and evaluates the performance of the filter lot against requirements. This PLT supports production lot decisions for approximately 700 GP filters and 1,200 filter pairs, used by the Warfighter with the M53/M50 Series Protective Mask.

In March 2024, division personnel performed a successful test flight of the Deployable Integrated Microsensor Evaluation System (DIMES) deployment device on the FLIR SkyRaider UAV in support of DEVCOM CBC's Deployable Microsensors Program. This test flight successfully demonstrated that a fully loaded DIMES deployable device can be effectively transported via UAV with negligible impact to flight characteristics and the camera/sensor interface.

In March 2024, division personnel successfully completed a pre-operation survey for the bio-safety level 3 (BSL-3) test apparatus called the Containment Aerosol Chamber (CAC). Present were representatives from the Office of the Director of Army Safety, the Defense Health Agency Defense Centers for Public Health, the Army Office of the Surgeon General, DoD BSAT Biorisk Program Office, CBCs Risk Management, and CBC-BioTesting Division. They reviewed equipment, instrument, and operational procedures to ensure the safe operation of the CAC as modifications were made to improve its test capability.

In April 2024, division personnel completed shelf-life extension testing (SLET) for the Tank automotive and Armaments Command (TACOM). They completed Dimethyl Methylphosphonate (DMMP) and cyanogen chloride (CK) gas life testing on M61 filters. Execution of this SLET supported shelf-life extension decisions for approximately 50,000 filters, evaluating their current ability to meet requirements, and eliminating roughly $1 million in procurement costs. This reduced the logistical burden to procure new filters, while protecting against chemical biological warfare agents and radiological particles when the M61 filter is used in conjunction with the M50 Joint Service General Purpose Mask.

In June 2024, division personnel performed testing on the Autonomous Biological Critical Area Disinfection payload to show that terrain or fixed site decontamination can be accomplished, and to demonstrate the benefits of robotics, artificial intelligence, and autonomy in an operational field setting. This was done in partnership with the DEVCOM Ground Vehicle Systems Center. A robotic platform unmanned ground vehicle (UAV) with an autonomy kit was fitted with a decontamination applicator that included a spray bar, holding tank, pump, and electronic controls. The purpose of the testing was to investigate potential issues with the pumps, and further refine their performance.

In August 2024, division personnel travelled to the Vojenský výzkumný ústav in Brno, Czech Republic to oversee the Decontamination Concept of Employment Phase II testing commissioned by the Joint Project Manager for the U.S. Chemical, Biological, Radiological, and Nuclear Protection. This test investigated the ability of select technologies to decontaminate chemical agent from material surfaces and military vehicles when used individually and as part of a system of systems.

In October 2024, division personnel completed Shelf-Life Extension Testing (SLET) for the Tank-automotive and Armaments Command (TACOM) on M61, M23A1, and M12A2 filters. Execution of this SLET effort supports shelf-life extension decisions for approximately 7,300 filters. Work included evaluating their current ability to meet requirements and eliminating roughly $450,00 in procurement costs. This reduced the logistical burden to procure new filters, while protecting against chemical biological warfare agents and radiological particles.

In 2025, the Engineering Directorate's Test Division will prioritize advancing chemical and biological defense capabilities through the integration of emerging technologies, such as artificial intelligence and robotics, to enhance operational readiness and resilience. Building on 2024's successful testing initiatives, the division will focus on refining autonomous decontamination systems and expanding shelf-life extension programs to mitigate procurement costs and logistical burdens, ensuring robust protection for warfighters against evolving threats. Additionally, fostering collaborations with key external organizations will be crucial to leveraging diverse expertise and maintaining cutting-edge defense solutions.

Autonomous Systems Lead List of Design Priorities for Center

The Design Division of the DEVCOM CBC Engineering Directorate provides technical solutions to rapidly solve challenges, and 2024 saw the team engaging with stakeholders, working to make testing more efficient, experimenting with autonomous systems and participating in an exercise with the joint force.

Under a partnership with the U.S. Army Tank-Automotive and Armaments Command, the Design Division helped formulate efficient test strategies to eliminate redundancies, foster collaboration, provide strategic support, and ensure accurate and consistent data to support decision-making. In 2024 the team engaged test capabilities from five different test laboratories located at Aberdeen Proving Ground, Pine Bluff Arsenal, Arkansas, and Rock Island Arsenal, Illinois to improve shelf-life extension testing for multiple chemical and biological protection and decontamination systems.

Autonomous equipment decontamination continued to be a priority for the division in 2024. This project prototypes and conducts experiments to demonstrate how robotics, autonomy, and other evolving technologies can modernize contamination mitigation. Spiral integration of mobility, application, and sensing systems under increasing levels of autonomous control to support a series of technology demonstrations are ongoing as the technology continues to improve. Similarly, demonstrations of autonomous systems performing mitigation tasks, such as contamination mapping and application of decontaminants were conducted.

Along with the feedback gathered from demonstrations, the team conducted analysis of current processes and capability gaps to drive design decisions for the future and worked to demonstrate the feasibility of the autonomous decontamination concept for combat developers.

One area that saw growth in 2024 was autonomous biological critical area disinfection. This project demonstrates a proof of concept to provide a capability to disinfect large areas while minimizing personnel exposure to threats, lowering impact of work and rest cycles, and leveraging benefits of autonomy. Part of this effort includes a new disinfectant based on commercially available ingredients that that can be mixed on-site as needed. It was optimized for concrete and asphalt surfaces, and does not have to be stocked and monitored as a niche decontaminant. This is a three-part effort that the division continues to prioritize. The first part is developing a payload for the Multi-Utility Tactical Transport – eXpanded Mobility, an autonomous ground system. The payload will spray a biological disinfectant, and flow rates will adjust automatically with platform speeds. Additional autonomous behaviors are being created to support automated path generation. The second part of the effort is to develop a potassium monopersulphate based disinfectant for use in the system that can be mixed on-site. The third part is to develop a refilling station.

DEVCOM CBC Team Lead, Michael Mays, explains the controls for the Boston Dynamics mobile robot, Spot, to CBC warfighter touchpoint, Major Jason Slone.

Representatives from the division also attended the Beholder's Gaze Experimentation exercise event at Bellows Air Force Station, Hawaii, to demonstrate the Deployable Integrated Microsensor Evaluation System (DIMES) early concept in support of the Deployable Microsensors program, and the Manned UnManned Teaming (MUM/T) system of systems. During the event, DIMES and MUM/T both demonstrated integration with CBRN support to command and control to ensure compatible architecture and provide integrated early warning of simulated chemical/biological threats at the tactical level.

Design Division also assisted Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense in redesigning kits for the Dismounted Reconnaissance System to make them more mobile than ever. These new kits will have a huge impact on how operational units move and use their equipment in the field. The kits are mission and commodity oriented to allow the user to quickly identify which containers they need to meet mission needs. In addition, movement of the containers can be accomplished by less specialized equipment allowing the units to do more with less.

Design Division also played a major role in the CBRN Sensors Integrated on Robotic Platforms program by developing and providing initial CBRN kits for use with fielded Expeditionary Organic Airborne Intelligence, Surveillance, and Reconnaissance Capability Set, commonly called EOTACS Unmanned Aerial Vehicles, currently in use. The kits contain chemical and radiological detection payloads which are used to assess potentially hazardous sites prior to and during mission operations.

A major effort for the Design Division that will continue into 2025 and beyond began in November 2024 from an agreement with the Project Manager, Force Projection/Product Manager Petroleum and Water Systems team to begin preliminary engineering design support of the 3k Tactical Water Purification System, or TWPS, program. The 3k TWPS is a complete water purification system with the ability to produce potable water from all surface and ground sources, including those with chemical, biological, radiological, and nuclear contamination. This new system would replace the legacy 3k Reverse Osmosis Water Purification Unit, which has an average fleet age of 31 years. This is a big step for the team and the Center towards a favorable acquisition decision in early 2025 for the potential production of 190 3k TWPS systems during the next five years.

MAKING AN IMPACT

Officials gathered on June 12, 2024 at Aberdeen Proving Ground, Md. to cut the ribbon and open the U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) Biomanufacturing Facility. (From left to right, Dr. James Watson, Director of Engineering, DEVCOM CBC; Dr. Patricia McDaniel, Army Senior Research Scientist for Chemistry, DEVCOM CBC; Dr. Rick Cox, Director of Research and Operations, DEVCOM CBC; BG John Cushing, Commanding General, DEVCOM; Mr. Robert Cassilly, County Executive, Harford County, Maryland; Mr. Michael Bailey, Director, DEVCOM CBC; Mr. Michael Holthe, Principle Deputy Assistant Secretary of Defense for Science and Technology, Office of the Under Secretary of Defense for Research and Engineering; Dr. Kelly Basi, Biomanufacturing Branch Chief, DEVCOM CBC; Dr. Peter Emanuel, Deputy Principal Director for the Office of Undersecretary of Defense for Research and Development.

DEVCOM CBC Cuts Ribbon on Expanded Biomanufacturing Facility

Pentagon senior leaders and Harford County Executive Robert Cassilly joined DEVCOM CBC leaders in cutting the ribbon on the Center's newly renovated and expanded Biomanufacturing Pilot Facility at Aberdeen Proving Ground, Maryland, in a ceremony held on June 12.

The 25,000-square-foot Biomanufacturing Pilot Facility fills a vital niche in the effort to both free the nation from foreign suppliers and pioneer the creation of entirely new materials essential for national defense. Academic and other Department of Defense (DoD) research laboratories are synthesizing microbes that can produce chemicals and materials with extraordinary properties, but only at a gram-sized scale.

This facility increases production capability for these materials from the gram-size level to up to 1,000 kilograms so that industry can further scale production to the commercial level for real-world applications. DEVCOM scientists working in the facility also optimize the microbes they receive to make them more suitable for scale-up.

Having begun production in 2020, DEVCOM CBC received a $50 million in investment from the Army and the Tri-service Biotechnology for Resilient Supply Chains Program of the Office of the Secretary of Defense, Research and Engineering to modernize and expand its capabilities. Improvements included the addition of liquids separation technologies in its new process development laboratory for downstream processing of biomanufactured chemicals and upgrades to the fermentation laboratory.

NATO Researchers, DEVCOM CBC Scientists Hold Demonstration for Handheld Sensors

DEVCOM CBC scientists completed four years of collaborative research with NATO partner nations on developing a better field sensor with a laboratory demonstration at its Aberdeen Proving Ground research campus in Maryland on March 7.

Operating under the NATO Sensors and Electronics Technology (SET) Panel, NATO-SET-292 "Enhanced Raman Spectroscopy for Defense Applications," the effort resulted in the demonstration of a lightweight, fieldable modification that increases the sensitivity of handheld sensors by a thousand-fold for detecting chemical warfare agents, their breakdown products, and illicit drugs such as fentanyl.

The laboratory demonstration showed that this process of amplification can be used by warfighters in the field without increasing their load burden.

The handheld sensors used for the study are commercially available and commonly used portable Raman spectrometers that could be augmented with surface-enhanced Raman spectroscopy substrates, enabling a jump from only being able to identify bulk materials to identifying traces so small that they cannot even be seen with the naked eye.

The breakthrough came about when the international team of researchers determined that a very thin coating of either gold or silver on a paper tab smaller than a human thumb will amplify the light signature that the Raman sensor receives while shining a light on a substance.

"The sensor shines a light on a sample and that excites the molecules so that they rise to a higher energy state," explained Dr. Jason Guicheteau, DEVCOM CBC research chemist and the vice chair of the NATO SET Panel. "The molecule then returns to its original state and emits photons of different wavelengths. The sensor reads that photon emission and can identify the substance using a library of known substances and their optical signatures in the sensor's software."

By combining that effect with gold or silver nanoparticles, the target molecule under interrogation experiences more than a thousand-fold increase in signal, thus allowing higher sensitivity of a previously unobservable threat. The increased signal is due to the concentration of the optical field near the nanoparticle surfaces by a process known as plasmonic resonance.

The success of this international research effort was possible because of the spirit of the scientists from USA, Canada, France, Germany, Poland and Sweden who came together to form the NATO Research Task Group. "The world got hit with COVID when we first started in 2020," said Dr. Erik Emmons, a DEVCOM CBC research physicist and co-chair of the team. "But that didn't stop us. Through video conference calls and experimental work at the different countries' labs we were able to keep the research going as a full collaboration."

"Everybody involved had the same motivation," added Dr. Ashish Tripathi, a DEVCOM CBC research physical scientist and co-chair of the team. "Everybody wanted to make a better sensor for the warfighters throughout the NATO coalition, and each of them brought their own special expertise to the table."

Dr. Bartlomiej Jankiewicz from Poland's Military University of Technology agreed. "I was happy with the collaborative way we worked. We developed a technology we can use. It was also an excellent learning experience for us."

The Research Task Group will continue working together to write up their findings and deliver them to NATO as well as explore future opportunities to bridge the gap between bulk and trace level detection through the augmentation of portable detection technologies.

Members of a NATO Research Task Group from six countries completed their four-year collaborative research effort on field sensor enhancement with a laboratory demonstration at Aberdeen Proving Ground, Maryland.

Curtis Kreuziger (left) tests out a 3D printed maintenance tool for the M53A1 protective mask he designed for the MakerSpace challenge alongside Bradley Ruprecht (right), engineering technician and MakerSpace lead.

Prototypes Come to Life in MakerSpace Challenge

The U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) wrapped up its Center-wide MakerSpace Challenge to encourage the use of the lab's unique capabilities. The four-weeklong competition pitted the CBC workforce's potential mission-related prototypes against each other, all while leveraging the various 3D printers offered by the lab.

The competition was touted as a way to promote MakerSpace's full potential as being the Center's main hub for proof-of-concepts to take shape. All CBC employees- were encouraged to participate in creating their own physical or virtual model to be evaluated, as long as it pertained to mission readiness. Competitors were judged by a panel from CBC's Innovation Council with winners announced in several categories during the Coffee with Colleagues poster session held on May 23.

CBC acquired its first 3D printer in 1989, just four years after the first commercial grade printer became available to the public. While those antique, hulking machines cost nearly half a million dollars then, MakerSpace now offers 28 machines encompassing 7 different processes, varying from cost-effective tabletop plastic filament models that retail closer to $1,200, to larger units capable of printing with metals.

Bradley Ruphrecht, the MakerSpace lead and an engineering technician at CBC, has been working with additive manufacturing for over 20 years. He says that the MakerSpace challenge offers the chance for all employees to try their hand at experiencing the significant advantages that a physical prototype of one's own design can offer.

"We had an open house this past November to spread the word on what our lab can offer," said Ruprecht. "We have a couple of experts here that are always ready to give a quick introduction to our printers to help everyone get started on their first iteration of whatever their trying to achieve."

Curtis Kreuziger, a general engineer from CBC's Rock Island satellite campus located at Rock Island Arsenal, Illinois, was one of several participants and teams selected on the merit of their initial proposals to the competition. Kreuziger had a novel solution to develop a 3D printed, plastic version of the tool that Soldiers use to perform maintenance on their M53A1 protective mask. The valve cassette removal tool – currently a proprietary part that retails for about $2,500 – could possibly now be replicated by utilizing a cost-effective and field-ready solution.

"The challenge announcement gave me an outlet – and an excuse – to go after this prototype I've been thinking of for a while now," said Kreuziger. "This new tool I'm developing can hopefully cut down cost by up to 90 percent for this tool that gets pretty regular use."

Kreuziger traveled to CBC's Edgewood, Maryland headquarters specifically for the MakerSpace challenge due to its multiple printer solutions and material types. He also anticipated his prototype to be created using FLM machines due to their ubiquity in the field. These designs can be utilized from a database, thus making them an ever-ready staple that Soldiers can have access to wherever they have access to a printer.

"The ability to print via multiple techniques and materials cannot be understated," said Kreuziger. "Some portions of my design, such as the smaller protruding tabs, are just inherently difficult for certain machines due to cooling time or their specific manufacturing process. I would never have known about that until physically holding it. Thankfully I have access to all the different types of printers as the intent is to try them all out."

Biological Weapons Field Guide Will Help ID Recovered Munitions

DEVCOM CBC's Chemical Biological Applications and Risk Reduction business unit, known as CBARR, provides field response for recovered chemical munitions all over the country and around the world. Sometimes bioweapons munitions turn up, too. Robert Malone, the CBARR Plans and Assessments branch chief, has a plan for that, he is writing a field reference guide for recovered bioweapons.

CBARR has had a field reference guide for chemical weapons since the mid-1990s called the U.S. Chemical Weapons and Related Material Reference Guide. But, as of yet there is not one for biological weapons and related material, so Malone decided to do something about it."

What brought this need home for Malone is what happened at a field operations site at Holloman Air Force Base in New Mexico. Recovery team members encountered E-61 bomblets. The CBARR project manager for this field operation, George Noya, came to him because he knew that Malone had done some extensive research on bioweapons several years earlier. That provided him with some good background. He also got help from a true DEVCOM CBC expert in this area, Chris Whalley, a long-time CBARR subject matter expert in biological weapons.

Malone and Noya went to Whalley's office. Whalley was able to tell them what the item was, its delivery system, its potential agent fills, and he even had an unfilled example of one sitting in his office that they could hold and examine.

That was enormously helpful to Malone, but then two things occurred to him. First, why doesn't CBARR have this kind of detailed knowledge for the broad range of bioweapons in a form that can be shared? Second, with whalley is approaching 70 and soon to retire, how best to preserve that knowledge?

Fortunately, the Center has a source of seed money for funding good ideas like this. It is the 'Quick Empowerment leads to Successful Tomorrows' program, or QUEST for short. To qualify for funding, there are no limits on ideas, so long as it is tied to CBC's mission. Projects of any size from $5,000 to $100,000 are considered. Applicants get ten minutes to pitch their idea before members of Center leadership followed by five minutes for questions.

In 2023, Malone submitted his idea, made his pitch and was selected to receive a $22,000 grant to begin work on a concise, easy-to-use field manual. He pulled together a team of CBC colleagues which included Whalley plus Mindy Soethe and Andrew Bailey. Although they were frequently away performing field responses at CBARR's many project sites, they were able to reach the 40 percent mark over the course of a year.

The manual, thus far, includes biological weapon types, the history of their development and use plus information on their likely prevalence. The manual goes into considerable detail, including figures, dimensions, their military name, military specifications, agent fills, packaging and dates of production. Compiling this data is a slow, meticulous process, but the team members believe that usefulness of that data warrants the effort.

A CBARR field team performing remediation and destruction of recovered chemical munitions in the field.

Dr. Christopher Whalley (center) describing an inert historical E-61 biological bomblet relic to Robert Malone (left) and CBARR biologist Andrew Bailey who is holding the E-61 bomblet.

There are also potential customers for a bioweapons reference guide. They include the Defense Threat Reduction Agency's Office of Cooperative Threat Reduction as they have been involved in biological remediation projects at both the Vozrozhdeniya Island bioweapons research facility in Russia and the Stepnogorsk research facility in Kazakhstan. Also, the United Kingdom's Porton Down Defence Science and Technology Laboratory, a frequent research partner of the Center, has expressed interest in a comprehensive field guide and Malone has already shared the format for his field guide with them.

Malone and his team submitted a request for funding to finish the field guide and at QUEST 24 Pitch Day in April they gave their pitch to the Innovation Council. They were persuasive, the Innovation Council members gave them another QUEST grant of $25,000, enough to finish the job. As soon as they complete it, they will make it available to CBARR field teams as well as the rest of the Center.

Lab Supports Detection Training For Army's Four-Legged Warfighters

The U.S. Army's Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) tested collective capabilities to determine if military working dogs can detect trace levels of explosives.

From March 20-22, researchers from the Center's Applied Synthetic Biology and Olfaction branch tested the Working Dog Advanced Threat Assessment System (WD ATAS) at Aberdeen Proving Ground South for the canine portion of the Maneuver Support & Protection Integration eXperiments 2024 (MSPIX' 24). The WD ATAS is a training aid kit designed to provide explosive detection canine teams with the ability to train on traditional and novel explosive threats, worldwide. The kit includes inkjet-printed coupons with non-detonable levels of threat material which are placed inside of a training aid delivery device (TADD), a DEVCOM CBC developed primary containment device for fine powders, liquids, and hazardous materials. The printed amounts are non-detonable and with the print solution being made from actual explosives, the odor profile is comparable to that of the larger quantities of bulk material.

These coupons were printed and supplied by the Center's Army Explosives Forensics Advanced Technology Program. During the testing, scientists placed the inkjet-printed coupons into TADDs. These devices were then randomly placed inside of scent cans on turnstile-like wheels along with other familiar odors to assess if military working dogs could detect the trace amounts of explosive material that had been printed onto the coupons.

Dr. Shawna Gallegos, a chemist in the Center's Applied Synthetic Biology and Olfaction branch, explained, "Adversaries use improvised explosive devices with very low amounts of odor coming from them. We're testing actual explosives printed onto filter paper in such a small amount that it is non-detonable. So, the question is, can dogs trained on bulk quantities of explosive material detect coupons that are printed with trace levels of explosives? Yes, we're seeing that they are capable of doing that."

The WD ATAS exemplifies CBC's aptitude for maximizing collective capabilities to support the defense mission. The Center leverages printing technology and skilled scientists who are adept at safely handling and analyzing various chemicals and threat materials to support military working dog training. This assessment also supports the Center's memorandum of agreement with the Army's Office of the Provost Marshall General to supply the expertise, training, and training aids for military working dog teams. "This event evaluates the WD ATAS and the potential utilization in our military working dog explosive detection training. Based on the data collected, DEVCOM-CBC will be able to assess if the WD ATAS is an effective technology to enhance military working dog trace detection training," said Dr. Patricia Buckley, deputy chief of the Center's Sensors Technologies and Biomaterials Division.

This exercise, which was an official MSPIX event hosted at Aberdeen Proving Ground, preceded the Army's larger MSPIX '24 event at Ft. Leonard Wood, Missouri, May 6-24, 2024. Hosted by the Army's Maneuver Support Capability Development Integration Directorate, MSPIX is a crucial platform that allows Army scientists to take innovations from a laboratory and demonstrate them in front of warfighters for a chance to test viability. "Our technology was approved for an offsite assessment due to broader local support of military working dog teams," Buckley said.

In the future, the Center will continue to work with the Office of the Provost Marshall General and the Defense Health Agency to modernize military working dog training programs that support large-scale combat and Army operations. Specifically, Center scientists want to evaluate the ability of military working dogs to detect trace levels of a variety of existing and emerging threats. "DEVCOM-CBC has been instrumental in helping us with our modernization efforts," said Sergeant Major Viridiana Lavalle, Army Military Working Dog Program manager. "Our collaboration with various research and development projects are enhancing our canine scent kits, military working dog capabilities, performance, and increasing survivability. The Army Military Working Dog Program will continue to evolve by participating in these innovative efforts with our partners at DEVCOM-CBC."

A military working dog sniffs a scent can containing a training aid delivery device during an exercise hosted by DEVCOM CBC in support of the Maneuver Support and Protection Integration Experiments Program.

DEVCOM CBC Celebrates 10 Year Anniversary of Syrian Chemical Weapons Destruction

Standing in front of the FDHS system from left to right are DEVCOM CBC Research & Operations Director Dr. Frederick Cox, DTRA Director Rebecca Hersman, CBARR Operations Director Timothy Blades, Secretary of the Air Force Frank Kendall, DEVCOM CBC Director Michael Bailey and DEVCOM CBC Engineering Director Dr. James Watson.

DEVCOM CBC celebrated the tenth anniversary of its historic destruction of the Syrian declared chemical agent stockpile inside the hold of a ship in the international waters of the Mediterranean Sea in a ceremony in Mallette Hall at Aberdeen Proving Ground, Maryland on August 14.

Speakers included Secretary of the Air Force Frank Kendall, who was Under Secretary of Defense for Acquisition, Technology and Logistics during the Cape Ray mission and a key figure in the accomplishment; Craig Campbell, Principal Director of the Office of the Deputy Assistant Secretary of Defense for Threat Reduction and Arms Control; DEVCOM CBC Director Michael Bailey; and Operations Director of DEVCOM CBC's field response team that performed the mission at sea, the Chemical Biological Application and Risk Reduction (CBARR) business unit, Timothy Blades.

Afterward, speakers and attendees toured displays of new chemical agent destruction technologies that DEVCOM CBC scientists and engineers developed based on the lessons learned from the Syrian stockpile destruction.

Bailey, in his remarks, pointed out that CBARR is unique. They take on operationally remote, dangerous missions where there are many ways a mission could go wrong. CBARR takes on these missions and makes them look easy.

Campbell added that this was a mission that still stands today as a perfect example of how success is generated. CBARR came up with the concept, and designed and built the technology, giving the U.S. a viable solution to the Syrian chemical weapons threat, something no other nation had.

Destruction at sea inside a ship was needed because no nation would agree to hosting the stockpile's destruction on their soil. CBARR made destruction at sea possible by miniaturizing an existing chemical agent neutralization technology. The technology known as hydrolysis, was housed in large factory buildings when used to destroy U.S. chemical agent stockpiles on land in the early 2000s.

DEVCOM CBC engineers designed and built a version that could fit inside a 35 by 25-foot shipping container for transport and take up a 400 by 700 feet area once assembled. Known as the Field Deployable Hydrolysis System (FDHS), they also made it rugged enough to operate inside a pitching ship, easy to assemble and disassemble, and doubled up on crucial parts to avoid any single points of failure. The FDHS was a fast-track acquisition project initiated in February 2013 with a functioning prototype delivered in four months.

Up until then, nobody envisioned putting the destruction system on a ship, but CBARR succeeded by anticipating a problem, assumed risk, and executed according to plan according to Kendall.

Blades told the audience that he knew CBARR was the right organization to perform the mission because it maintains a culture of solving very difficult problems by working collectively and with ingenuity.

In attendance were Rebecca Hersman, Director of the Defense Threat Reduction Agency (DTRA); Dr. Robert Kristovich, Director of DTRA's Chemical and Biological Technologies and Joint Science and Technology Office; Maj. Gen. James Turinetti, Commanding General of Communications-Electronics Command; and Senior Commander of Aberdeen Proving Ground, Brig. Gen. John Cushing, Commanding General of the U.S. Army Combat Capabilities Development Command; and Brig. Gen. W Bochat, Commanding General of the 20th CBRNE Command. Also in attendance was Joe Weinand who was DEVCOM CBC director during the mission.

The showcase of chemical agent destruction technologies on display in Mallette Hall represented the legacy of the Cape Ray mission. These technologies included a further miniaturization of agent destruction systems, the next generation of the FDHS, the Compact Rapid Chemical Agent Neutralization System. Also on display were a bulk container destruction system small enough to be carried, known as the Blackdog, and a thermite bag destruction system that fits inside two backpacks.

Attending the event are, from left to right, DEVCOM Commanding General Brig. Gen. John Cushing, Commanding General of Communications-Electronics Command Maj. Gen. James Turinetti, Assistant Director of the Harford County Office of Economic Development Larry Muzzello, National Defense University Deputy Director of the Center for the Study of Weapons of Mass Destruction Patrick Terrell, DTRA Director Rebecca Hersman and Secretary of the Air Force Frank Kendall.

Secretary of the Air Force Frank Kendall talks with DEVCOM CBC Protection Division Chief Scientist Daniel Baker during the technology showcase.

Soldiers Provide Input on Microsensor Tech Developed in Partnership with ROK

The U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) hosted a Soldier touchpoint event at Aberdeen Proving Ground in Edgewood, Maryland to test out new unmanned drones equipped with a set of microsensors developed in conjunction with the Republic of Korea's (ROK) Agency for Defense Development (ADD). Soldier touchpoints are one of the first major milestones in testing a potential technology to be fielded.

The microsensor effort began as a partnership between the Center and ROK ADD in 2018 to successfully meet the stringent form-factor requirements set forth by the customer. Kevin Wan, a DEVCOM CBC chemical engineer and project manager for the microchemical sensor effort, called in ROK ADD for assistance with the 3-gram sensor size requirement while his team focused on suitable use cases. Both centers pushed to complete their collaborative effort in time for this upcoming user assessment.

"The design space was quite limiting to begin with, so we worked with our Korean partners to get this working on a three-gram payload," said Wan. "The hornet drones are great at intelligence, surveillance and reconnaissance (ISR) missions, but adding chemical-sensing capabilities would further its use cases – this is what we primarily wanted to focus on."

The effort came to a head on July 31 when the Center hosted Soldiers from the US Army Reserve's 455 Chemical Brigade, headquartered in Sloan, Nevada, as well as their partners from ROK ADD, which serves as their DEVCOM equivalent, in an exercise where all participants could give concerted feedback on the drones and sensors.

Initial funding for the project came from DEVCOM Soldier Center in Natick, Massachusetts, which had the need for a sensor weighing no more than three grams. This form factor would specifically fit on the Black Hornet III, a currently fielded minuscule drone platform weighing in at 38 grams. The project received funding from the Assistant Secretary of Defense for Industrial Base Policy International Cooperation Office's Coalition Warfare Program and other organizations.

Wan and his team shifted their focus on the sensor's early warning detection capabilities against a chemical threat – whether it may be a nerve or blister agent. They then focused their efforts on redundancy and reliability to increase detection. "Having two independent sensors provide the same response would increase the confidence of detection," said Wan. "That redundancy and reliability coupled with a low limit of detection for early warning is critical to us and our Soldiers."

To test their prototypes, DEVCOM CBC invited CBRN specialists to learn how to fly these drones and run a simulated scenario involving piloting the Black Hornets into various tents in an enclosed space with one of the tents housing a simulated agent. Corporal Brittney Batimana, one of the Soldiers involved, said that the new drones would increase Soldiers' safety and mission success.

"It's pretty simple – once you get comfortable with the camera's point of view, it's easy to identify your targets," said Batimana. "Our job is to identify and decontaminate hazards: this is just another way for us to always stay prepared if a situation were to ever turn chemical."

The collaborative effort between the two centers was evident throughout the Soldier touchpoint and mirrored the success of this joint development process. "We love to work together with our partners," said Wan. "Highly competent and highly intelligent. What we both want to see going forward are more use cases and increasing the library of threats that can be detected." This sentiment was further echoed by Dr. Myung Kyu Park, Wan's ROK ADD counterpart and Micro Chemical Sensor (MCS) project manager: "We do very well together – [they] worked very hard to see that these sensors work."

Increasing the library of substances to detect would include various explosives, narcotics or industrial chemicals, furthering the drone's use cases significantly beyond the ISR realm. With the success of the Soldier touchpoint exercise, Wan and his team know that the form factor lends itself to an even wider variety of scenarios.

A chemical specialist from Nevada's 455th Chemical Brigade operates a Black Hornet drone during a chemical agent detection exercise at Aberdeen Proving Ground, Maryland. The Soldier touchpoint event utilized the prototypes in a scenario where operators had to detect simulated chemicals with the drone's onboard sensors.

DEVCOM CBC Researchers Explore 3D Printed Chemical Sensors

Dr. Brian Hauck, a U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) research chemist, and his research team started out with a question: What if you could 3D print a sensor that changed color in the presence of chemical warfare agents and toxic industrial chemicals?

If it worked, it would be on-demand, low cost, small, very light, easy to carry and easy for a warfighter or first responder to use.

That is just the kind of high-risk, high-reward idea that DEVCOM CBC provides seed money to explore. Hauck and his research team received a grant of $30,000 to find out.

The source of that seed money was DEVCOM CBC's 'Quick Empowerment leads to Successful Tomorrows' Program, or QUEST for short. There are no limits on ideas that can qualify for funding, so long as the idea is tied to DEVCOM CBC's mission. Projects of any size from $5,000 to $100,000 are considered. Applicants get 10 minutes to pitch their idea before members of Center leadership followed by five minutes for questions. Hauck and his team were one of 12 pitches out of 26 to receive funding in 2023.

The goal was to take commercially available filament for fused deposition modeling, the most common form of 3D printing, and figure out how to embed a colorimetric indicator into it to make it change color, much like a pH strip. They named the system Chemically Reactive On-demand Materials, or ChROMa for short.

The research team used their grant to develop this procedure by soaking a sample of filament in a liquid indicator and then drying it out. The optimum times for the soaking and drying stages had to be determined, as well as which type of filament then exhibited the greatest degree of color change when exposed to chemical vapor. That involved experimenting with different plastics such as nylon, polylactic acid, and acrylonitrile butadiene styrene, in their original formulation or with different additives such as white dye or glass fiber.

Given these variables to work with, the number of possible experiments was more than 300. They were able to cut that number to 90 using a method known as Design of Experiment — a technique using statistical analysis to determine the relationship between factors affecting a process – to reduce the number of experiments needed.

They discovered that the best material was a white nylon that had been soaked for 15 minutes and dried for four hours. Having proved the concept, they would like to move on to experimenting with novel colorimetric chemistries, compounding the indicator and plastic together, and testing it on a 3D printer. The goal would be to create a spool of colorimetric filament that retains its colorimetric sensing capacity during the 3D printing process. This would ultimately lead to experimentation with the form factor—for example, could you print a sensor in the shape of a credit card?

However, Hauck is very satisfied with his team's work thus far. "Whenever you come up with an idea like this there is always the possibility that it simply won't work," he said. "It's a great sense of accomplishment when everyone and everything comes together to make it work, and now we have a lot of exciting possibilities to explore."

The Defense Logistics Agency (DLA) has already expressed interest in the research. ChROMa holds the potential for easing the logistical burden of providing field sensors to warfighters if 3D printers and materials can be deployed near the front to create custom sensors and form factors that suit the mission at hand.

The team plans to submit their work on ChROMa thus far to the DLA's Emergent IV Broad Agency Announcement, a funding program for scientific study and experimentation directed toward advancing the state-of-the-art or increasing knowledge or understanding in additive manufacturing.

Research chemist Dr. Brian Hauck and biologist Melissa Dixon set up a vapor generator to test one of the ChROMa samples by exposing it to ammonium hydroxide vapor.

A SOCOM operator uses F-FAST in the dark during Arctic Edge 24 inside a permafrost tunnel near Fairbanks, Alaska.

Identifying Pathogens in the Field with F-FAST

Future battlefields require an on-the-go approach to the identification of whatever biological threat our warfighters may come across. One such approach — Far-Forward Advanced Sequencing Technology, or F-FAST – uses rapid DNA and RNA sequencing systems for biothreat identification in far-forward environments.

While these types of tests normally require a degree of scientific know-how, researchers at the U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) are working to make F-FAST's rapid testing methods quicker and simpler than ever to address all potential biothreats – including those that are emerging and genetically modified.

As opposed to the previous forms of assays (e.g., COVID-19 type tests), there is a need for DNA/RNA sequencing capability – the next frontier in pathogen identification – as the threat of modified pathogens can obfuscate traditional methods. According to CBC Research Biologist Dr. Cory Bernhards, F-FAST's technology to perform rapid sequencing in the field, reach-back genome assembly can then be the catalyst to create countermeasures such as therapeutics or vaccines.

"The big thing is that most operators are not laboratory trained," said Bernhards. "We've greatly simplified the sample preparation process for DNA and RNA sequencing in the field. We've moved to using syringes instead of pipettes, scaled up liquid volumes and reduced time and steps that are needed. As a result, we have developed the fastest DNA and RNA sequencing systems in the world, where military operators can go from sample to result in under 30 minutes."

F-FAST is sponsored by the Defense Threat Reduction Agency, and the program recently transitioned the warfighter-focused systems to the Far-Forward Biological Sequencing (FFBS) Program of Record at the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense.

Other F-FAST partners include the Naval Research Laboratory and United States Army Medical Research Institute of Infectious Diseases. While these partners focus on targeted sequencing, DEVCOM CBC have their sights set towards untargeted, whole genome sequencing.

"We obtain direct feedback from military operators during field tests on all aspects of our sequencing systems," said Bernhards. "Then we immediately incorporate the feedback to develop the next iteration of the system. Using this approach, frequent field testing has enabled rapid development of these sequencing systems which are specifically designed to meet operator needs."

F-FAST's "quick and dirty" method of sequencing is its biggest attractor – good enough to identify a biothreat while also generating the sequencing data for further analysis. Getting warfighters the information they need quickly is critical in a field/combat setting.

"Even though we've simplified the sample preparation process for DNA/RNA sequencing drastically, operators would still prefer an automated sample preparation device to reduce their burden in the field," said Bernhards. "So, this is what we are currently working toward."

The F-FAST team has participated in field exercises as often as every three months during development, with each new challenge breeding even more innovation. F-FAST has been pushed to show its prowess in harsh environmental conditions such as Dugway Proving Ground, Utah in the summer (up to 100 0F) and Fairbanks, Alaska in the winter (down to 0 0F). In the few months left of the F-FAST program, the team is looking forward to additional field experiments at Beholder's Gaze 24 in Oahu, Hawaii and Dragon Spear RDAX 24 in Perry, Georgia.

After F-FAST was tested at a prior exercise, SOCOM operators were asked what was further needed. Their response was simple: "We want F-FAST tomorrow."

Center Improves Handwear Testing with "Glove as a Glove" System

In 2024, DEVCOM CBC developed a new technique for testing gloves worn by warfighters to ensure that they provide full protection from chemical agent.

Dubbed "glove as a glove", the technique involves using special equipment developed by DEVCOM CBC engineers and using well-worn gloves to ensure realism when testing the entire glove as if it were a full system.

"With the massive dependence on our hands – and by extension, our gloves – we figure 'why not test them as such?' as opposed to using multiple swatches," said Jennifer Hughes, a laboratory manager for DEVCOM CBC's Engineering Directorate. "When striving for mission success, DEVCOM CBC has decided it's more important than ever to ensure our Soldiers' gloves are thoroughly and strenuously tested for their durability and permeation protective capabilities against a chemical threat."

Traditionally, a Soldier's uniform and other synthetic materials are tested on a smaller scale. Swatches are cuts of fabric taken from a full article of clothing that are meant to be samples for design or testing purposes. But gloves aren't so simple, since their complex seams and multiple materials lend themselves poorly for the swatch method of permeation testing. Features such as leather palm reinforcements and plastic knuckle armor make traditional testing on gloves a challenge in the chemical, biological, radiological, nuclear (CBRN) realm.

Thomas Hughes, a chemist at DEVCOM CBC and principal investigator for the glove as a glove program, had guidelines for the gloves being tested to be field worn. According to Hughes, cutting a swatch is impossible for a worn glove because their dimensions do not line up for the Center's previous fixtures.

A worn glove conforms to the contours of the hand over time, stretching in some areas more than others, said Hughes. Wear and tear are best collected as data points when not simulated, so the gloves being tested have seen 504 hours of use – dirt, sweat and all. "The three-dimensionality of a hand is complex, and can't be captured in a swatch. Hence the need for a new testing capability," Hughes said.

The glove as a glove initiative was specifically requested by the Joint Project Manager for CBRN Protection (JPM CBRN Protection), a component of the Joint Program Executive Office for Chemical, Biological, Radiological, and Nuclear Defense (JPEO CBRND). Their request was for a method that tests a complete system – the entire glove – at one time. There can be no margin for chemical agents to penetrate what is essentially the first line of defense for Soldiers and scientists in the field.

Jennifer Hughes, a DEVCOM CBC lab manager at Aberdeen Proving Ground Edgewood, Maryland, administers droplets of chemical testing agent on a glove to test its permeation capabilities for the Glove as a Glove initiative.

Since a flat, worn combat glove is not possible for testing, Hughes got to work back in November 2022 creating a testing methodology called Verification and Validation (V&V). It is comprised of two foam molds that distribute even pressure across the glove, thus ensuring consistent results for measured permeation. According to Jennifer Hughes, V&V for initiatives like glove as a glove can be just as intensive and thorough when compared to the actual tests.

"Our process is to have multiple pads inside the glove that are meant to absorb chemical agents if they seep through," said Jennifer Hughes. "Our other fixtures have a contact pressure of 1 psi for the swatch. We want to have consistency to compare previous results. Swatches are tested one way, and whole gloves are tested another. Using similar dosing amounts and pressures links the glove method back to the accepted swatch methods. We used the same test plan from the swatch method for Verification and Validation, then said we will test under these conditions, so that when we're done it will be approved under the same program of record."

Development of the prototype system was done by DEVCOM CBC's Advanced Design Manufacturing facility. They completed the 3D-modeling, engineering and working from concept, to prototype, to final capability. V&V for glove as a glove was completed in January 2024.

"The results we generate have to be accepted by all the different agencies under our joint services program," said Thomas Hughes. "There are many stakeholders that need to know we have the test infrastructure needed to generate consistent data. There's no point if we can't do it consistently or without it being accepted by a stakeholder. This is the only place that is validated for the glove as a glove testing."

"The demand signal from customers is that they may want us to do this for a boot at some point," said Thomas Hughes. "There is a potential for a mannequin to look at everything as an ensemble, boots, uniform, mask, hood – we may move forward with that in the future."

DEVCOM CBC Innovates and Integrates through Autonomous Technologies

The U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) is paving the way and helping the Army transform into a multi-domain force through its modernization and priority research efforts that are linked to the National Defense Strategy and nation's goals.

CBC continues to lead in the development of innovative defense technology, including autonomous chem-bio defense solutions designed to enhance accuracy and safety to the warfighter.

PROTECTING THE WARFIGHTER

Having successfully developed new versions of military assets, including a biological sensor integration project for unmanned aerial vehicles (UAV) in 2018, DEVCOM CBC has become a reputable leader for the Army's large-scale technology integration efforts. The addition of sensors and in-house engineering innovations applied to the UAV allowed rapid detection of airborne biological threats through remote operations and real-time communication between the payload and drone operator.

The addition of autonomous capabilities paired with other advanced technologies also improves warfighters' decision-making capabilities. "Broadly, we're in a digital world now," said Patrick Riley, a research chemist and machine learning advisor to the sensors program at DEVCOM CBC. "Information is constantly being generated. The integration of AI/ML compiles the most pertinent information to warfighters faster," he noted. "Warfighters are still making decisions, but this capability allows them to make them more quickly without having to filter through every aspect of information."

Technology leaders such as DEVCOM CBC play a key role in providing the tools that allow troops to readily adapt based on the conditions and threats in specific domains at any given time. "The application of AI/ML supports a lot of projects we do, with the number one goal of protecting warfighters and reducing exposure to hazards," said Riley.

Pairing AI/ML with technology that has already been developed and tested at CBC can further reduce hazardous chemical and biological exposures to the warfighter while improving decision-making and readiness. The Center is using advanced tools like sensors and data-driven algorithms to create detailed maps and develop a greater understanding of the environment to which various technologies can be applied. These useful tools are being incorporated into advanced technologies like robots, drones, bio-printing, and high-tech manufacturing and adhere to responsible AI ethics principles.

The Autonomous Equipment Decontamination System has been demonstrated at several exercises, including the Maneuver Support Protection Integration Experiments (MSPIX) at Fort Leonard Wood, Missouri in May 2024 and Chemical Biological Operational Analysis event held at Camp Dawson, West Virginia in August 2023 (shown in image).

REDUCING WARFIGHTER BURDEN

In a prototype of the Autonomous Equipment Decontamination (AED) System, DEVCOM CBC demonstrated the future of decontamination technology. The concept of the AED System combines unmanned systems, AI/ML, and autonomous behaviors to identify, map, and decontaminate military combat vehicles on the battlefield. The Center has spearheaded the project, combining its specialization in the development and advancement of robotics, AI/ML, and sensors along with industry partners to provide advanced solutions for the Army's missions.

The system reduces the burden for warfighters and enhances mission readiness on the field by using robotic platforms, autonomous behaviors, and other advanced technologies to reduce the time, logistics, and personnel required to conduct decontamination operations. It includes remotely operated robotic systems configured with sensors to identify and map chemical and biological contamination and precisely apply an advanced decontamination solution to only the contaminated areas of a military vehicle.

SUPPORTING MULTI-DOMAIN OPERATIONS

All of this is helping the Army move into a new era of chem-bio defense for multi-domain operations (MDO) and the Center has recently unveiled several innovative capabilities in support of this transformative effort.

The MDO approach is pushing the defense sector to think critically about new ways to apply tools and technology to work in specific situations, while also enabling systems to switch between different functions and environments smoothly. The need for military assets to be versatile is becoming increasingly important as the battle

Dr. Patricia McDaniel, the Army's Senior Research Scientist for Chemistry at DEVCOM CBC, has led the microsensors program for the Center, focused on enhanced hazard detection capabilities and integration with other autonomous technologies.

domain quickly changes. David Glynn, DEVCOM CBC Liaison Officer to the Maneuver Support Center of Excellence at Fort Leonard Wood, Missouri, says, "We must be able to fight and win in different situations, considering the environment, rules, conditions, sizes, formations and places." As DEVCOM CBC continues to develop these advanced systems, it is critical to meet these needs.

The Center is supporting this effort by integrating its current capabilities throughout its project portfolio to support the U.S. Army in its vision to develop the fighting force of the future and applying it to other organizations as well. "We are having collaborative discussions to identify where a demand lies," said Glynn. "We're taking components from one military branch and integrating them into other branches so we can bring these solutions into the realm of possible."

Collaborations among partners and the Center's sister organizations have also been beneficial in creating and refining systems. "We develop various partnerships in the industry including academia, businesses, and other government entities to help facilitate solutions," Glynn continued. "Communication is the most critical component of any development capabilities." Continued collaboration will allow the Center with greater capability to accelerate technology advancements and support and defend the warfighter.

SEEING THE BATTLEFIELD THROUGH MICROSENSORS

In a proof-of-concept study, scientists at DEVCOM CBC have been working to miniaturize sensors so information can be provided to Soldiers and equipment on a universal interface. These microsensors would allow users to select and customize capabilities for each unique mission. Project researchers envision stealth microsensors that can be used for deployment which are also cost-effective enough to discard after use. This new development has been applied to various prototypes, with the most recent deployment of the microsensor application taking place at Rio Robotico in April of 2024. The demonstration used a robotic dog to deploy the CBRN microsensors and establish mesh network communications.

The microsensor program has proven to be successful, becoming an officially recognized program in September of 2023, creating an opportunity for the Center and other joint partners to implement microsensors into various project areas. "The solutions do not lie in a single sensor or single type of sensor," said Dr. Patricia McDaniel, the Army's Senior Research Scientist (ST) for Chemistry at DEVCOM CBC. Instead, the microsensors, which are essentially a 'system within a system,' will allow for greater continuity amongst Army functions.

"The microsensors will help us develop a deeper understanding of our environment and various detection capabilities," McDaniel said. "We will be able to utilize a variety of sensor modalities to query an area and determine if there is a threat without having to place our warfighters in harm's way." The addition of this program opens new avenues for functions of military assets by enhancing and exploring new use cases for current capabilities. It also aids in the development of other autonomous technologies that are being harnessed throughout various projects at the Center.

DEVELOPING CRITICAL SOLUTIONS

DEVCOM CBC is a key player in supporting the U.S. Army's mission to capture and implement cutting-edge science and technology capabilities that align to priorities identified in the Department of Defense's National Defense Science & Technology Strategy. With a team of experts at the forefront of innovation and a wide range of capabilities that span across various domains, the Center has supported the Army in developing mission critical solutions designed for integration across the board. DEVCOM CBC is harnessing its specialization in research and development of chemical and biological protection for warfighters to counter emerging threats and navigate a new era of the battlespace.

PARTNERSHIPS AND OUTREACH

Technology Transfer at DEVCOM CBC

DEVCOM CBC has a long history of collaborative research. Technology transfers, or T2, involves cultivating technology in government laboratories and then formally transferring that intellectual property to a nongovernment organization for the purpose of commercialization. These important agreements allow for more rapid development of emerging technologies and foster collaboration between government and industry partners. The Center's laboratories have extensive technical capabilities, research, development, testing and evaluation facilities, and data that our partners may choose to leverage. Ultimately, the goal of T2 is to increase warfighter operational readiness and effectiveness through interoperability and partnership with allies and coalition partners, providing the best technologies available for equipping the U.S. Army.

Number of Technology Transfer Agreements:

39
Active Interagency Agreements

123
Active Cooperative Research and Development Agreements (CRADAs)

58
Active Memoranda Of Understanding (MOUs)/ Memoranda Of Agreement (MOAs)

69
Active Technology Support Agreements (TSAs)

44
Active University Agreements

22
International Agreements/Annexes

Strategic Partnerships

The Center's Technology Transfer Office facilitates collaborations and works to reach mutually agreeable terms and conditions and appropriate legal mechanisms for other CBRNE organizations to expand upon our work or find private sector applications for it.

Our government laboratories have extensive technical capabilities, research, development, test, and evaluation facilities, and data that add tremendous value to our collaboration partners.

Through our technology transfer collaborations we're able to:

Enable accomplishment of technology transition objectives while benefiting U.S. industry

Enable industry, academia and other organizations to leverage the Center's unique assets including:

- The Center's intellectual property portfolio
- Its science and engineering expertise
- Its unique infrastructure and rapid prototyping capabilities

In-house Laboratory Independent Research / Chemical Biological Advanced Materials and Manufacturing Science Programs Active Collaborations

Johns Hopkins University
Yale University
Defense Threat Reduction Agency
National Institute for Occupational Safety & Health
Environmental Protection Agency
Army Research Laboratory
DoD Military Working Dog Veterinary Service
Department of Homeland Security

Transportation Security Administration
Defense Advanced Research Projects Agency
United States Food and Drug Administration
U.S. Naval Research Laboratory
University of Wisconsin – Madison
United States Military Academy West Point
Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense
Command, Control, Communications, Computers, Cyber Intelligence, Surveillance and Reconnaissance Center

DEVCOM CBC Partners with Vanderbilt University in Educational Agreement

Vanderbilt University (V.U.) and the U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) officially formalized an Educational Partnership Agreement (EPA) during a signing ceremony that took place at V.U. in Nashville, Tennessee on March 28, 2024.

The objective of the agreement is to officially establish mutually beneficial collaboration and innovation between DEVCOM CBC and V.U. It will encourage and enhance efforts with the university in key areas of science, mathematics and engineering at all levels of education with the goal of educating the next generation of scientists and engineers and enhancing critical defense capabilities.

Through the EPA, Center employees will be permitted to teach and assist in the development of science courses and materials at V.U. as part of a sabbatical program. It also permits the immersion of VU faculty and students (including post-doctoral and interns) in defense laboratory research projects at the Center and establishes groundwork for collaboration on publications and technical materials. Through these mechanisms, the EPA aims to optimize, inspire and nurture cross-disciplinary research and foster discovery with global impacts between the two organizations.

DEVCOM Deputy to the Commanding General Dr. Eric Moore, DEVCOM CBC Director Michael Bailey, V.U. Chancellor Daniel Diermeier, and VU Vice Provost for Research and Innovation Padma Raghavan all participated in the signing ceremony in Kirkland Hall at V.U.. They also toured several of the campus' unique research spaces and met with V.U. administration and faculty to discuss research interests and project goals, followed by a reception hosted by the university.

Bailey explained the importance of partnerships between DEVCOM CBC and academic institutions like VU. "Agreements like the one we're establishing with Vanderbilt are crucial for advancing innovation and sharing ideas," he said. "By combining the expertise and resources of these two institutions, we can accelerate progress in fields such as science, math and engineering."

The agreement between the Center and V.U. aims to develop innovations that will have a transformational impact on the national defense mission. "Vanderbilt leads in chemical biology by bringing science, engineering and computing together to enhance our understanding of everything from cells to complex systems," said Vice Provost for Research and Innovation Padma Raghavan. "This new partnership with DEVCOM CBC is an ideal opportunity for our teams to collaborate around DEVCOM CBC's need to protect against chemical and biological threats and Vanderbilt's strengths at the bio-nano interface."

Michael Bailey, DEVCOM Chemical Biological Center Director (left), and Daniel Diermeier, Chancellor of Vanderbilt University (right), conducted an Educational Partnership Agreement signing ceremony at the V.U. campus on March 28, 2024. Also participating in the ceremony were Padma Raghavan, V.U. Vice Provost for Research and Innovation (far left) and Dr. Eric Moore, DEVCOM Deputy to the Commanding General (far right).

Scientists Support High School STEM Team in Drought Mitigation Research

The U.S. Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) recently finished an educational partnership with a group of high school students from Arizona. CBC scientists supported the students with their research on methods to prevent megadroughts through innovative water harvesting methods.

The educational partnership began during the 2023 eCYBERMISSION competition in Hunt Valley, Md. eCYBERMISSION is an Army Educational Outreach Program (AEOP) sponsored event that pits teams of students in grades 6-9 from across the country to submit research project ideas and compete with existing prototypes for awards. The research targets social and environmental impacts in the local community, with the most promising ideas awarded grants to advance them to an operational level.

At the eCYBERMISSION event, Ann Kulisiewicz, a research chemist within the Protective Materials Development Branch at CBC, participated in a demonstration of how Metal Organic Frameworks (MOFs) can be used to degrade chemical warfare agents (CWA). Kulisiewicz has been working with MOFs for nine years at the Center, looking at their applications in the degradation of chemical warfare agents. As part of her demonstration, Kulisiewicz was assisting students in a virtual reality laboratory simulation of MOF synthesis and testing when the Scottsdale, Arizona team, who call themselves the Water Warriors, approached her looking for help.

"We were working on ways to show off MOFs when the Water Warriors stopped to chat," said Kulisiewicz. "They had won a grant for their project, but they weren't able to build their prototype because they didn't have the MOF needed to test it. They requested that we make a MOF that could be used in a prototype to present at the 2024 national judging and educational event in Virginia this year."

Led by team leader Audrey Skidmore, the Water Warriors are comprised of 9th graders W. Ira Parsons, Charles Skidmore, Aditya Vashistha, and Eric Wang, all hailing from different high schools in the Scottsdale area. With their Star Wars-inspired design, they now have a prototype filtration system built out of MOF-801 that collects ambient moisture from the air to create water. This MOF acts as a giant molecular sponge, attempting to pull moisture out of air that can be recycled for use in drought-stricken environments. According to Kulisiewicz, previous MOF chemists have tested this theory in desert environments and found it to be successful. With the help of some CBC consultation and a new grant-winning prototype in hand, the Water Warriors are on the path to making a difference by solving a 30-some-year megadrought that has plagued their community.

The Water Warriors, joined by their high school Team Advisor, right, stand behind an early prototype for their atmospheric water filtration system.

"We had to make a somewhat tutorial video for the process of MOF synthesis, going as far as recording a series of professional videos to demo and instruct the students remotely on their new materials," said Kulisiewicz. "They get to see and experience a government lab – it's a huge win for them. We get to mentor that next generation of scientists, easily one of the best parts of my job."

After missing last year's eCYBERMISSION, the Water Warriors presented their demo at this year's National Judging & Educational Event on June 27 in Chantilly, Virginia. While they didn't win among the 2,000 entrants, their in-action grant from the AEOP allowed them to refine their design further and perfect their MOF filtration system. After their most recent tests, they hope each MOF will create seven liters of water daily, running entirely off solar power.

When asked how DEVCOM CBC finds educational partnerships such as these, Kulisiewicz credited Casey Weininger, the CBC STEM Program Manager, with being the primary catalyst for increasing student involvement in Army research opportunities.

"It's so great to see that sending out these outreach opportunities, interacting in local science fairs, and STEM outreach in the classroom, in general, is making a difference in both those kids' lives and our lives here at the Center," Kulisiewicz said.

From Classroom to DEVCOM CBC, Teachers Participate in AEOP RESET

The U.S. Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) had the opportunity to host two high school teachers in the Army Education Outreach Program's (AEOP) Research Experiences for STEM Educators and Teachers (RESET) initiative. This multi-week "internship" for teachers focuses on providing high school or middle school STEM educators with a lab-focused professional development program coupled with a summer research experience at one of the many participating Army research laboratories and centers.

RESET, an Army funded program that takes K-12 educators nationwide and immerses them in a genuine summer research experience, is designed to equip them with the necessary tools to provide students with applied STEM concepts within real-world contexts.

The two interns, Sistina Martin and Caitlin Meador, are both STEM instructors from the same school district in Crossville, Tennessee. Martin, a ninth-grade instructor specializing in biology, chemistry and ACT test prep, is on her second year of the RESET program. Meador teaches middle school science. Both were personally invited to experience the program from Dr. Jennifer Meadows, associate professor at Tennessee Tech University as well as director of AEOP's RESET program.

"We both went to Tennessee Tech and know her very well – she reached out personally," said Martin. "Dr. Meadows met with me and said, 'I have another space; do you want it?' and I said absolutely – it's such a good opportunity that few get."

Both Martin and Meador have master's degrees in STEM subjects, but noted the lack of real-life application that comes with college lab courses. With a heavy emphasis on hands-on experience, the RESET program gave both teachers new experiences and motivations to bring back to their classrooms.

"You take a lot of courses in college, but all the labs in particular are set in stone," said Martin. "You follow protocol and it's like you're not doing real research. You don't have the opportunity to "break new ground" and work with new materials or work out problems, when in the real world [here at DEVCOM CBC] you collaborate. That's what happens when you're researching and working as part of a team in science. You don't often get the opportunity to teach that in the classroom."

"We get to be in an actual lab with actual scientists," said Meador. We're watching them research and helping them work. It's easy to see how it connects back to the classroom with real-world concepts to reference. I never had the opportunity to work in a lab before and it's amazing—I learned so much and such an amount of information that is truly fascinating."

The RESET program's success stems from the quality of the teachers that are accepted, coupled with the guidance of experts from the wide range of Army centers across the nation. As director of the RESET program and a member of the AEOP Consortium Management Committee, Dr. Meadows ensures that the right teachers are paired with the right mentors for optimal growth in their mutual fields, vying mostly for educators that value inquiry, creativity and innovation in the classroom. Meadows also actively recruits for RESET, presenting at multiple educator conferences throughout the year, such as the National Science Teaching Association conference.

"Our teachers report gains in their STEM knowledge, overall confidence in teaching STEM and increased understanding of careers relating to STEM," said Meadows. "The mentors, likewise, have shared that while our RESET educators are much like other interns they work with, the maturity and experiences of RESET educators set them apart as valuable members of their research teams."

The mentors are just as integral to the operation as the selected mentees. Dylan Fudge, a research biologist with CBC's Molecular Toxicology Branch, says that having eager STEM instructors to assist brings with it benefits beyond just an extra set of hands.

"Personally," says Fudge, "it helps us reinforce concepts – brings us back to the basics. They are shadowing all of our organ-on-a-chip projects, studying in our zebra fish laboratory as well as working in our 3D printing facilities at the MakerSpace lab. They were absolutely ecstatic to be growing their own cells. It kind of reinvigorates your love for the job." said both Martin and Meador. "We assist in any way we can and just be a helping hand. We've visited more than just this lab, yet so many people here want to teach you and help."

The AEOP RESET program is accepting applications for next year's mentorships until November 1.

From left to right: Dylan Fudge, Tyler Goralski, Sistina Martin and Caitlin Meador at the DEVCOM CBC Toxicology Lab during their last week with the RESET Program.

> **"I've never had the opportunity to work in a lab before and it's amazing."**

DEVCOM CBC Co-Hosts 2024 NCT USA Conference

> **“This event is a way to make those technologies come to life.”**

Attendees at NCT USA 2024 pose for a group shot on the exhibition floor, where booths from industry and government were available for discussion and future collaboration.

Participants at the 2024 NCT USA’s PRO eXperience simulated a training scenario where the FBI Hazardous Evidence Response Team were sent into a building where people were manufacturing WMDs. The participants were then sent in with gear that could detect/identify chemical agents. The PRO eXperience is meant to foster interoperability of first responders while introducing teams to the latest in CBRNe defense.

The U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC), in co-sponsorship with the CBRNe Society, hosted the NCT USA conference from September 3-5 at the Chemical Demilitarization Training Facility at Aberdeen Proving Ground, Maryland.

The conference is designed to enable collaboration among high-level decision makers and experts in chemical, biological, radiological, nuclear and explosive (CBRNe) threats from across the globe including members from the counter improvised explosive devices (C-IED) and explosive ordnance disposal (EOD) communities. The forum provided a world-class networking and knowledge exchange platform for government and military senior leaders, local and federal first responders, academia, as well as industry partners in the field.

“This is our fourth year of co-hosting – I’m not sure there’s another event that brings together a community like this,” said DEVCOM CBC Director Michael Bailey as he addressed the audience during his opening remarks. “There are key elements of the CBRNe enterprise here with us today, so talk to them. They’re the ones that will be able to answer the question of, ‘is this capability able to turn into a real-life thing?’ This event is a way to make those technologies come to life.”

Over the duration of the three-day-long conference, NCT USA’s 400+ attendees were able to participate in the main hall’s tech exhibition for government and industry stakeholders to preview potential collaborations, and a Dragon’s Pitch, which allows members from all communities to present their ideas in a “shark tank” environment for industry awareness. Attendees also had the opportunity to attend an NCT PRO eXperience, which fosters interoperability of first responders while introducing teams to the latest CBRNe, C-IED and EOD technologies.

On day two of the event, Bailey briefed the audience alongside a roster of keynote speakers, including Dr. Eric Moore, Deputy to the DEVCOM Commanding General and Darryl Colvin, Joint Program Executive Officer for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND). All were eager to welcome attendees and give insight into what their organizations have to offer while posing questions for the upcoming walkthrough on to the showroom floor.

“Modernization is just one element of the DEVCOM mission,” said Moore. “We’re looking towards total transformation. We need new processes, new partners and more assurity so that our warfighters have the best capabilities ever. No matter where we are in the materiel lifecycle, we’re impacting it – but we can’t take all the credit since we have so many partners. These kinds of events ensure that we keep fostering those partnerships.”

The international and inter-organizational aspect of the CBRNe field is one of the community’s strongest assets. With partnerships from around the globe in attendance, NCT USA remains a pivotal event to catalyze collaborative efforts in CBRNe defense. Bailey put it best, by saying “It is incumbent on us to work with industry and international partners and get on board the moving train.”

AWARDS, PUBLICATIONS & PATENTS

Awards

The Department of the Army presents honorary awards to civilians in recognition of individual achievements. In 2024, 42 DEVCOM CBC employees received honorary awards.

CIVILIAN SERVICE COMMENDATION MEDAL

Gary Guyer
Joseph Gardner
Gerald Starnes
Debra Rapp
Christopher Ritchey
James Buchanan
Steven Kaminsky
Renee Singleton
Bryan Rivers
Lorenzo Hankla Jr.
Jennifer M. Hughes
Thomas M. Hughes
Wayne Gulian
David Whitcraft
Michael O'Brien
Michael Simini
Anna Crumbley
Joe Kragl III
Henry Gibbons
Melody Zacharko
Lois Single
Courtney Conner
William Lake

CIVILIAN SERVICE ACHIEVEMENT MEDAL

Steven Kaminsky
Laura Simpson
Dr. Thomas Saltysiak
Julie Renner
Laura Belasco
James Herbert
Tanner Fuselier
Shannon Efird
Mark Winemiller
Dr. Paul Sneeringer
Daniel Davis

MERITORIOUS CIVILIAN SERVICE MEDAL

Laura Starkey Bayne
Megan Hower
Amanda Hess
Dr. Kelly Basi
Humberto Galarraga
Roderick Fry
Lowry Brooks
John Strawbridge II.

FY24 Patents

Vehicle Trailer or Shipping Container and Evacuation Assembly
Patent # 12,103,765 | Oct. 1, 2024
Brian J. O'Donnell, Jr., Jeffrey M. Kiley, Amy L. Dean, Michael C. Glorioso, Michael Richter, Donnie Lester

Multivariate Carboxylate Derivatized Phenyl-Based Metal-Organic Frameworks
Patent # 12,012,423 | June 18, 2024
Gregory W. Peterson, Thomas H. Epps, III

Polymer-Based Composite Beads Comprised of Metal-Organic Frameworks and Metal Oxides for Toxic Chemical Removal
Patent # 11,998,785 | June 6, 2024
Gregory W. Peterson, Thomas H. Epps, John M. Landers

Multivariate Carboxylate Derivatized Phenyl-Based Metal-Organic Frameworks
Patent # 11,987,594 | May 21, 2024
Gregory W. Peterson, Thomas H. Epps, III

Single Threaded Composite Fibers and Yarns for the Degradation of and Protection Against Toxic Chemicals and Biological Agents
Patent # 11,975,313 | May 7, 2024
John M. Landers, Christopher J. Karwacki, Trenton M. Tovar, Gregory W. Peterson

Passive Outdoor Aerosol Sampler
Patent # 11,940,365 | March 26, 2024
Jana S. Kesavan, Jerold R. Bottiger

Mass Spectrometry Ionization Based-Assay for the Detection of Enzyme Activity and/or Presence
Patent # 11,913,059 | Feb. 27, 2024
Trevor G. Glaros, Elizabeth S. Dhummakupt, Phillip M. Mach, Daniel O. Carmany

Fired Cartridge Case Collectors and Methods of Use Thereof
Patent # 11,879,712 | Jan. 23, 2024
Richard B. Moore, David F. Whittaker, Kevin S. Wallace, Todd W. Bille, Gregory A. Peiffer, Steven M. Weitz

Chemical Detection Training Container and Method for Use Thereof
Patent # 11,872,562 | Jan. 16, 2024
Patrick C. Riley, Brian C. Hauck

Pressure Sensitive Adhesive Coated Paper for Paper Spray Mass Spectrometry - Jointly owned with Indiana University/Prosecuted by IU
Patent # 11,823,885 | Nov. 21, 2023
Nicholas Edward Manicke, William Raymond Anthony Wichert, Ethan M. McBride, Trevor G. Glaros, Phillip M. Mach

Auxiliary Filter for Enhanced Chemical Protection
Patent # 11,794,140 | Oct. 24, 2023
Gregory Peterson, Ryan Ballantyne, Michael Boruch, William Clark, Bruce Corso, William B. Feaver, Nicole Puckace, Jeffery Stephen Hoene, Joseph Hunt, Neil Kennihan, Craig LaMoy, Robert Kinter, Michael J. Knapke, Mark Noltimier, Michael Pompeii, Chris Ritchey, Joseph A. Rossin, Rachel L. Rossin, Richard Warder, Jr.

2024 Peer-Reviewed Publications

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