Solutions

U.S. Army Combat Capabilities Development Command
Chemical Biological Center

NEWSLETTER
Q4 FY2020

PANDEMIC RESPONSE

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DIRECTOR'S MESSAGE

Diligence Pays Dividends in Battle vs COVID-19

Eric L. Moore, Ph.D., is the director of the U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC), the only chemical and biological defense technology center of its kind. He is a member of the Senior Executive Service and is an expert in chemical and biological defense and medical countermeasures.

Prior to his selection as Center director in October 2017, Moore served in various roles at the Defense Threat Reduction Agency including chief of the Advanced and Emerging Threat Division, chief of the Basic and Supporting Sciences Division and senior science and technology manager for chemical medical countermeasures.

Cum Scientia Defendimus – With Science We Defend. These words have long embodied the spirit of the U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC).

Never have they been more relevant than today.

The COVID-19 pandemic has turned the world's attention to science and to the seemingly miraculous results it can generate. While science can achieve miracles, those miracles are made possible by years, sometimes decades, of research and data collection quietly performed by some of the world's best minds.

Although nobody knew specifically that COVID-19 would occur, we at DEVCOM CBC were already researching and preparing for the possibility of a biological incident, human-caused or naturally occurring. Our experts have been tracking and researching the implications of biological pandemic events, and they are the science and technology experts on personal protective equipment, decontamination and additive manufacturing. So the moment the pandemic started, we were ready to help the Nation respond.

The first step in helping our partners and ensuring the readiness of our armed forces was to ensure the safety of our workforce. Our staff and directorates came together very early in the crisis to make sure we had the capabilities and protective measures in place. We more than tripled our telework capability to allow the majority of our workforce to perform their duties remotely, and we rapidly adopted protective measures for those employees who continued to work on site at Aberdeen Proving Ground, Rock Island Arsenal, Pine Bluff Arsenal and Dugway Proving Ground.

With that protection in place, our workforce was able to support the readiness of U.S. forces in the face of the pandemic. We supported the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND) in the deployment of mobile laboratories to Camp Ripley, Minnesota to provide COVID-19 testing for Soldiers deploying to the National Training Center. We also worked with JPEO-CBRND to support the Air Force with the Negatively Pressurized CONEX – a transportation system that can accommodate up to 30 COVID-19 patients aboard a C-17 transport jet. In addition, we developed surface decontamination techniques that members of our armed forces and first responders can use in the field to decontaminate personal protective equipment, vehicles, military equipment, buildings and other surfaces.

We've been designated as the first stop for the assessment of candidate Defense Department-made N95 respirators. We test them before they go to the National Institute for Occupational Safety and Health (NIOSH) for certification, and before they are distributed to warfighters and first responders. Our subject matter experts were sought out by Army, DoD, and commercial organizations to consult on NIOSH regulations for personal protective equipment. Within the Center, our filtration and additive manufacturing experts have joined forces to support projects to fabricate filters and create novel designs such as clear masks to enable facial recognition and better communication.

We also continue to work on new ideas and technologies in the Nation's continuing fight against the pandemic. We've partnered with the University of Pennsylvania to train dogs to safely detect biomarkers produced by the COVID-19 virus in humans. So far, the dogs have demonstrated a success rate of more than 98 percent, and this work could lead to a cadre of trained dogs that could be used to screen Soldiers at military processing centers or at the military academies. We've also received Coronavirus Aid, Relief and Economic Security (CARES) Act funding for lung-on-a-chip research using our Biosafety Level 3 containment facilities. This research will help us better understand how the novel coronavirus attacks human lung cells, which will aid in identifying protective measures and preventative medicines.

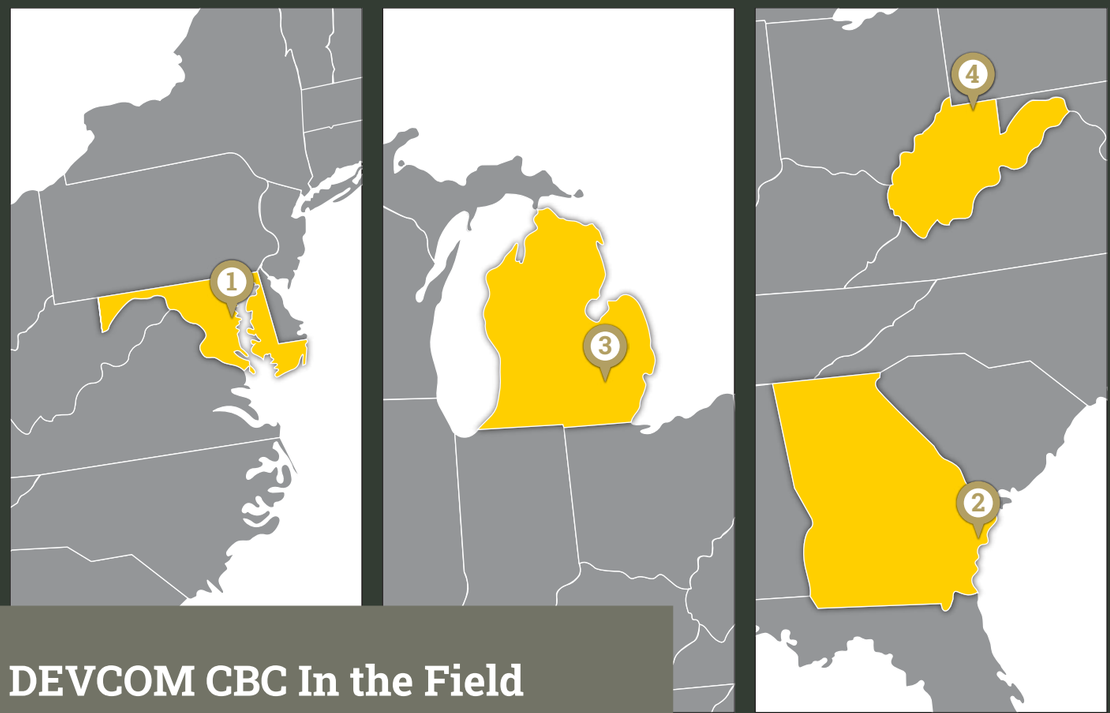
We recognized early on that sharing our expertise and technology with other organizations and leveraging the expertise of others would be critical to our success, so we set up key partnerships to support the COVID-19 response effort across government, industry and academia. We continue to work with hundreds of partners to explore how our technologies can be adapted to support this all-of-Nation effort.

We can do all this because of the expertise of our workforce, and because of the investments we've made in our technology infrastructure over decades. That is how we are able to defend our warfighters, our first responders and our nation. *Cum Scientia Defendimus* – With Science We Defend, is more than just a motto.

It's why DEVCOM CBC exists.

People first — winning matters — Army strong!

Eric L. Moore, Ph.D.
Director, DEVCOM CBC



DEVCOM CBC In the Field

DEVCOM CBC is made of many parts and each part has an important role to play in the protection against and destruction of chemical and biological threats. In the past several months, personnel have traveled not only around the country, but around the world in support of our common mission. Here's a look at just a few of the many places our workforce has touched down.

1 In August, DEVCOM CBC personnel completed the installation of biosafety cabinets at the Kimbrough Ambulatory Care Center at Fort Meade, Maryland and the Barquist Army Health Clinic at Fort Detrick, Maryland as part of establishing a clinical testing capability for COVID-19.

2 DEVCOM CBC personnel haven't let the COVID-19 pandemic prevent them from training Soldiers in the field. Center experts provided virtual chemical-biological threat training in August to the 83rd Chemical Battalion using Microsoft Teams. Unclassified CB agent related classroom training material was delivered virtually by Center scientists to more than 50 Soldiers, followed by a day of hands-on work by participants to construct mock clandestine chemical biological laboratory processes from training supplies. Soldiers then briefed their procedures to classmates, their leadership, and Center training staff to affirm lessons learned.

3 In August, Center personnel performed acceptance testing for Negative Pressure Container Lite (NPCL) production unit number 2 at the contractor facility in Howell, Michigan. The NPCL fits into the cargo compartment of an Air Force C-130 Hercules, and is designed to transport individuals with the COVID-19 virus and other highly infectious diseases while preventing the aircrew and medical professionals onboard from being exposed. CBC engineers subject each NPCL unit to a series of operational tests as well as a full inspection of components and features.

4 The CCDC Chemical Biological Center led a Dismounted Reconnaissance Sets, Kits, and Outfits (DR SKO) software upgrade mission in August for a U.S. Army Reserve unit Morgantown, West Virginia. The Center conducted system inspection, property accountability, and performed software upgrades on several components of the DR SKO system. The DR SKO software upgrade provided the unit with the latest information that significantly improves the warfighter's capability for detection, identification, protection and decontamination of chemical and biological threats.

Software Tools and Educating the Workforce to use Artificial Intelligence for Research and Development, known as STEWARD, is an internal investment to develop key applications of artificial intelligence and machine learning in CBRNE.

Center Invests in AI/ML Research and Development

Core Team Gears Up for 2020 Grand Challenge

By Jerilyn Coleman

Photo by Getty Images

FOR THE NEXT THREE YEARS, scientists and engineers at the U.S. Army's Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) will explore ways in which artificial intelligence and machine learning (AI/ML) can help solve chemical and biological defense issues to better protect the warfighter on the battlefield.

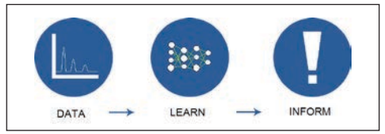
The 2020 Grand Challenge is a three-year initiative to educate the Center, provide practical opportunities and promote a better understanding of applications for AI/ML. In the last decade AI/ML has become an integral tool for the warfighter, using data to teach computers to predict outcomes without explicitly being programmed. For example, if a warfighter was pinned down by fire and was unable to search for an escape route, AI/ML could analyze all available data and provide the recommended safest retreat path without him or her having to divert attention from the fight. "What AI/ML can do is consume the data related to those decisions to provide suggestions and confidence to help guide a warfighter on the battlefield," said Patrick Riley, a research chemist in the Center's Detection Spectrometry Branch and a member of this year's core team.

This year's challenge will be called Software Tools and Educating the Workforce to use AI for Research and Development (STEWARD). "When I read the DoD's five principles of AI technology to be responsible, equitable, traceable, reliable and governable it reminded me of traits you would want in someone who is a good steward," Riley said.

In addition to Riley, the core team includes Mark Colgan, executive officer to the Center director; Janet Betters, program manager in the Center's Test Resource and Integration Group; Samir Deshpande, a senior bioinformatics scientist in the Detection Spectrometry Branch; and Matthew Lux, research biologist in the Center's BioChemistry and BioSciences Division. From leaders who supported past grand challenges to experts in AI/ML, this team is committed to researching AI/ML tools and methods that will provide better solutions and equipment for the warfighter, faster.

STEWARD's goal is to equip the workforce with resources to take advantage of AI/ML methods and the core team will achieve this through education, small projects, infrastructure/tools and communication. As the program ramps up, the team will begin their efforts by offering learning opportunities. "We invite the Center to join us for the educational series, including short videos and in-person invited lectures," Riley said.

Historically, grand challenges were designed to identify investments that would enable new business areas for the Center. The challenges are a part of a larger Center-wide innovation goal. Teams comprised of investigators from around the Center research various subject areas and are responsible for proposing new programs or ideas as potential grand challenge investments, and the Center's senior leaders select the proposals that are the most feasible and have the greatest potential to produce tangible results in the next three years.



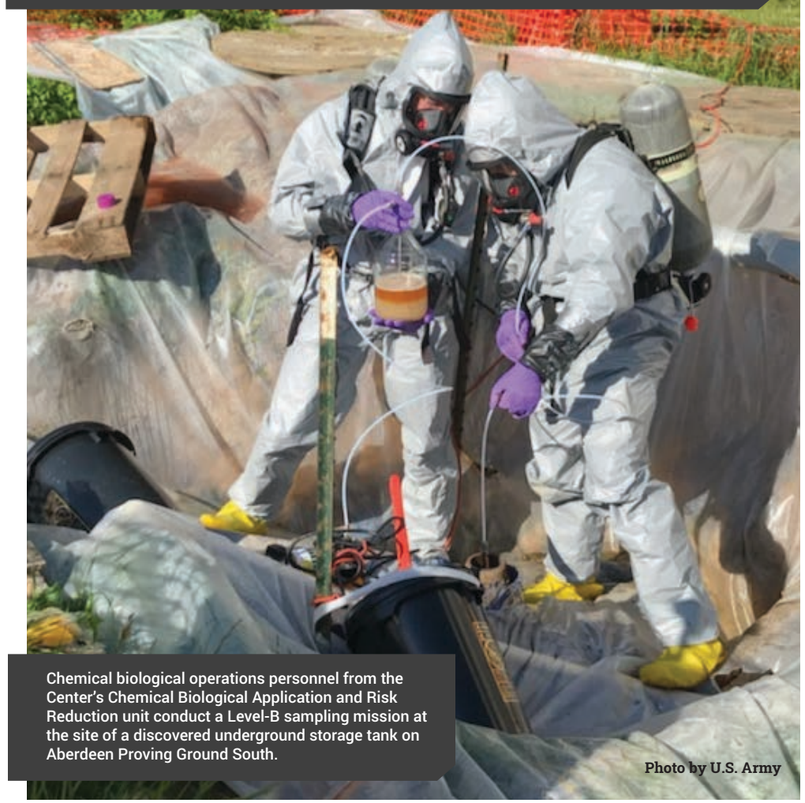
ML allows systems to analyze data, learn and identify patterns and inform decision making.

In 2014, the Center's first grand challenge project was the Chemical, Biological, Radiological, Nuclear and Explosive, Assessment, Science and Technology Laboratory at Edgewood. It allowed scientists to test chemical and biological detectors against substances up to 24 meters away and provided customers with a better way to assess detection equipment before it gets into the hands of warfighters. In 2017, the second challenge, Biological Engineering of Advanced Material Solutions was executed to unite a variety of scientists and engineers from across the Center to form interdisciplinary teams to develop novel materials using synthetic biology.

Going forward, the 2020 Grand Challenge core team will help programs throughout the Center address specific challenges with AI/ML solutions. Ultimately, the team hopes that STEWARD will be established as a voluntary research council that will continue to support the workforce and the DoD in the overarching CBRN defense space as well as developing alternative customer sources and enhancing the Center's standing in the science and technology community.

Capability Spotlight: CBARR Supports APG Garrison in Mystery Storage Tank Mission

By Robin Schumacher



Chemical biological operations personnel from the Center's Chemical Biological Application and Risk Reduction unit conduct a Level-B sampling mission at the site of a discovered underground storage tank on Aberdeen Proving Ground South.

Photo by U.S. Army

IMAGINE YOU ARE DOING YOUR JOB EXCAVATING A TRENCH, a normal day's work, until you hit something. What is it? It appears to be an underground storage tank (UST). Then you see what looks like mercury in the soil. What do you do? This is exactly what happened this summer when an electrical utility contractor was working near a building on Aberdeen Proving Ground (APG) Edgewood Area/APG South. Luckily, the Garrison Directorate of Public Works Environmental Division (DPW-ED) knew exactly who to call.

According to Andy Murphy, an environmental protection specialist at the DPW-ED Waste Management Branch, there is historical information on the placement of most legacy USTs and other subsurface systems used to convey and/or store petroleum and hazardous substances. Most of the older underground fuel oil tanks were removed by the APG Oil Control Program in the early 1990s and were replaced with aboveground, double-walled tank systems. "That being said, surprises such as this are not uncommon," said Murphy.

Due to the unknown nature of this particular UST and its proximity to former World War I/World War II chemical agent production facilities, the Garrison DPW-ED contacted the U.S. Army Combat Capabilities Development Command Chemical Biological Center's (DEVCOM CBC) Chemical Biological Application and Risk Reduction (CBARR) unit. CBARR's mission is to perform global chemical and biological operations in a safe, secure and environmentally sound manner, and response and remediation are a big part of that. When something out of the ordinary is discovered, such as a strange material, bomb, tank, or other anomaly, CBARR is one of the first groups involved because of Edgewood's history with chemical warfare agents (CWA). In fact, CBARR has 200 field-deployable scientists, engineers, technicians and operators who provide chemical biological support worldwide. This is what makes them unique from typical lab work -- they are actually putting on hazmat suits and going into the field.

When it came to this operation, CBARR brought not only its expertise on how to conduct the mission, but how to accomplish it safely. They know what personal protective equipment (PPE) to use, how to gather the sample and how to keep the surrounding areas safe. The first step for CBARR in operations like this is to develop a job safety analysis (JSA). "The JSA is the gateway to everything. It lists the steps to do the job, identifies potential hazards for each and addresses how to mitigate these hazards. It is driven by safety from beginning to end," said Brandon Bruey, a supervisory chemist in the Chemical Biological Operations Branch. The team begins gathering supplies and, once the plan is approved, they begin the operation. This process is usually accomplished within a week.

Initial analysis on the UST sample was performed by CBARR's Environmental Monitoring Lab (EML). Lab samples typically have a turn-around time of 72 hours; however, because of the nature of this project, the results came back within 24 hours despite the work restrictions imposed due to the COVID-19 outbreak. The testing conducted by the EML was critical as it was able to confirm that no chemical agent was present in the UST. The EML can tentatively identify what is in a sample, but, more specifically, its mission is to determine what is not in a sample. "We

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typically contact CBARR and request their assistance in screening these materials to rule out hazards for which our contract environmental laboratories are not qualified or prepared to handle," said Murphy.

Once any CWA was ruled out, the Garrison was able to safely send out samples to commercial labs to conduct additional analysis required to identify the contents for disposal. Bruey stressed, "If EML didn't do their step first, we could potentially be sending a highly dangerous material to a lab that is not equipped to safely handle it."

> ***"The team was responsive in both executing field sampling and analyses. In addition, the analytical information supplied by the CBARR lab provided ample information that pointed to #2 heating oil and water mixture. Subsequent analysis done by our environmental laboratory further reinforced this information, and provided data needed to characterize the waste fuel/water mixture for compliant off-site disposal."***
>
> *Andy Murphy, an environmental protection specialist at the DPW-ED Waste Management Branch*

Sample analysis from the EML did indicate the presence of both water and numerous hydrocarbons, however. This suggested the long-abandoned UST was likely for storage of heating or generator fuel and has since been exposed to rain or ground water. "The team was responsive in both executing field sampling and analyses. In addition, the analytical information supplied by the CBARR lab provided ample information that pointed to #2 heating oil and water mixture. Subsequent analysis done by our environmental laboratory further reinforced this information, and provided data needed to characterize the waste fuel/water mixture for compliant off-site disposal," added Murphy.

Another capability that makes CBARR unique is the ability to tailor sampling techniques and apparatus to the operation. In this case, because they did not know how far down the liquid was in the tank or if there was any agent present, it had to be contained in a closed system so that it was not released in the air. It also had to be rigid enough to reach the bottom of the tank, but flexible enough so that if there were two layers of liquid (i.e., oil and water) both would be collected. Using materials they had on hand, the CBARR team created a custom sampling apparatus using a vacuum pump, glassware and tubing to collect nearly four liters of a bi-phasic liquid sample from over 10 feet below ground level.

CBARR also conducts chemical agent monitoring, an important piece in a mission that could involve potential CWA. For this operation, the team deployed a Real Time Analytical Platform (RTAP), a mobile air-monitoring laboratory that allowed them to conduct near-real-time monitoring using Miniature Continuous Air Monitoring Systems (MINICAMS), as well as to collect historical Depot Area Air Monitoring System (DAAMS) samples around the tank's perimeter during the sampling operation. This ensured the protection of onsite workers as well as results that document no fugitive CWA emissions were released into the environment.

The mission was not without challenges, namely working in an environment highly contaminated with mercury and during a global pandemic. "To facilitate CBARR's UST sampling effort and mitigate potential exposures to the mercury contamination, the Garrison covered the mercury contaminated soil with plastic. CBARR personnel also wore PPE as an additional precaution," said Murphy. As for COVID-19 challenges, Bruey said that working remotely added an extra layer to getting the job done. For example, there were teleconferences and phone calls instead of face-to-face meetings and documents had to be emailed back and forth. Nevertheless, the team's persistence demonstrated how the workforce could still accomplish the mission, despite the vast majority of personnel being on remote work status. The many restrictions and approvals needed to access APG just

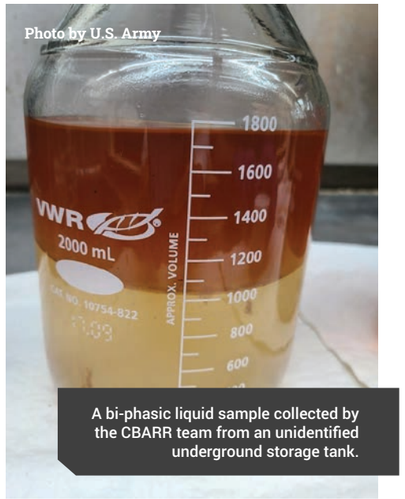

Photo by U.S. Army

A bi-phasic liquid sample collected by the CBARR team from an unidentified underground storage tank.

> ***"In true CBARR fashion, several branches came together to answer the call despite the added challenges presented by COVID-19."***
>
> *Brandon Bruey, supervisory chemist*

added another layer of effort. Because of social distancing, the team also had to look for alternative ways to do things, such as removing PPE when leaving the hot zone which is normally done with the help of other people.

All said and done, the UST sampling operation was conducted in a rapid and safe manner to provide the Garrison with the confidence needed to proceed with remediation. It is important to note that this was a team effort as there were multiple facets involved in the execution – environmental, safety, lab analysis, air monitoring and mask issue, each with their respective role. "In true CBARR fashion, several branches came together to answer the call despite the added challenges presented by COVID-19," said Bruey. He added that the successful effort was the latest in a long list of examples of how CBARR is helping to make the world a safer place.

WITH SCIENCE WE DEFEND

Center's Mobile Lab Expertise Enables Readiness

Operation tests Soldiers for COVID-19 prior to NTC deployment

By Brian Feeney, Ph.D.

A DEVCOM CBC team of specialists customized, transported, and operated two mobile laboratories to test nearly 4,000 Soldiers for COVID-19 at Camp Ripley, Minnesota prior to a rotation at the National Training Center at Fort Irwin, California.

Photo by U.S. Army

WHEN THE U.S, ARMY NEEDED TO TEST NEARLY 4,000 SOLDIERS for COVID-19 prior to a training rotation at the National Training Center (NTC) at Fort Irwin, California, a team of biological and logistics experts based at Aberdeen Proving Ground (APG) provided a deployable solution.

The Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND) was tasked with the mission of testing the entire 1st Armored Brigade Combat Team, 34th Infantry Division (1/34th ABCT), Minnesota National Guard, at their embarkation site at Camp Ripley Training Center in Minnesota. To rapidly field a solution, the JPEO-CBRN turned to the Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) for assistance.

The challenge faced by the team was to provide rapid testing onsite so the unit could successfully deploy to perform their mission at NTC. "Camp Ripley had no medical facilities to perform the testing," said Eric Miller, a DEVCOM CBC employee on loan to JPEO-CBRND.

The Center was responsible for shipping two JPEO-CBRND mobile laboratories to Camp Ripley, setting them up and overseeing the screening of nearly 4,000 members of the brigade in a month's time. Miller reached out to Chika Nzelibe, chief of the Center's Advanced Design and Manufacturing Division's Product Realization Branch, to assist with getting the two mobile laboratories outfitted with the analytical equipment needed for screening on this scale. Nzelibe pulled together a team of Center specialists who could get every phase of the mission done.

Inventing the Playbook

"Nothing like this had ever been tried before so we had to create a conduct of operations plan from scratch," said Miller. Operations consisted of screening every Soldier for COVID-19 using a laboratory testing procedure

> ***"Nothing like this had ever been tried before so we had to create a conduct of operations plan from scratch."***
>
> *Eric Miller, DEVCOM CBC*

that provides results in less than an hour. Those testing positive could be placed in quarantine for 14 days and retested; the rest could be cleared for transit to Fort Irwin.

However, the first step was to simply get the mobile laboratories from the Center's Aberdeen Proving Ground, Md., warehouse to Camp Ripley, 1,230 miles away.

"Before the laboratories could be mounted onto tractor trailers and driven away, everything in the laboratories had to be strapped down and fully secured," said Miriam Meller, a Center biomedical engineer on the

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> ***"It started with the Center's set-up and tear-down team being trained on the equipment in the labs, which was complicated by the fact that we had to maintain social distancing in a very confined space. That meant training only two people at a time."***
>
> *Miriam Meller, DEVCOM CBC engineer*

team. "It started with the Center's set-up and tear-down team being trained on the equipment in the labs, which was complicated by the fact that we had to maintain social distancing in a very confined space. That meant training only two people at a time."

There was a lot to secure in these laboratories: the analytical equipment, chairs, tables, shelving, toolboxes, and more. "It seemed like there was no end to what might move around inside these laboratories during transit, so we ratchet-strapped down everything that could move, always thinking, 'What might have I missed?'" said Meller. "So we strapped and strapped, and tightened and tightened, usually bending around in very awkward positions to do it."

The trailers were driven by members of the Center's Chemical Biological Application and Risk Reduction (CBARR) business unit without incident. Once they arrived, Meller and her teammate, Troy Thompson, a Center chemist, had to unstrap and put back in place everything they had strapped in Maryland. They also had to attach water and sewer systems, electricity, and HVAC. "Attaching all those utility systems involved many hours of climbing up and down the outside of the laboratories in very hot and humid weather," said Thompson.

Photo by U.S. Army

A Center technician straps down everything that might move inside a mobile laboratory before it is trucked to Camp Ripley, Minnesota.

A Thousand Tests per Day

Once the laboratories were fully set up and ready to start operating, Tim Karpich, a Center logistics management specialist, and Marcus Thermos, a Center biologist, began their job managing the day-to-day operations of the laboratories. That included making sure that all standard operating procedures were followed by the laboratory technicians, that the work flowed smoothly, and that they were well stocked with all the necessary supplies. Finally, it meant answering all manner of questions about the equipment, and making sure the work was performed correctly and efficiently.

Operations started on June 27 with 117 Soldiers tested. There was a pause and then they ramped up to test 3,000 over the course of July 5, 6, and 7 – a thousand a day. Those who tested positive were tested again 14 days later, so testing ended on July 27.

"We operated with no specific requirements, just a mission goal, so everyone had to be flexible," Miller said. "There were changes by the hour, and for a long time we didn't even know where the laboratories were going to be set up and what travel restrictions we would have to follow. The team really stepped up, they regularly worked overtime, and they accommodated every change and uncertainty thrown at them."

John McFassel, Joint Product Manager, Chemical Biological Radiological Nuclear and Explosives Analytical and Response Systems, said the support provided by the Center was critical to JPEO-CBRND's ability to successfully complete the mission. "We could not have performed this assignment without their skill and dedication," McFassel said. "They demonstrated initiative and perseverance to overcome the issues that inevitably arise when executing an effort this complex under such time constraints."

Center Helps Develop Capability to Transport Infected Warfighters

By Brian Feeney, Ph.D.

The Negatively Pressurized CONEX Lite system is placed inside an Air Force C-130 Hercules. The system is designed for transporting COVID-19 diagnosed and symptomatic warfighters out of forward installations and on to medical facilities.

Photo by U.S. Air Force

ANYTIME A DEPLOYED WARFIGHTER TESTS POSITIVE FOR COVID-19 he or she needs to be transported to a medical facility quickly to avoid affecting more warfighters in the unit. Up until now, commanders have relied on small isolation modules on airplanes or flying infected warfighters in open helicopters with the pilot and medical personnel in personal protective (PPE) ensembles. The U.S. Air Force CBRN Defense Systems Branch decided that there had to be a better way.

In Need of Something New

"The Air Force did not have any good choices at that point. The Transport Isolation System (TIS) already in service has limited capacity and is at the end of its service life, and the State Department's Portable Bio Containment Module (PBCM) is expensive and would take six months to produce additional units," said Jason Adamek, a Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) mechanical engineer who helped manage the design, manufacturing and testing of what turned out to be the answer to the problem, the Negatively Pressurized CONEX (NPC) system.

The Air Force jumped into gear in March, establishing a cross-functional team dedicated to rapidly prototyping, testing and fielding a high capacity transport system that could meet the U.S. Transportation Command goal of transporting up to 4,000 diagnosed and symptomatic COVID-19 cases a month at a reasonable cost. The team included the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND) and the Joint Project Manager for Protection (JPM-P). The Air Force rapidly established a contract with a vendor to provide the equipment the team was designing. From requirements generation to the request for proposal and contract award to fabricating the first prototype NPC, the entire effort took less than 30 days.

Repurposing an Old Reliable

The approach for the NPC was practical; use an existing, readily available, and entirely dependable container, the CONEX. It was developed during the Korean War to transport and store supplies, and it is now used as a shipping, rail and trucking container for commercial goods around the world. It was even used by the Center as part of the Field Deployable Hydrolysis System (FDHS) it designed and used in 2014 to destroy the Syrian declared chemical weapons stockpile inside a ship at sea. One of the key designers of that system was Adamek.

At 40 feet by eight feet by eight-and-a-half feet, the CONEX is big enough to hold an anteroom and patient area, each separated by an airtight door. The entire container is negatively pressurized using exhaust blowers and high efficiency particulate air filters to keep the virus under engineering controls. Directional flow enables medical personnel to enter and

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exit through the anteroom. Large enough to serve as a medical suite, it is also small enough to fit in an Air Force C-17 Globemaster. However, the other workhorse of the Air Force is the smaller C-130 Hercules, and the NPC could not fit in it. The Air Force team decided that a second version was needed for the C-130 in order to reach remote bases and replace open-air patient transport. They called it the NPC-Lite and Adamek would play a central role in its development.

Unique Expertise

It was at that point that the NPC lead engineer, Chip Warder of JPM-P, called Adamek for assistance. "The Air Force had to develop the NPC-Lite in parallel with NPC, but with the proper dimensions to fit inside the C-130. I had worked with Chip on other projects, and with my experience in collective protection and rapid design and fabrication projects, including the FDHS, he knew I could help," said Adamek. "NPC-Lite is the same as the full-sized NPC in every respect except that it's only 30 feet long and has 16 seats instead of 30 seats."

The project kept Adamek very busy from its start in May 2020. As the lead engineer for NPC-Lite, he managed the contractor's design and fabrication effort over a period of 14 days in Michigan. He then spent three weeks at Charleston Air Force Base in South Carolina supporting operational testing to get an Air Force flight release for the prototype. To get that release, the NPC-Lite had to be airworthy, and be able to withstand a crash at nine Gs without breaking apart. Following successful testing, he then traveled overseas for a whirlwind five weeks of site activation and training future users. He started at Ramstein Air Base in Germany where a small team fielded the first NPC. Within a week the NPC was flying its first mission evacuating COVID positive patients out of the U.S. Central Command area of responsibility. He then moved to Bagram Air Base in Afghanistan to field the first NPC-Lite and train teams of airmen how to use it inside of the C-130.

More NPC-Lites to Come

With all that work accomplished, his role in this project is far from over. "The plan is to have 25 to 30 NPCs and NPC-Lites made and in operation around the world. I will be performing acceptance inspections, leak and filter testing, and site activation as they arrive at their destinations," said Adamek.

> ***"I love doing rapid development and field engineering in general, but in this case, what we're doing is truly vital. Each one of these NPC-Lites is going to be used immediately upon fielding because when COVID-19 pops up at small Forward Operating Bases (FOBs) it can be catastrophic."***
>
> *Jason Adamek, DEVCOM CBC mechanical engineer*

While the work is grueling at times, Adamek is very proud to be able to serve the nation's pandemic response effort this way. "It feels great, I love doing rapid development and field engineering in general, but in this case, what we're doing is truly vital. Each one of these NPC-Lites is going to be used immediately upon fielding because when COVID-19 pops up at small Forward Operating Bases (FOBs) it can be catastrophic. They are not equipped to handle infectious outbreaks. It's vital that they are able to get infected people out immediately and take them to a proper medical facility that is able to isolate and treat them. The NPC-Lite on a C-130 can reach smaller, more austere bases and FOBs that the NPC on a C-17 can't," said Adamek.

Adamek's participation on the part of the Center did not go unnoticed. Lt. Col. Paul Hendrickson, who is in overall project command for the CBRN Defense Systems Branch, said, "Developing, testing, and fielding two different isolation container systems for two different aircraft in less than 100 days doesn't come easily. Without the amazing support of the entire JPEO CBRND and DEVCOM CBC team, especially Jason Adamek, this system would not have been possible. His presence on site for all stages of development for the NPC-Lite, his close interaction with the contractors, aircraft and air worthiness teams and the test organizations brought the NPC-Lite across the finish line."

Man's Best Friend Joins COVID-19 Fight

Army, University of Pennsylvania team up to train virus-detecting dogs

By Brian Feeney, Ph.D.

COVID-19 detection canine Poncho indicates a positive sample from multiple items presented on a canine training wheel. The Training Aid Delivery Devices attached to each arm of the wheel allow the dog to detect the substance inside, some of which are the proteins that a person produces in response to the virus.

Photo by DEVCOM CBC

MEDICAL RESEARCHERS at the University of Pennsylvania School of Veterinary Medicine (Penn Vet) Working Dog Center have trained dogs to detect ovarian cancer and diabetes. Could using dogs to detect COVID-19 in humans be far behind?

That was the question that motivated researchers from the Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC).

"We had just begun teleworking at the Center," said Michele Maughan, Ph.D., a Center researcher. "And I called up the research partner in my branch who I work most closely with on dogs, Jenna Gadberry, and said to her, 'We keep saying we need to find a way for dogs to detect COVID-19, let's do this! Do you have the will to try?'" With a collaborative yes, they approached their branch chief.

The Biochemistry Branch Chief, Patricia Buckley, Ph.D., gave them the green light to get started. "I liked the idea immediately," said Buckley. "And since my branch had already developed the Training Aid Delivery Device we call TADD, I knew the training could be done in a way that would be safe for the dogs and handlers."

The TADD was first developed by a Center research team in 2013 as a laboratory device for containing hazardous substances needed for testing and evaluation of new detection equipment. In 2018 it was ruggedized so that it could be used in field settings without fear of breaking it if it was dropped or roughly handled. It is a container that comes in sizes ranging from one ounce to eight ounces. A membrane covering the mouth of the container lets the volatile organic compounds (VOCs) that a hazardous substance emits flow out of the TADD. The hazardous substance itself remains inside. A grid placed over the membrane prevents punctures.

The Training Aid Delivery Device, or TADD, is a canine training device developed by CCDC Chemical Biological Center researchers; it can safely contain a substance hazardous to dogs by only letting out the volatile organic compounds emitted.

"The TADD made it safe for dogs to be trained using live substances because explosive powders and narcotics stay under the membrane and do not go up into a dog's nose," said Maughan.

"In the case of detecting COVID-19, the dogs never actually have any exposure to the live virus. Rather, they are trained to detect the biomarkers associated with COVID-19 disease in humans. These biomarkers are the proteins that the human immune system produces in response to the presence of the virus and not the actual virus. The goal is to train dogs to detect the disease state before a person starts showing signs of disease such as fever, coughing, and shortness of breath," Maughan added.

Another feature of the TADD is that all of its components, from the tight-sealing lid to the protective grid emit very little odor. "Plastic and rubber materials can be very stinky to dogs and interfere with their detection of the substances we're looking for," said Maughan. "We knew the TADD would be perfect for containing COVID-19 patient samples of saliva or urine because we knew this odor profile would be quite nuanced and require the dogs to key in on some really low VOC molecules. It's important that the containment system, the TADD, doesn't compete with the target odor."

The TADD development project was a part of the support Center researchers had been providing the military explosives community's canine detection programs since 2012. Over the course of that work Maughan and Gadberry had developed strong connections with the military working dog community, both within government agencies and with some of the nation's most gifted dog trainers who work as independent contractors.

Maughan had another important connection, too. As an undergraduate pre-veterinarian student at the University of Delaware she had gotten to know the director of Penn Vet's Working Dog Center Cynthia Otto, DVM, Ph.D. "The working dog community is small and I had stayed in touch with Cindy over the years because we are both very interested in how to use dogs to improve people's lives," said Maughan. "So when the COVID-19 pandemic first began, the idea of approaching her on

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training dogs to detect the virus in humans was a natural."

Just like Buckley, Otto liked the idea immediately. In fact, the Penn Vet Working Dog Center had a one to two-year canine COVID-19 project in mind already. What Maughan and Gadberry brought to this effort is what the U.S. Army does best – up the tempo and get a hard job done fast. Maughan and Gadberry were perfect for this. In addition to their relationship with Otto and the Working Dog Center, through the Center they had developed relationships with military users, the virus research community, and a host of other government agencies.

Given the green light, Buckley, Maughan, and Gadberry put the project on a fast track. Maughan called Otto on March 27. Within ten days the Center team and the Penn Vet team were holding project planning discussions. On April 28, the teams were notified that the University of Pennsylvania had found a philanthropic gift to fund the project. On May 14, the Center established a cooperative research and development agreement (CRADA) with the University of Pennsylvania to perform cooperative research. By May 21 all of the COVID-19 human samples had been collected, and the dogs began training on May 26.

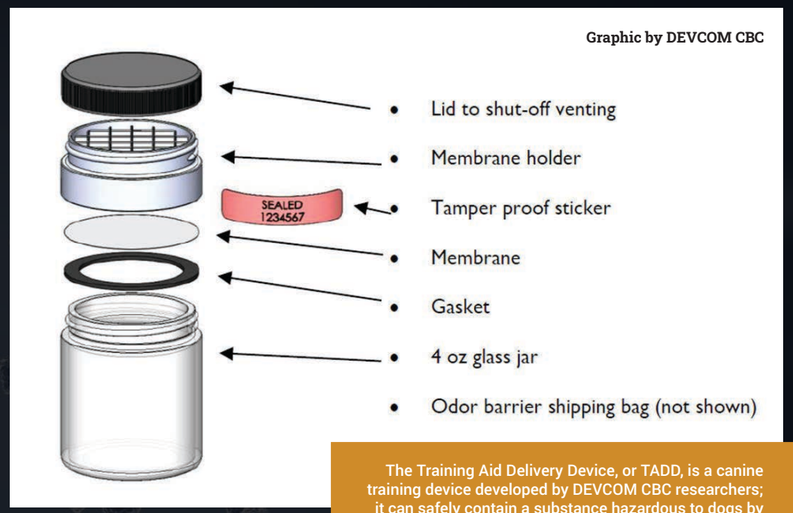
To perform this highly specialized training, Maughan and Gadberry reached out to another dog trainer they had stayed in contact with over the years, Patrick Nolan, owner of a working dog business in Hagerstown, Md. He started his business after 12 years of working with U.S. Army Special Forces training military working dogs and 30 years of training retrievers to hunt.

"Pat provided ten working dogs and, using human saliva and urine samples provided by the University of Pennsylvania, got the dogs working with the TADDs right away," said Maughan. "Training dogs to do this kind of work, detecting a substance down to the parts per trillion level is an art, and I could think of no one better than him to do it."

What the dogs are actually identifying is not the virus itself, but the proteins that the human immune system generates to fight the virus. The art that a trainer like Nolan applies is to get the dog to pay attention only to that smell, and to stay engaged in the hunt for it for hours at a time.

The training wheel is central to that training process. It has multiple arms, each one has a TADD attached at the end of it. Some contain saliva or urine from a symptomatic COVID-19 patient, some contain an asymptomatic person's sample, and some are from a person who does not have the virus. But the choices do not end there. Some contain an inert substance as a control, some have a distraction element inside such as an open magic marker or food item or a tennis ball, and some are empty.

Graphic by DEVCOM CBC



The Training Aid Delivery Device, or TADD, is a canine training device developed by DEVCOM CBC researchers; it can safely contain a substance hazardous to dogs by only letting out the volatile organic compounds emitted.

The dog is, in effect, paid to become increasingly selective, honing its attention down to just the COVID-19 immune response odor. For these Labrador retrievers, payment is a food treat or a favorite toy. As the training progresses, Nolan stacks the wheels making for even more sources of stimulation for the dogs and demanding that they become more and more selective.

This is a six to nine week process and not every dog makes it through. "Not every dog can stick with the length and degree of intensity of the training to get all the way to being able to detect in the part per trillion range," said Gadberry. "And not every dog has the drive to stay with the game for hours at a time, which is essential if the dogs are to provide COVID-19 screening at the entrances to crowded public places such as at airports, sports stadiums, or at border control checkpoints."

Those dogs that make it all the way through the training to eventually be operationalized are far better at getting the job done than swabs used for later analysis, or thermal cameras currently being used to detect a fever. Their method of detection is immediate and can detect COVID-19 in people who have not become feverish yet.

However, getting to that next step, creating a cadre of trained dogs ready to be deployed, is not part of the scope of this study. "The Army and larger Department of Defense, envisions utilizing COVID-19 detection dogs as an added layer to the nation's biosecurity posture, in coordination with fever checks, screening questionnaires, and PCR testing," Buckley said. "The dogs represent a non-invasive, autonomous, rapid, and continuous screening technology that can help identify presymptomatic and asymptomatic COVID positive patients. In the Army, it is not always possible to socially distance in our close quarters facilities and operational environments, so we could deploy these dogs at entry control points, secure buildings, aircraft, military colleges, etc.

Buckley added that any such deployment will be dependent on the next phase of the study, which involves testing the sensitivity and specificity of the dogs' abilities. "We will not deploy COVID-19 detection dogs without a thorough independent verification and validation test to ensure our dogs are reliable within their area of operations and on the population of people that come through that real-world environment," she said.

Everyone involved in the project fervently hopes for further funding. They see the potential benefits of virus-detecting dogs as a routine presence at public gatherings as simply too promising to not pursue further. "This is even bigger than the pandemic we are dealing with now," said Buckley. "We will face future pandemics from other viruses and having a capability like this will keep the nation ready for whatever happens next."

Photo by Brian Feeney

Dan Angelini, Ph.D., a DEVCOM CBC research biologist, loads the Emulate lung chip into its medium supply system known as a "Pod."

Army Applies Lung-on-a-Chip Technology to COVID-19 Research

By Brian Feeney, Ph.D.

MILITARY UNITS CONDUCT RECONNAISSANCE MISSIONS to obtain information – by visual observation or other detection methods – about the activities and resources of an enemy. That is exactly what a team of researchers at the U.S. Army Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) is doing in the laboratory to better understand how a new kind of enemy, the novel coronavirus, attacks human lung cells.

Seeing What You Are Fighting

"The best way to fight the virus is to understand as much as possible about how it interacts with actual lungs cells," said Tyler Goralski, Ph.D., a Chemical Biological Center research biologist. That requires Goralski and his team of researchers to observe those interactions as directly as possible, and they have come up with a way that is much like how ants can be observed in a glass-sided ant farm. It is the transparent Alveolus Lung-Chip, a new technology developed by Emulate, Inc., a Boston company that recreates true-to-life human biology systems in microenvironments for researchers.

Emulate has been working on microphysiological systems for research for almost a decade. This effort ran in parallel with CBC efforts over the same time period. Now, with U.S. Defense Threat Reduction Agency (DTRA) funding made available to it through the FY20 Coronavirus Aid, Relief, and Economic Security (CARES) Act, the Center is taking the technical leap of using the Alveolus Lung Chip in its own research. "This project provides another expansion of capabilities at the Center, with 195more physiologically relevant human lung models," said Kyle Glover, chief of the Center's Molecular Toxicology Branch.

The result is a dynamic lung tissue microenvironment inside a clear plastic container about the size of a computer thumb drive. It has a top layer of lung tissue that recreates air moving along it, and a bottom layer that mimics blood flow delivering micronutrients inside the tissue. The cassette's flexible plastic walls mimic the breathing process in lung cells to make the microenvironment as realistic as possible.

Knowledge is Power

With the microenvironment set up, the stage was set to introduce the SARS-CoV-2 virus

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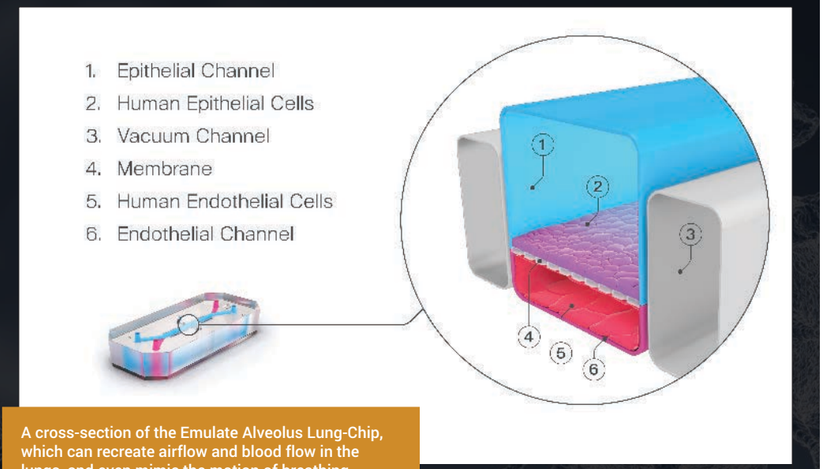

A cross-section of the Emulate Alveolus Lung-Chip, which can recreate airflow and blood flow in the lungs, and even mimic the motion of breathing.

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and watch exactly what it does to these lung tissues in real time.

"In the past, the closest researchers could get to something like this was by introducing a virus into animals and then dissect them. With this, there is no need for animals in performing toxicological research," said Dan Angelini, Ph.D., a Center research biologist on the team. "For example, we can observe which specific lung cells engaged the virus and allowed it to cross the cell membrane. We can then track the actions of the virus inside the infected cell both recording the virus' mechanisms of pathogenesis and the timing of the damage it causes."

> ***"Only by having it inside the BSL3 can we take our research to the next step, looking at the virus in its aerosolized state, droplets suspended in air, which is how the virus is most commonly transmitted."***
>
> *Kyle Glover, chief of the Center's Molecular Toxicology Branch*

The team hopes that in this way it will be able to identify which specific proteins in lung cells act as receptors for the virus and its routes of entry. The team can also determine the exact infectious dose and time the cascade of effects inside the lung tissue when that threshold is met. That knowledge will be the first step toward creating therapeutic and protective measures that can be taken, and ultimately help in the development of preventative medications. As the team compiles this information it will share the data with the entire global medical community, which is now fighting the pandemic.

Unique Assets

The Center is able to perform this research not only because it possesses the brain power of this particular research team, it also has state-of-the-art research facilities that can safely house an infectious virus. "We have a biosafety level 3 laboratory, or BSL3, to work with," said Goralski. "It has engineering controls that allow us to work with microbes which can cause serious and potentially lethal disease through inhalation – which clearly includes the SARS-CoV-2 virus. So it has a negative-pressure air handling system and double sets of self-closing doors to make sure no airborne particles can escape.

Only by having it inside the BSL3 can we take our research to the next step, looking at the virus in its aerosolized state, droplets suspended in air, which is how the virus is most commonly transmitted."

"We are fortunate to be able to bring everything together here at the Chemical Biological Center," said Glover. "The Center has some of the best microbiologists and toxicologists in the world, willing to collaborate and find solutions to support the warfighter. In this instance, we are diving into the global battle against the COVID19 pandemic, while also significantly bolstering our capabilities to meet future chemical and biological challenges."

U.S. ARMY
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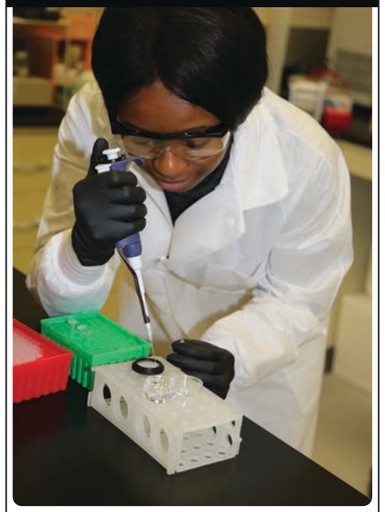

CAREERS AT U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND CHEMICAL BIOLOGICAL CENTER

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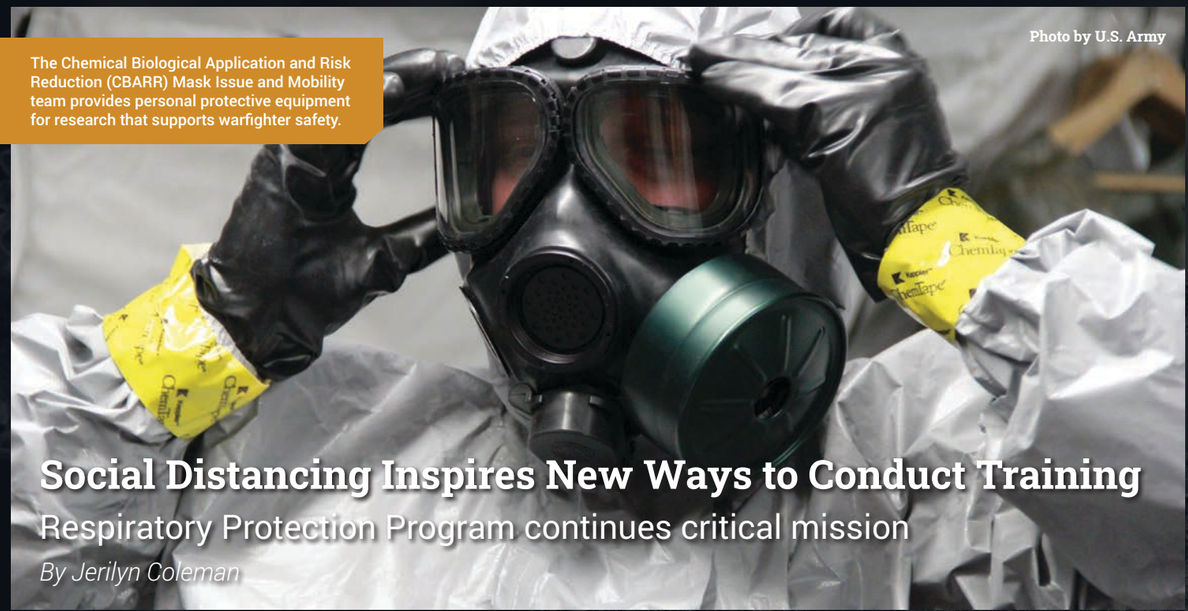

Photo by U.S. Army

The Chemical Biological Application and Risk Reduction (CBARR) Mask Issue and Mobility team provides personal protective equipment for research that supports warfighter safety.

Social Distancing Inspires New Ways to Conduct Training

Respiratory Protection Program continues critical mission

By Jerilyn Coleman

AS THE U.S. ARMY'S COMBAT CAPABILITIES DEVELOPMENT COMMAND CHEMICAL BIOLOGICAL CENTER (DEVCOM CBC) continues to redefine workspaces and processes during the COVID-19 pandemic, its employees are executing the Center's mission in the face of adversity. Among those professionals are the protective mask experts in the Chemical Biological Application and Risk Reduction (CBARR) unit, who have created new ways to conduct training for the Respiratory Protection Program (RPP).

CBARR issues personal protective equipment (PPE) for research that directly supports the warfighter. In addition to issuing PPE, CBARR's Mask Issue and Mobility Team also trains personnel on how to use the equipment.

During the pandemic, mandated social distancing and telework made conducting the RPP difficult. "As the shutdown progressed it was identified that essential personnel on post needed their annual training as well as fit tests in order to continue the activities they were tasked," said Ed Parshley, supervisor of Mask Issue and Mobility for the Operational Applications Directorate.

Recognizing these concerns, Parshley and his team began identifying ways to provide the training while also adhering to social distancing guidelines.

The RPP is designed for individuals whose duties may bring them in contact with chemical agents. At some point, they may have to wear respiratory protection, otherwise known as masks. The training includes how to sanitize, inspect, don, and doff the mask, as well as what mask is needed for specific situations and environments. For instance, if a warfighter or laboratory technician is in an environment that is immediately dangerous to life and health (IDLH), then an air purifying respirator is authorized for escape purposes only. In cases where cleanup operations need to be performed in an IDLH environment, a supplied air breathing apparatus with an airline or a self-contained breathing apparatus may be used.

Typically, trainees complete the RPP in-person and get fit-tested in order to receive a new mask to maximize the amount of time they can keep it. Since the pandemic, a limited number of people were allowed in the training room. First, it was limited to 10 people, then it decreased to six in a room that typically holds 16 people. To combat this, the Mask Issue and Mobility Team started to schedule personnel for training sessions. "Before we set specific hours, personnel would show up and you had a seat to take the training. But in the new environment we had to start scheduling people to do the training," Parshley said.

Once access to the installation was restricted due to the pandemic, personnel weren't available to train on-site. At the time, there wasn't an online capability for the training. Ultimately, the team made the decision to move forward and maintain the RPP requirement as best as they could with the resources they had. Parshley recognized that the Center's IT staff had other complex Center-wide challenges that took precedence, so he used his computer skills to find innovative solutions to continue the mission.

Through the team's investigation and collaborative thinking, they discovered that Microsoft Teams had the capability to upload files and record video calls, which led to Parshley experimenting with the video share feature. "I just played the video, turned my microphone off, recorded the entire session, then uploaded the file to the MS Teams file folder so that it allowed people to view the videos in the order they chose, and the time they chose to take it," Parshley explained.

The next thing they had to figure out was how to get people to join the MS Teams meetings and verify attendance. They sent invitations to the workforce required to take respiratory training and verified that a trainee actually watched the video by embedding a code in the last video at the end of the training. That final video then took trainees to a new MS Teams session that included an uploaded test.

MS Teams hasn't become a certified platform for RPP training yet, and CBARR's Mask Issue and Mobility Team will revert to the traditional RPP training once the installation's Health Protection Condition status allows them to do so; however, this new process could still be an option for employees who cannot train in person. "MS Teams is a good alternative to provide this training. It is a very good tool and should be considered as a usable source," Parshley said.

Employee Spotlight: Col. Scott W. McIntosh

Col. Scott W. McIntosh is the U.S. Army Combat Capabilities Development Command Chemical Biological Center's (DEVCOM CBC) newest Military Deputy (MILDEP). Solutions sat down with McIntosh recently to get acquainted, learn about his prior experience and give readers an inside perspective on his role as MILDEP for the Center.

Solutions: What inspired you to serve at the DEVCOM CBC?

McIntosh: This is the third opportunity I've had to serve on Edgewood. My first two assignments were as a major and lieutenant colonel with the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO CBRND). Most recently, from 2013-2016, I served as the Joint Product Manager for Biological Detection Systems which was part of Joint Project Manager (JPM) Contamination Avoidance, now known as JPM CBRN Sensors. Getting to do what you want to do doesn't always happen in the Army. Fortunately, this time around, the Army gave me my first choice of assignments – the Chemical Biological Center.

Solutions: Tell us a little about your new role at the Center.

McIntosh: My official title is Military Deputy, or MILDEP. A couple examples of what I think a MILDEP should do includes: acting as the military representative to the joint warfighter; executing all aspects of daily operations to include planning, organizing and leading Center interactions with the Army Modernization Enterprise and providing military operational and acquisition experience to assist in aligning science and technology efforts to joint modernization priorities. Simply put, I think it's my job to lead and to solve problems. Don't hesitate to reach out if you think I can be of assistance.

Solutions: How would you describe how you help the warfighter?

McIntosh: As an acquisition officer serving in program management positions, I would say delivering capability that meets requirements, at the right time and for the right price. When I worked at the Combined Arms Support Command, I tried to make sure requirements met warfighter needs. When I worked for the Army Test and Evaluation Command, I helped by assuring requirements were met. At the Defense Contract Management Agency, it was all about delivering safe aircraft. Here, at the Center, I think I help by having a positive impact on the organization, making a difference, and by being an advocate for the capability our Center can provide.

Solutions: What prior experiences, education or background prepared you most for your role?

McIntosh: I believe a combination of things prepared me for my role at the Center. As mentioned, I have two prior assignments with JPEO CBRND. I've commanded at the colonel (O6) and lieutenant colonel (05) level so I can provide a certain amount of perspective on leadership. I'm level III certified in program management and level II in logistics, and I've completed PMT 401 and PMT 402 courses at the Defense Acquisition University. My master's degree is in program management and I have 34 years of experience in the military.

Solutions: Do you/did you have any role models or mentors and how did they influence your career?

McIntosh: I've had several role models over the years. On a personal level, I have always looked to my father. I feel like he set the bar for how he balanced working a full-time job while still being present for his children – he did it right. On a professional level, I've looked to a couple former battalion commanders for examples of what right looks like. From one person in particular I learned valuable lessons about the importance of leading from the front and how technical expertise can lead to credibility. Based on these examples, I pushed to be both a tactical and technical expert as an Army aviator; ultimately leading to my attendance at the AH-64 maintenance test pilot course.

Solutions: What are you most looking forward to in your new role?

McIntosh: Getting involved and making a difference. You always want to leave an organization better than you found it, or at least that should be your goal. That's my goal with the Chemical Biological Center.

Solutions: What is your leadership style?

McIntosh: I try to adapt my leadership style to the situation. If you are familiar with Myers-Briggs, I'm a solid ISTJ. If you are familiar with Emergenetics, my scores are: Analytical 10, Structural 53, Social 16 and Conceptual 20.

Solutions: In light of COVID-19 and remote working, how have you stayed productive and influential? Tell us about your experiences in a virtual work environment.

McIntosh: I started working remote while in Orlando, both with my past organization and the Center. I've been fortunate to have a dedicated workspace in Florida and Maryland. I believe that is key to making the at-home work experience productive. I've been impressed with the tools we have available at the Center to make us productive while working from home. Going forward, I believe we need to develop a long-term remote work plan that balances the goals and objectives of the Center with the goals and objectives of the workforce. I really think positives will outweigh the negatives regarding long-term remote work opportunities.

Solutions: Is there anything additional you'd like people to know about the work you do?

McIntosh: I take what I do very seriously, but I don't take myself seriously. My son is now in the armed forces, so what I do is personal. We need to make sure we bring our "A-Game" every single day.

Solutions: Do you have a favorite quote or motto that keeps you motivated?

McIntosh: My favorite motto is from my last organization – Program Executive Office Simulation, Training and Instrumentation in Orlando, Florida. Their motto is, "We work for our Soldiers. It's the best job we ever had." I believe this says it all.

Photo by DEVCOM CBC Public Affairs Office

DEVCOM CBC Liaison Officer Mike Cress shares future warfighter needs with Center engineers and scientists.

CBC Liaison Officers Bridge Gap Between Researchers and Soldiers

By Jerilyn Coleman

ALL PERSONNEL AT THE U.S. ARMY'S COMBAT CAPABILITIES DEVELOPMENT COMMAND CHEMICAL BIOLOGICAL CENTER (DEVCOM CBC) are essential to the overall chemical biological defense mission but Liaison Officers (LNO) make up a special group of unsung heroes that are critical to the safety of the warfighter and who support a broad spectrum of organizations in the Department of Defense (DoD) and beyond.

LNOs are government personnel employed by the Center and stationed with other organizations 90 to 100 percent of the time. They develop rapport and establish a presence in the chemical biological field to facilitate new, cutting edge technologies, capabilities and research required to support the warfighter. According to the Center's acting Deputy Chief of Staff and Associate Director of Programs, Adam Seiple, "LNOs work for us, but they support the Center from the designated organization from which they are stationed. They basically work for two organizations." These individuals speak the Center's language, serve as their voice and bridge the gap between the Center, stakeholders and experts in the field. As supervisor to the LNOs, Seiple ensures that they keep the Center's best interests in mind, have a firm grasp of the priorities and know when to speak up and when to ask the right questions.

Notable LNOs at the Center include Victor Hairston who recently retired from his role as G-8 at the Pentagon, Mike Cress and David Glynn who both serve at Fort Leonard Wood (FLW) and support the Maneuver Support Center of Excellence (MSCoE). Cress is a Vietnam veteran with combat experience as an airborne Infantry Officer in the 101st, 173rd and 82nd Airborne and he became an LNO for the Soldier, Biological and Chemical Command in 2001. For decades Cress has dedicated his service to developing innovations that keep Soldiers safe. "As a liaison officer, I handle requests for information; support the research portfolio; plan and execute data collection events; conceptualize ideas for capability development and interface with faculty, action officers, senior leaders and students," Cress said. Lowry Brooks is the Client Manager for Center efforts and partnerships with the Joint Program Executive Office (JPEO) and he also supervises Glynn and Cress at FLW. "Mr. Cress is truly one-of-a-kind. We are blessed to have someone with his depth and breadth of knowledge. It is unmatched at the Center," Brooks said. Following a 40-year warfighter and civilian service career, Mr. Cress is retiring in January 2021. "His steadfast integrity and consummate reliability receive the highest

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level of trust, loyalty and dedication among all senior leaders, peers and colleagues within the Center. We wish Mr. Cress all the best in his future endeavors and sincerely thank him for his exemplary performance on behalf of the warfighter and his numerous innovative contributions to Chemical, Biological, Radiological and Nuclear (CBRN) defense," Brooks added.

Liaison Officer David Glynn collaborates with Army organizations at Fort Leonard Wood on behalf of DEVCOM CBC.

In nearly two years as an LNO, Glynn has also proven to be an asset to the Center and FLW. He participates in the development of concepts that leverage Center research; facilitates novel approaches to technology demonstration, experimentation and analysis; collaborates with MSCoE, chemical school, engineer school and military police school to facilitate the Top Down Futures Development Process and works with different Center of Excellence (CoE) battle labs to help further define requirements by presenting detailed solutions among other tasks. "Glynn and Cress write concepts and requirements and they figure out how the CBRN warfighters will fight in future warfare. That must be linked back to the Center so that we can inform the CBRN School about what technology can do for them," Brooks explained. The CBRN School studies future warfare and threats and decides how the Center should accomplish military objectives.

The LNOs explore what science and engineering can do for the warfighter; what is possible now and what could be possible in the future. "We merge the concept writers with the technologists and that's what Cress and Glynn do primarily, bridge that gap. They must provide that critical link. From the futurist, to the concept writers, to the requirements writers, they have to link them back to our scientists and engineers. So we know what the future concept is and what the future technology is," Brooks said.

Michael Guinn serves as an Interagency Technology Officer stationed at MacDill AFB in Tampa, Florida at Special Operations (SOCOM) headquarters.

Though he doesn't serve in an official LNO role, Michael Guinn is taking strides to support the Center and LNOs in a similar and influential way. Guinn is the Interagency Technology Officer within the Office of the Director. Guinn wears two hats that of executing agile acquisitions as a Program Manager and implementing advanced manufacturing as an Engineer. Like LNOs, Guinn works remotely and is stationed at MacDill AFB in Tampa, Florida at Special Operations (SOCOM) headquarters. One of Guinn's most influential projects is Accelerator for Innovative Minds (AIM). AIM is an acquisition collaboration among different organizations that are trying to work toward the same thing. Organizations that are a part of this initiative so far include the Center, JPEO, Chemical Biological Radiological Nuclear Defense, Defense Threat Reduction Agency, SOCOM, Department of Homeland Security, and more. The purpose of AIM is to actively harvest Warfighter and government stakeholder ideas/needs and work with non-traditional industry, academic, and international partners to transform those into proof of concepts and/or improvements upon an existing concept. Routinely this is done pre-requirements and ends up helping define requirements more efficiently and effectively. "This acquisition process enables warfighter voices to be heard, they get to influence what is coming down the pipeline and interact with the technology much earlier on," Guinn said. Soon, there will be an LNO position filled at SOCOM headquarters in the Tampa office and Guinn will help bring that individual up to speed and ensure they're integrated into the day to day operations of the Center and SOCOM. According to Kevin Wallace, the Center's Division Chief, Systems Engineering and Acquisition, "Michael's roles and responsibilities are somewhat reflective of what LNOs do. The Center's workforce needs to be aware of Michael and what opportunities he affords us in the national capital region while he's embedded at SOCOM in Tampa."

Historically, the Center has staffed an LNO position at the Army G-8 office which serves as the executive agent for the Chemical Biological Defense Program. "We felt it critical to have someone there to support that office and to keep us in tune with the movers and shakers and decisions being made in the program," Seiple said. Typically, the individual that would fill that role would be the director's executive officer. This role was filled by someone for about six months but Center leaders realized they needed the role filled permanently to have a bigger impact. Recruiting LNOs can often be difficult, because the ideal candidate knows both organizations, but that is rare. The Center primarily recruits individuals that are more familiar with the organization where they will be embedded and focus on bringing them up to speed on the Center once they are on board.

During the COVID-19 pandemic, most Center personnel had to adjust to working in a virtual environment and not being able to engage with their peers in-person, but for the LNO this circumstance is normal. The LNO role is unique because these individuals spend most of their time away from the Center and many perform responsibilities that are equivalent to two jobs. There are many challenges associated with working with and for two entities and working away from the majority of your colleagues due to the collaborative nature of the role. "In order to collaborate, oftentimes you need to speak with folks in a face-to-face environment. If not face-to-face collaborating, I am involved with conducting experiments of sorts and this definitely requires more of an in-person interaction," Glynn said. "It takes a special personality to really balance two positions. You need to be loyal to both places. It's about building trust on both sides. As a technology organization we need to stay ahead of the technology. If we stay in our bubble here, we won't be in touch with our customers of stakeholders and the high strategy makers. We won't be as impactful as we could be." Seiple said.

Despite the challenges associated with the role, LNOs perform their missions with grace. Leadership at the Center work to make the experiences of LNOs as smooth as possible. They try to arrange trips to the Center's headquarters in Edgewood, MD as frequently as possible to spend time on base and connect with colleagues, participate in staff meetings remotely and educate personnel at the Center about the LNO and how they can support the workforce and the warfighter.

LNOs are a crucial asset to the Center as they are an integral part in developing innovations in the DoD's chemical biological space. We must remember them when reflecting on the Center's legacy as the premier support organization in the Chemical Biological Defense mission. Brooks described the LNO's impact perfectly in a Winston Churchill quote. "A hiatus exists between inventors who know what they could invent, if they only knew what was wanted, and the soldiers who know, or ought to know, what they want, and would ask for it if they only knew how much science could do for them. You have never really bridged that gap yet." LNOs seek to bridge that gap every day.

Photo by DEVCOM CBC Public Affairs Office

The confocal laser focused microscope was an investment through the BEAMS Grand Challenge. It now sits in the BioChemistry area of the Berger Building.

Synthetic Biology Grand Challenge Concludes

Investment positions center to become biomanufacturing leader

By Jerilyn Coleman

SCIENTISTS AT THE U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND CHEMICAL BIOLOGICAL CENTER (DEVCOM CBC) concluded the 2017-20 Grand Challenge known as Biological Engineering for Advanced Materials Solutions (BEAMS) on June 25. As personnel across the Center gathered via Microsoft Teams, Center chemist and principal investigator on the Grand Challenge, Jared DeCoste, Ph.D., provided an overview of the challenge, what they've accomplished, lessons learned and things to look forward to in the future.

The Investment

Scientists at the Center utilized synthetic biology to harness naturally occurring biological processes to create novel and advanced materials within the BEAMS program. The goal of BEAMS was to lay the foundations to establish the Center as the DoD leader in the area of synthetic biology for materials. In 2017, they set out to do this by educating the workforce, creating an infrastructure for synthetic biology and creating a synthetic biology portfolio. In the last three years, the Center has invested $1.8 million into this Grand Challenge. "I can't say enough how much the Center rallied around this Grand Challenge, and how many people have been involved from day one," DeCoste said. During this Grand Challenge, the Center has developed new equipment, research and partnerships that put them at the forefront of synthetic biological solutions.

A Winning Team

Just like the Grand Challenge before it, and the one to follow, the key to the success of BEAMS was solid collaboration between the brightest scientists and engineers at the Center. DeCoste searched throughout the Center for enthusiastic individuals with diverse backgrounds who were already involved in synthetic biology efforts, and people who specialize in different areas that would be beneficial to highlighting the Center. In addition to DeCoste, the core team consisted of research biologists Matthew Lux and Daniel Angelini; post-doctoral fellow Mary Lee and chemical engineer Sabrina Rawlings Seiple.

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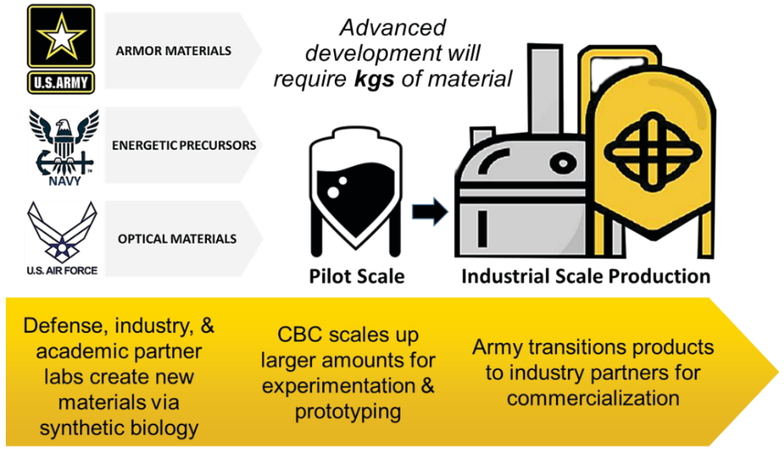

The Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) is working with partners across the Army, Navy and Air Force to bridge the gap toward industrial scale biomanufacturing of materials for a variety of military applications.

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"No one aspect, group, branch or division could solve this Grand Challenge by themselves, so we had to invest in minds across the Center," DeCoste said. Additionally, the core team collaborated with external researchers at the Massachusetts Institute of Technology (MIT) and a variety of other institutions including the Air Force Research Laboratory, Naval Research Laboratory, Navy Warfare Center, Northwestern University and more. DeCoste and the core team stressed the importance for experts from various disciplines to work together, communicate, collaborate and speak the same synthetic biology language.

Accomplishments

Over the past three years, the core team worked on several innovations. Perhaps one of the most immediate needs during the challenge was to develop human capital and educate personnel at the Center about the subject matter. The core team started by leading a lecture series that received attendance from about 100 unique individuals, and a total attendance of about 500 across the lectures collectively. "People were excited to be engaged in a new way," DeCoste said.

While the lecture series was helpful and encouraged more conversations about synthetic biology within the Center, scientists and engineers wanted hands-on projects. This created a great segue to the BEAMS Laboratory Competition. Twenty-three people across the Center were organized into five teams. The teams were tasked to develop the strongest nanocellulose, a polymer that is produced by bacteria. Some teams used 3D printer molds, various nutrients and other methods to increase the strength of the nanocellulose.

The synthetic biology projects helped the BEAMS core team recognize what equipment was needed to benefit the Center in the area of synthetic biology and they decided to invest in a confocal laser focused microscope, which now is now installed in the BioChemistry area of the Berger Building.

Once the core team acquired educational resources and the equipment they needed, they established research projects to carry out the challenge. The core team focused on four areas, with biomanufacturing being the first. Biomanufacturing uses living systems to produce a molecule that may not easily be synthesized using traditional chemistry. The biomanufacturing focus birthed Protoporphyrin IX, which can absorb light and modify oxygen to create the highly reactive singlet oxygen, that can decontaminate a mustard agent and degrade it to a less harmful product.

The team also worked to mobilize cell-free lysates to take an organism like E. Coli, remove the biological machinery and place it into a solution. Additionally, BEAMS participated in MIT's Defense Advanced Research Projects Agency 1000 Molecules program. The Center has been working with MIT to design carbons with high surface areas and the functionality to react with toxic chemicals for incorporation into gas mask filters and textiles. "BEAMS was able to supplement the program to de-risk emerging technologies out of this program, including the initial scaling of material," DeCoste said.

Moving Forward

In the future, the core team plans to continue to advance their goals. When BEAMS was established as the Grand Challenge investment for 2017, Center leaders intended for it to be a long-term effort past the designated three years. Going forward, BEAMS and synthetic biology will be a big part of the Center's chemical biological defense strategy. "BEAMS was able to establish the Center as a key contributor to the DoD biotechnology ecosystem," DeCoste said.

The core team's research in cell-free lysates has earned an upcoming $5 million Congressional investment with Northwestern University, the expert in cell-free manufacturing. A brand-new biomanufacturing facility is being established, more manuscripts will be published, and experts will continue to speak about synthetic biology at conferences and in other venues to ensure that the Center is always part of the conversation.

The core team will also prioritize how the Center responds to crises and they believe they have positioned themselves to do this well in the last three years. The team is beginning to think about how to utilize synthetic biology in the development of materials and detection. "Synthetic biology is a tool. Across our Center we have a lot of goals and synthetic biology doesn't always have to be the answer, but it should be something that we have in the back of our minds as a potential way to solve our problems," said DeCoste.

DeCoste asserted that one of the biggest lessons he's learned during this Grand Challenge is to be flexible. "BEAMS allowed us to leverage internal funding to bridge gaps. We turned unfunded work into funded work." He hopes the next Grand Challenge team can take that from their experience. He challenges them to fund ideas out of the Grand Challenge that are small seedling efforts that could grow into powerful tools.

DEVCOM CBC Successfully Hosts Summer Interns Despite COVID-19 Challenges

By Jerilyn Coleman

FOR THE FOURTH SUMMER, THE U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND CHEMICAL BIOLOGICAL CENTER (DEVCOM CBC) hosted 18 graduate and undergraduate students during the Department of Defense's (DoD) Historically Black Colleges & Universities and Minority-Serving Institutions (HBCU/MI) Summer Research Program.

In the midst of the COVID-19 pandemic, access to the Center's facilities was restricted and personnel were inspired to be flexible and creative under unique circumstances. However, Center leaders proved that a global pandemic is not an excuse to miss an opportunity to invest in the next generation of thought leaders in the chemical biological space.

Supported by the DoD's Office of the Under Secretary of Defense for Research and Engineering/Research, Technology & Laboratories, the HBCU/MI program is administered by the Department of the Army. The program provides a bridge between the classroom and real-world experiences and aims to increase the number of minority scientists and engineers throughout the DoD. The initiative encourages students in science, technology, engineering and mathematics (STEM) disciplines, guides them toward advanced studies and prepares them for careers in science and engineering fields important to the defense mission. Once placed at a DoD facility, students conduct research under the supervision of scientists and engineers. At the Center, leaders ensured that scholars from several illustrious HBCUs had innovative and relevant projects to work on.

The 10-week program is a partnership with the DEVCOM Army Research Laboratory (ARL). It ran from June 1 to August 7, 2020 and is offered to students who maintain a 3.0 grade point average and have excellent community involvement. Candidates are required to complete an application and write an essay that highlights why the program would benefit their career goals.

Eugene L. Vickers, supervisory chemist and chief of the Engineering Operations Division, led the Center's HBCU/MI Student Research Program.

Eugene L. Vickers, Sr., supervisory chemist and chief of the Engineering Operations Division, spearheads facilities operations in all Engineering Directorate buildings comprehensive of engineering, engineering services, building maintenance, emergency service activities and more. Vickers, a Tuskegee University graduate, leads the HBCU/MI program at the Center and has served as site coordinator for the past three summers. He is charged with the task of matching the chosen interns with mentors and DoD facilities. Vickers's role is to act as organization liaison, identify mentors, assist mentors with student selection, conduct agency specific orientation and assist with facilitating mentor evaluations.

Vickers decided to bring this program to the Center after attending a conference geared toward minority professionals four years ago. From there, he teamed up with ARL and obtained three students the first year. In the second year, the program expanded, and Vickers was able to add mentors for additional support and his program grew to five students. This year, 18 students participated from schools including Alabama Agricultural & Mechanical University, California State University-Dominguez Hill, Kentucky State University, Tennessee State University, Tuskegee University, University of Maryland Eastern Shore, University Texas-San Antonio, Prairie View Agricultural and Mechanical University, Jackson State University, Southern University and Norfolk State University. "Now we're growing and serving the Center and other DoD agencies," Vickers said.

The program mentors are at the heart of providing an enriching experience for the students. They welcome interns to the Center, help them set goals, establish research projects and objectives and help them access necessary facilities, programs and equipment.

Computer scientist Jarell Johnson served as a mentor in the HBCU/MI Student Research Program.

Jarell Johnson, computer scientist for the Engineering Operations Directorate and Southern University graduate, executed his duties as a mentor by assigning a challenging task to his interns, despite the unique state of COVID-19. "I made a point to invest time in the interns and investigate their career goals, needs and interests," Johnson said. "This helped drive their respective projects and helped me understand what they wanted to gain out of the program."

Johnson added that it was crucial to assign projects that were interesting, challenging and reflected real world scenarios. Johnson's strategy was to allow the interns to explore alternatives to various defense issues and defend their solutions to him. "I never told them how to do things," he said. "I let them explore and bring their findings back to me. From there, we would evaluate their reasoning together."

Johnson held frequent meetings to check in with his interns. He even took the initiative to offer professional development opportunities; helping the students with their resumes

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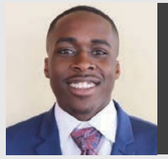
and connecting them with his professional contacts. He reflected on the privilege and significance of mentoring three Black women in STEM and he wanted to make sure they were able to see themselves in leadership roles in their career areas. He scheduled virtual meetings between the interns and other women of color who are leaders in their fields. "I didn't join the calls because I wanted them to feel free and comfortable speaking about issues that matter to them most with people who look like them. A lot of the women they spoke to were former interns that were mentored through a similar minority program," Johnson said. "They were meeting what could be themselves in 10 to 15 years."

Among the bright scholars in this year's mentoring class were three students who shared their experience at the Center.

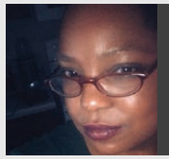


Mark Eldridge, a junior aersospace engineering major at Prairie View A&M University.

MARK ELDRIDGE, A JUNIOR AERSOSPACE ENGINEERING MAJOR AT PRAIRIE VIEW A&M UNIVERSITY and second-time HBCU/MI intern, supported building renovations at the Center, bringing a fresh new look to the base. Eldridge discovered the HBCU/MI program in 2018 when attending the Black Engineer of the Year Awards and interned for the first time in 2019. He returned this year and has continuously proven to be a champion for the Center's program by encouraging students at his university to apply. "This internship has had a large impact on me and my university because attending and participating in programs targeting minority and underrepresented students is something I never thought my peers and I would be able to experience," Eldridge said.

Lauri Kight, a senior mathematics and physics major at Southern University.

LAURI KIGHT, A SENIOR MATHEMATICS AND PHYSICS MAJOR AT SOUTHERN UNIVERSITY, also participated in this summer's program. She worked to develop a mobile application that gives the public important health and safety information about the pandemic. Her tasks included reading, research and coding.



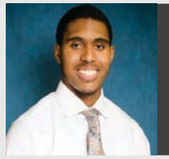
Gerita Cochran, a graduate student at Norfolk State University majoring in cybersecurity.

GERITA COCHRAN, A GRADUATE STUDENT AT NORFOLK STATE UNIVERSITY majoring in cybersecurity, worked on a project for the Defense Threat Reduction Agency where she researched the Center's needs for public access on the website.

Participants find this program to have an invaluable benefit. It allows emerging minority professionals to be mentored and to gain first-hand work experience. "Being able to apply everything that I've studied over the last two years to this actual environment is helpful," Cochran said. "I'm putting what I learned in school to work. It helps you realize that there's a lot more to learn outside of the classroom."

Kight agreed. "Sometimes you can't fathom what the workforce will look like until you're in it. Working for the federal government, I've seen diverse career fields and now it feels real that I could really be here one day," she said.

The interns weren't the only ones who benefited from the program, having brilliant and eager minds spend time working on important projects at the Center also contributed to the Center's goals for warfighter safety.



Simeon Sykes, a senior electrical engineering major with a concentration in nuclear power at Alabama A&M University (AAMU).

SIMEON SYKES, AN INTERN WHO FOCUSED ON ARTIFICIAL INTELLIGENCE (AI), was invited to present his research to Center leaders. His presentation has helped leaders understand the Center's next steps into the AI space. Interns also helped the Center develop solutions for authentication on the websites related to security protocol.

Since its inception, Vickers has been able to cultivate the HBCU/MI program and match interns with various agencies throughout the DoD such as Office of the Deputy Under Secretary of the Army for Test and Evaluation. "By branching out to agencies beyond the Center, this helps us market ourselves and receive funding to get the Soldiers what they need," Vickers noted.

This year's program looked different than previous summers because the interns successfully completed their internship entirely in a virtual environment. While there were challenges, the mentors, coordinators and students found innovative ways to carry out their missions. Typically, interns would be housed in a hotel, work in a facility with Center personnel and have in-person meetings. In fact, mentors struggled to figure out what projects they could assign that did not require the physical presence of an intern. "I gave my interns a project that I normally wouldn't assign," Johnson explained. "I tasked them with building a mobile application. Because COVID-19 is a critical health concern right now and since we couldn't work on anything work related, I thought it was best to work on something that was relevant to the pandemic but could also leverage the Center." This project ultimately helped get information out to the workforce and gave the interns a chance to work on a meaningful project despite the restrictions brought on by the pandemic.

The interns had their own individual challenges with working remotely, though some voiced that there were benefits to working in a virtual environment. Eldridge said he usually likes to have face-to-face interactions with people, but the experience taught him to be more comfortable in virtual meetings and showed that although we're in different places, we're still connected. The interns unanimously agreed that Microsoft Teams was an asset. Kight found the screen share feature especially useful when needing additional help or instruction on a subject matter. Although this experience wasn't a traditional one, they all thought that it prepared them for the future. "Next year, I'll begin my own career and because of this virtual experience, I won't be worried about interacting with others when we're not face-to-face. This internship prepared me for the real world," Eldridge said.

Moving forward, Vickers expects to see the HBCU/MI Summer Research Program expand. His team is strategizing how to access talent from a wider variety of schools and they're thinking about how to improve the program if COVID-19 persists next year. As each internship cohort leaves, Vickers and his team of mentors are dedicated to staying in touch with the students and offering professional development support beyond the 10 weeks.

Gerita Cochran had one piece of advice to future interns. "A lot of us are high achievers, and we all have that perfectionist state of mind, otherwise we wouldn't be in this program, but don't be so hard on yourself," she said. "Take a breath every once in a while and enjoy the moment."

Photo by DEVCOM CBC Public Affairs Office

The inventors of DEVCOM CBC's VOCkit observe the signing of agreements to leverage that technology into a commercial biological reader. The Center's T2 and You series of interactive workshops are designed to help researchers engage with external companies to further develop the Center's intellectual property.

Collaboration Corner: T2 and You—Where Science and Engineering Meets Business

By Jerilyn Coleman

WHEN WE TAKE A CALL, send a text, snap a picture or even use our GPS systems, we appreciate our cell phone's capabilities. Have you ever considered the thousands of patents within that one device? Those patents come from research done in federal labs just like the U.S. Army Combat Capabilities Development Command (CCDC) Chemical Biological Center and often their initial use is intended for the safety of Soldiers. Leaders in the Center's Technology Transfer Office understand just how essential intellectual property (IP) can be to the warfighter, and they're also committed to building strong relationships between scientists, engineers and industry partners. One of the ways they're working to demonstrate this is through their newest effort, T2 and You: Supporting Warfighter Wins through the Development of Creative Innovation Partnerships.

T2 and You is an educational series of interactive workshops designed to provide education to scientists and engineers in Department of Defense (DoD) laboratories to improve familiarity with engaging and working with external companies.

On June 25, more than 70 industry professionals joined the Center's Technology Transfer team for the very first T2 and You session. Attendees shared their networking experiences, warfighter wins and how they overcome projects that require knowledge about subject matters they may be unfamiliar with. Gary Evans, Ph.D., executive director of the Defense Technology Commercialization Center (DefTech), and Ken Malone, Ph.D., principal at Early Charm Ventures, were invited to discuss how Technology Transfer can encourage colliding ecosystems to work collaboratively. The session also covered topics about warfighter solutions with dual use and discovering small businesses with capabilities to solve warfighter problems.

The Technology Transfer Office and the Maryland Defense Technology Center (DefTech) is leading by example because this series is a collaborative effort. "We want to be a good partner. We're working to educate ourselves so that we can partner with others when that's needed," said DefTech's Project Manager, Kimberly Mozingo.

DefTech is a free program of the Maryland Department of Commerce (MDC), funded by the MDC Office of Economic Adjustment Defense Industry Adjustment to support connections between Maryland businesses and their DoD laboratories. DefTech facilitates business partnership opportunities with several labs through patent license agreements, test service agreements and cooperative research and development agreements. Simply put, they seek businesses through the state that could license technology that is developed in the labs and ensure that those businesses can develop a product and bring it to fruition. DefTech then introduces the businesses to people like Amanda Hess, Office of Resource Technology Applications in the Center's Technology Transfer Office, where they would be connected to experts in the labs to get their technical questions answered. If everyone agrees that the new solution can be turned into a viable product, it could be licensed.

The T2 and You series isn't the first time the Technology Transfer Office and DefTech have worked together. They've been recognized by the Federal Laboratory Consortium Awards program for economic development work in Harford County. Together, they utilized their

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proximity to advanced defense technology to the region's advantage, advancing a focused and coordinated effort to foster innovation, build a pipeline of skilled workers, create a regional entrepreneurial ecosystem, develop a regional brand and support entrepreneurial activities and commercialization in the area.

Hess hopes T2 and You highlights the opportunity for commercialization and how it can impact the Center's intellectual property. She explained that, "the series allows both personnel in labs and public sectors to be educated on topics that are not part of their routine or mandatory education." T2 and You topics will include networking and commercialization of IP. These workshops apply to IP that doesn't exist yet, that may be undisclosed, disclosed or have provisional patents. However, the series doesn't just focus on IP. It also sheds light on building integral relationships, education and seeking ways to innovate and engage with small businesses.

Hess knows first-hand the benefits of this work. In nearly a decade, she has spent the majority of her career as a chemical engineer supporting Technology Transfer; focusing on topics like sustainment, acquisition lifecycle, government contracts in the sustainment of fielded military systems, respiratory protection and developing programs that were focused on training military users for protective equipment.

The Technology Transfer Office has a great reputation for excellence and cultivating solutions that positively impact the warfighter by encouraging CRADA. Thus, private businesses can leverage the Army's research and development, using it to build a final product for their customers. During COVID-19, the Center's testing capability for the N95 face coverings is being heavily leveraged at the Technology Transfer Office. This is an example of the type of service the office can provide for industry customers. This type of work keeps the Technology Transfer team up to date on relevant equipment.

In the future, the Technology Transfer Office and DefTech want scientists and engineers to view T2 and You as a contact sport so that professionals in the workforce can work collaboratively to understand how the science impacts the business and vice versa. "It's the beginning of a culture change and it begins with education," Mozingo said. It is important for the workforce to understand Technology Transfer and be able to navigate all aspects of it, from innovation to commercialization.

To learn more about Technology Transfer or the T2 and You series, contact Amanda Hess via email at amanda.l.hess.civ@mail.mil.

LET'S COLLABORATE

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Member nations voted to add Novichok to the Organization for the Prohibition of Chemical Weapons list of banned substances during the 24th OPCW Conference of States Parties held at The Hague, the Netherlands, Nov. 25-29, 2019.

Photo by the Organization for the Prohibition of Chemical Weapons

Army Scientist Plays Key Role in International Ban on Nerve Agent

By Brian Feeney, Ph.D.

THE WORLD WAS REMINDED OF THE EXISTENCE OF A DEADLY RUSSIAN-DEVELOPED NERVE AGENT in March 2018 when a former Russian double agent, Sergei V. Skripal, and his daughter were found poisoned by it and unconscious on a park bench in Salisbury, England. The agent was Novichok, which the Russian scientists who developed it claim is five to eight times more potent than VX.

The Organization for the Prohibition of Chemical Weapons (OPCW) rose to the occasion and led a world response. In October 2018 at a 41-member OPCW Executive Council meeting, the United States, the Netherlands, and Canada formally proposed adding two families of Novichok-series agents to the OPCW list of banned substances.

The U.S. State Department led the U.S. effort to garner support for the technical change proposal and to ensure that the proposal would be adopted. The State Department tapped the Combat Capabilities Development Command Chemical Biological Center's (DEVCOM CBC) Robert Kristovich, Ph.D., and Frederic Berg, Ph.D., to provide technical expertise. Specifically, they presented the underlying science behind Novichok's lethality to members of the OPCW States Parties in order to pass the proposal at its next annual all-members meeting.

Kristovich was selected to lead the Center's efforts because he has been a toxicologist specializing in chemical agent lethality his entire career and had developed the deep scientific understanding required to explain the need to counter the proliferation of this deadly compound.

Robert Kristovich, Ph.D., chief of the Toxicology and Obscurants Division at the DEVCOM CBC, was called upon by the U.S. State Department to present the scientific argument for adding Novichok to the OPCW's Schedule 1 list of banned chemical materials.

"To develop the argument, we had to thoroughly analyze the agent to determine its degree of toxicity, its molecular stability, and how easy or hard it is to produce," said Kristovich. "I had a lot of help from extremely knowledgeable chemists from around the Center and was strongly supported by the Defense Threat Reduction Agency Joint Science and Technology Office for Chemical and Biological Defense, the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense, and the office of the Deputy Assistant Secretary of Defense for Chemical and Biological Defense. In this whole-of-nation chemical biological defense program approach, we determined that, by all counts, Novichok is a very, very bad thing to have in the hands of a bad guy."

Kristovich and the team of Center experts got to work building the case for adding Novichok to the OPCW's Schedule 1 list of banned chemical materials. They provided an educational briefing to the participating states of the French-led International Partnership Against Impunity for the Use of Chemical Weapons and on the margins of the Fourth OPCW Review Conference in November 2018. Then in November 2019, after more than a year's work, the proposal was adopted at the 24th Session of the OPCW Conference of the States Parties. The members not only unanimously passed the resolution, they all stood and applauded, a very rare show of appreciation in OPCW history and one deserving for the first ever change to the list of banned chemicals.

Kristovich looks back at this coordinated international response with satisfaction. "We proved that the U.S. Chemical Biological Defense Program and the OPCW possess such a technological lead in chemical agent detection and defense that it makes no sense for another nation or group to even try to use these materials."

Working for the Warfighter

Testing of Biocontainment Units for Transport of COVID-19 Patients

By Jana Kesavan

Jana Kesavan, Ph.D. is a research physicist at the U.S. Army Combat Capabilities Development Command Chemical Biological Center. She received her Bachelor of Science in biomedical engineering, Master of Health Science and Ph.D. in environmental health sciences from the Johns Hopkins University. After one year of post-doctoral fellowship at the Johns Hopkins University School of Medicine and one year of National Research Council fellowship at the U.S. Army, she started working for the Center. She has more than 20 years of aerosol related experience and is managing an advanced laboratory for aerosol research on chemical and biological defense.

COVID-19 HAS CHANGED OUR LIVES. U.S. citizens residing outside of the U.S. face the problem of getting adequate medical care in the countries they live in when they get infected with the SARS-COV-2 virus that causes COVID-19. The U.S. government is transporting COVID-19 patients to hospitals for medical care if adequate medical care is not available in the countries the patients reside in.

Biocontainment units are infectious disease containment units designed to transport patients while providing medical care. These units are also designed to protect the aircrew, medical attendants and the airframe from getting exposed to infectious organisms. In addition, these units must be tested before fielding to confirm their function.

Recently, the Sensors Signatures and Aerosol Technologies Branch at the Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) supported biocontainment unit testing at Joint Base Charleston, South Carolina. From March to June 2020, I travelled multiple times to Joint Base Charleston to participate in the testing of two fielded units and two new units.

The first type of biocontainment unit was developed after the Ebola crises in 2014 to transport infected patients. This unit is called the Transport Isolation System, or TIS, and was constructed with metal frames lined with clear plastic walls. This design allows for the walls to be removed and discarded after each transport. The next biocontainment unit used to transport Ebola patients was built for the Department of State in 2015 and is called the Portable Bio-Containment Care Module, or PBCM. Unlike the TIS, the PBCM is a solid walled unit.

The Negatively Pressurized Conex, or NPC, is the first new unit built and delivered to the U.S. Air Force's Air Mobility Command at the end of April 2020 to transport COVID-19 patients. Another smaller unit, called the NPC-lite, was also built and delivered to the Air Mobility Command in May 2020 for use with smaller planes, such as C130, transporting COVID-19 patients. All biocontainment units are separated into a patient room and an anteroom. Personal protective equipment is donned and doffed in the anteroom. In addition, the PBCM has a staff room for resting.

In general, biocontainment units need to maintain negative pressure, adequate air exchanges and biocontainment during various activities such as blower malfunction, health care worker entry and exit to the anteroom and deplaning. The negative pressure is maintained by one or two blowers pulling air from the far end of the patient room. This allows high-efficiency particulate air (HEPA) filtered air to enter the staff room, then the anteroom and then the patient room. HEPA filters are also placed between the rooms to prevent any aerosol from entering the anteroom if negative pressure is lost. In addition, these units need to be secured to the aircraft and should not produce electromagnetic interferons to affect the function of the aircraft.

An operational utility evaluation is conducted by practicing patient care and deplane activities on the ground and in air. Aerosols need to be contained during various patient care activities, movement of health care workers into the anteroom and during deplaning. Various decontamination solutions and methods were also tested during this time.

The Defense Threat Reduction Agency (DTRA), Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND) and Air Force Life Cycle Management Center provided the funding for SSAT's support of the biocontainment unit testing at Joint Base Charleston under the Joint Urgent Operational Need testing event. Many agencies and universities participated in the tests to determine the negative pressure, filter efficiency, air exchange rate, aerosol purge rate, biocontainment efficiency and decontamination efficiency. The testing of these biocontainment units was truly a team effort, and I learned a lot from interacting with the many groups that supported the test, such as the Air Force test group, health care providers, Clarkson University, Public Health Center, DTRA and the JPEO-CBRND. I was able to interact with Aeromedical Evacuation Airmen and influenced key decisions with Army Materiel Command's COVID-19 patient movement plan.

Harford County Public Schools Superintendent, Dr. Sean Bulson (center left) and Board of Education President, Jansen Robinson (center right) lead a school board meeting.

Photo by Harford County Board of Education

In the Community: Center Security Specialist Dedicated to Improving Education, Keeping Youth Safe

By Jerilyn Coleman

SECURITY PROFESSIONAL BY DAY, EDUCATION AND COMMUNITY ADVOCATE BY NIGHT. Jansen Robinson isn't letting a global pandemic stand in the way of what he sees as his responsibilities as a community member.

Robinson has provided safety and security services for various organizations for more than three decades. For 13 of those years, he has served the Combat Capabilities Development Command Chemical Biological Center (DEVCOM CBC) in the crime prevention, emergency management and antiterrorism spaces. Robinson's first mission is to protect some of the U.S. Army's most valuable assets as a physical security specialist in the Center's Risk/Surety & Protection branch. His second mission is to champion education and youth in his community. As president of the Harford County Board of Education, he serves as chief advocate to 38,000 students, 5,000 employees and thousands of parents in Harford County. Robinson sets agendas and policies, passes the operating and capital budget, creates the strategic plan for the direction of the Harford County Public School (HCPS) system and more. "Balancing both roles during this pandemic was different and somewhat challenging, but it provided me with the opportunity to be creative as I discovered new ways to accomplish both missions," Robinson said.

Despite the uncertainty that comes with the COVID-19 pandemic, he has found a silver lining. He's finding ways to stay productive in his work at the Center while continuing to engage with the workforce and community. As an essential employee at the Center, Robinson has been balancing on-site work with telework. He attends more virtual meetings than usual these days and he recognizes the need to be flexible and creative in times of adversity. He is excited about the new opportunities to virtually engage and learn from colleagues and to become proficient in evolving technology that he wouldn't typically utilize.

When he's not fulfilling his duties at the Center, he's hard at work to ensure that Harford County's children have access to safe learning environments. The HCPS system has had its own challenges during the pandemic. Among those are "food service for kids who rely on schools for food, distance learning challenges, an impatient community and all of the expected human reactions," Robinson said. Additionally, many parents are trying to balance working from home with teaching their children unfamiliar subject matter, all while spending more time together than any of them are used to.

Robinson has dedicated his life to improving education and keeping community youth safe. As the first person in his family to complete college, he knows the value of education. His parents demonstrated how powerful it was to be educated by taking him to marches, demonstrations and meetings regarding improvement in their community's schools, housing, jobs and food markets. It was those experiences that made him decide he wanted to make a difference. "I have tried not to forget where I came from. I can remember my father saying to me one day as we were walking home from his job, that if we want things to be different, then we have to do something about it," Robinson reflected.

Harford County has 54 schools representing diverse communities. Those schools need partnerships with individuals and organizations who can devote their time, services and knowledge throughout the year by mentoring and developing relationships with school officials and students. "I would like to encourage the APG community to consider getting involved in the community outside the gate," Robinson said. "The security of APG does not start at the gate but rather in the communities where the workforce resides."

Robinson doesn't just talk about getting involved – he sets the standard. He's on the board of directors for the Boys & Girls Club and Harford County Library Foundation; he serves as Edgewood Community Advisory Board President; and he's an auditor for the National Federation of Federal Employees.

This grandfather of two, Vietnam-era veteran, church deacon and public servant is dedicated to making a difference, multiple missions at a time. "I believe that as an African American male, I have certain obligations and responsibilities," he said. "They include serving the God of my choice; being a role model for my family; serving my country and investing my skills, talent and time to improve the quality of life for residents of my community."

EDITOR'S NOTE: This article is informational and intended to highlight the contributions of a DEVCOM CBC employee to the community. No endorsement of Harford County Public Schools, the Harford County Board of Education, or any other non-Federal entity is stated or implied in this article. The employee's activities as discussed in this article are conducted in a personal capacity and are permitted under the Federal ethics rules, the DOD Joint Ethics Regulation (DOD 5500.07-R), and the Hatch Act.

McDaniel Selected as Center's Senior Technologist for Chemistry

By Jerilyn Coleman

Patricia McDaniel, Ph.D. is the Chemical Biological Center's fifth Senior Technologist. She is an expert in chemistry, research and analytical sciences.

PATRICIA MCDANIEL, PH.D., IS THE LATEST SENIOR TECHNOLOGIST (ST) at the U.S. Army Combat Capabilities Development Command Chemical Biological Center. A former program manager at the DoD's Combating Terrorism Technical Support Office (CTTSO), McDaniel replaced August Fountain, Ph.D., as the Senior Research Scientist for Chemistry and joined Peter Emanuel, Ph.D., Senior Research Scientist for Bioengineering as one of two STs assigned to the Center.

Senior Technologists perform and develop high-level research in chemical sciences, life sciences and physical science. They are Army senior leaders and hold protocol level equivalent to a one-star general. The Research and Technology (R&T) Directorate position is an Army asset that explores essential science to benefit the warfighter. The federal government's most decorated scientists and engineers are appointed as STs. The role was created to capitalize on the research in their respective areas of expertise and relieve the individual of the managerial and supervisory responsibilities associated with a Senior Executive Service position, though the ST can supervise a team of individuals and provide oversight of research conducted.

The Research and Technology (R&T) Directorate position is an Army asset that explores essential science to benefit the warfighter.

The ST role is an extremely competitive position and reflects outstanding professional achievement, creativity and leadership. In fact, less than 600 individuals have received this honor in the Executive Branch since its inception in 1990.

In nearly 35 years, McDaniel has excelled in research, analytical science and management roles in the field of chemistry. According to McDaniel, "Every ST across the DoD brings a different skill set and I think the whole idea is to apply that expertise in a way that's going to benefit the organization." Her most recent role with the CTTSO sharpened her contract and proposal review skills and portfolio development. This role also exposed McDaniel to working collaboratively and mentoring a team of analysts. She served as the Chemical, Biological, Radiological, Nuclear and Explosives Program manager, spearheading more than 60 high-level projects. McDaniel also served as Science and Technology Fellow in National Defense and Global Security for the Executive Branch of the American Association for the Advancement of Science. There, she gained appreciation for the importance of providing policy makers with critical scientific information in a succinct and technically appropriate manner. She also served as a senior chemist at the National Aeronautics and Space Administration and held roles in other government and private agencies.

As a Senior Technologist, McDaniel is responsible for managing the Center's fundamental exploratory science programs, including the In-House Laboratory Independent Research Program and the Surface Science Initiative. Another part of her role is to keep the organization leaning forward in a way that can be applied to defense issues. "My goal is to find new approaches to solving problems through interdisciplinary teams, new technology or new vehicles to collaborate with others." Moving forward, McDaniel wants to initially focus on mapping innovation to identify areas of success and opportunities for growth to leverage how the Center's current and past work can best impact the future.

"My goal is to find new approaches to solving problems through interdisciplinary teams, new technology or new vehicles to collaborate with others."

Patricia McDaniel, Ph.D., Army's Senior Research Scientist for Chemistry at the Combat Capabilities Development Command Chemical Biological Center

Publications and Patents

Quarterly Listing

This page contains the peer-reviewed journal articles recently published on research conducted by Center scientists and U.S. patents recently awarded to the Center.

PUBLICATIONS

Title: Backbone Interactions Between Transcriptional Activator ExsA and Anti-Activator ExsD Facilitate Regulation of the Type III Secretion System in Pseudomonas aeruginosa **Author(s):** Shrestha, M; Bernhards, RC; Fu, YC; Ryan, K; Schubot, FD; **Source:** SCIENTIFIC REPORTS **Volume:** 10 **Issue:** 1 **Article Number:** 9881 **DOI:** 10.1038/s41598-020-66555-z **Published:** JUN 18 2020 **ISSN:** 2045-2322

Title: Uncovering the Role of Metal-Organic Framework Topology on the Capture and Reactivity of Chemical Warfare Agents **Author(s):** Son, F; Wasson, MC; Islamoglu, T; Chen, ZJ; Gong, XY; Hanna, SL; Lyu, JF; Wang, XJ; Idrees, KB; Mahle, JJ; Peterson, GW; Farha, OK **Source:** CHEMISTRY OF MATERIALS **Volume:** 32 **Issue:** 11 Pages: 4609-4617 **DOI:** 10.1021/acs.chemmater.0c00986 **Published:** JUN 9 2020 **ISSN:** 0897-4756

Title: Generating Biologically Stable TNA Aptamers that Function with High Affinity and Thermal Stability **Author(s):** Dunn, MR; McCloskey, CM; Buckley, P; Rhea, K; Chaput, JC **Source:** JOURNAL OF THE AMERICAN CHEMICAL SOCIETY **Volume:** 142 **Issue:** 17 Pages: 7721-7724 **DOI:** 10.1021/jacs.0c00641 **Published:** APR 29 2020 **ISSN:** 0002-7863

Title: Mesoporous Copper Nanoparticle/TiO2 Aerogels for Room-Temperature Hydrolytic Decomposition of the Chemical Warfare Simulant Dimethyl Methylphosphonate **Author(s):** McEntee, M; Gordon, WO; Balboa, A; Delia, DJ; Pitman, CL; Pennington, AM; Rolison, DR; Pietron, JJ; DeSario, PA **Source:** ACS APPLIED NANO MATERIALS **Volume:** 3 **Issue:** 4 Pages: 3503-3512 **DOI:** 10.1021/acsanm.0c00228 **Published:** APR 24 2020 **ISSN:** 2574-0970

Title: Detection of Chemical Warfare Agents by Colorimetric Sensor Arrays **Author(s):** Davidson, CE; Dixon, MM; Williams, BR; Kilper, GK; Lim, SH; Martino, RA; Rhodes, P; Hulet, MS; Miles, RW; Samuels, AC; Emanuel, PA; Miklos, AE **Source:** ACS SENSORS **Volume:** 5 **Issue:** 4 Pages: 1102-1109 **DOI:** 10.1021/acssensors.0c00042 **Published:** APR 24 2020 **ISSN:** 2379-3694

Title: Accurate Evaluation of Potential Calibration Standards for Ion Mobility Spectrometry **Author(s):** Hauck, BC; Harden, CS; McHugh, VM **Source:** ANALYTICAL CHEMISTRY **Volume:** 92 **Issue:** 8 Pages: 6158-6165 **DOI:** 10.1021/acs.analchem.0c00859 **Published:** APR 21 2020 **ISSN:** 0003-2700

Title: Laser Scanning Confocal Microscopy Was Used to Validate thePresence of Burkholderia Pseudomallei or B. Mallei in Formalin-Fixed Paraffin Embedded Tissues **Author(s):** Amemiya K; Cote CK; Soffler C; Dankmeyer JL; Ribot WJ; Trevino SR; Welkos SL; Worsham PL; Waag DM; Zeng X; Bearss JJ; Bernhards RC **Source:** TROPICAL MEDICINE AND INFECTIOUS DISEASE **Volume:** 5 **Issue:** 2 Pages: 6158-6165 **DOI:** 10.1021/acs.analchem.0c00859 **Published:** APR 21 2020 **ISSN:** 0003-2700

Title: A Flexible Interpenetrated Zirconium-Based Metal-Organic Framework with High Affinity toward Ammonia **Author(s):** Zhang, YY; Zhang, X; Chen, ZJ; Otake, K; Peterson, GW; Chen, YW; Wang, XJ; Redfern, LR; Goswami, S; Li, P; Islamoglu, T; Wang, B; Farha, OK **Source:** CHEMSUSCHEM **Volume:** 13 **Issue:** 7 Pages: 1710-1714 **DOI:** 10.1002/cssc.202000306 **Published:** APR 7 2020 **ISSN:** 1864-5631

Title: Metal-Organic Framework- and Polyoxometalate-Based Sorbents for the Uptake and Destruction of Chemical Warfare Agents **Author(s):** Grissom, TG; Plonka, AM; Sharp, CH; Ebrahim, AM; Tian, YY; Collins-Wildman, DL; Kaledin, AL; Siegal, HJ; Troya, D; Hill, CL; Frenkel, AI; Musaev, DG; Gordon, WO; Karwacki, CJ; Mitchell, MB; Morris, JR **Source:** ACS APPLIED MATERIALS & INTERFACES **Volume:** 12 **Issue:** 13 Pages: 14641-14661 **DOI:** 10.1021/acsami.9b20833 **Published:** APR 1 2020 **ISSN:** 1944-8244

Title: Multimodal Characterization of Materials and Decontamination Processes for Chemical Warfare Protection **Author(s):** Ebrahim, AM; Plonka, AM; Tian, YY; Senanayake, SD; Gordon, WO; Balboa, A; Wang, H; Collins-Wildman, DL; Hill, CL; Musaev, DG; Morris, JR; Troya, D; Frenkel, AI **Source:** ACS APPLIED MATERIALS & INTERFACES **Volume:** 12 **Issue:** 13 Pages: 14721-14738 **DOI:** 10.1021/acsami.9b19494 **Published:** APR 1 2020 **ISSN:** 1944-8244

Title: Graphene Oxide-Based Membrane as a Protective Barrier against Toxic Vapors and Gases **Author(s):** Peng, C; Iqbal, Z; Sirkar, KK; Peterson, GW **Source:** ACS APPLIED MATERIALS & INTERFACES **Volume:** 12 **Issue:** 9 Pages: 11094-11103 **DOI:** 10.1021/acsami.0c00615 **Published:** MAR 4 2020 **ISSN:** 1944-8244 **eISSN:** 1944-8252

Title: A Survey of Antimicrobial Resistance Determinants in Category A Select Agents, Exempt Strains, and Near-Neighbor Species **Author(s):** Taitt, CR; Leski, TA; Vora, GJ; Chen, A; Berk, KL; Dorsey, RW; Gregory, MJ; Frey, KG; Sozhamannan, S; Dutt, DL **Source:** INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES **Volume:** 21 **Issue:** 5 Page: 1669 **DOI:** 10.3390/ijms21051669 **Published:** MAR 2020 **ISSN:** 1422-0067

Title: Metal–Organic Framework- and Polyoxometalate-Based Sorbents for the Uptake and Destruction of Chemical Warfare Agents **Author(s):** Grissom,TG; Sharp, CH; Siegal, HJ; Troya, D; Morris, JR; Plonka, AM; Ebrahim, AM; Tian, Y; Frenkel, AI; Collins-Wildman, DL; Hill, CL; Kaledin, AL; Musaev, DG; Gordon, WO; Karwacki, CJ; Mitchell, MB **Source:** ACS APPLIED MATERIALS INTERFACES **Volume:** 12 **Issue:** 13 Pages: 14641-14661 **DOI:** 10.1021/acsami.9b20833 **Published:** JAN 29 2020 **ISSN:** 1944-8252

Title: Hydrolysis and enzymatic degradation of Novichok nerve agents **Author(s):** Harvey, SP; McMahon LR; Berg FJ **Source:** HELIYON **Volume:** 6 **Issue:** 1 **Article Number:** e03153 **DOI:** 10.1016/j.heliyon.2019.e03153 **Published:** JAN 2020 ISSN 2405-8440

Title: Phage display as a tool for vaccine and immunotherapy development **Author(s):** Hess, KL; Jewell, CM **Source:** BIOENGINEERING & TRANSLATIONAL MEDICINE **Volume:** 5 **Issue:** 1 **Article Number:** e10142 **DOI:** 10.1002/btm2.10142 **Published:** JAN 2020 **eISSN:** 2380-6761

Title: Integration of Metal-Organic Frameworks on Protective Layers for Destruction of Nerve Agents under Relevant Conditions **Author(s):** Chen, ZJ; Ma, KK; Mahle, JJ; Wang, H; Syed, ZH; Atilgan, A; Chen, YW; Xin, JH; Islamoglu, T; Peterson, GW; Farha, OK **Source:** JOURNAL OF THE AMERICAN CHEMICAL SOCIETY **Volume:** 141 **Issue:** 51 Pages: 20016-20021 **DOI:** 10.1021/jacs.9b11172 **Published:** DEC 25 2019 **ISSN:** 0002-7863 **eISSN:** 1520-5126

Title: Methodologies for Preparation Of Prokaryotic Extracts for Cell-Free Expression Systems **Author(s):** Cole SD; Miklos AE; Lux MW; Chiao AC; Sun ZZ; Chiao AC; **Source:** SYNTHETIC AND SYSTEMS BIOTECHNOLOGY **Volume:** 5 **Issue:** 4 Pages: 252-267 **DOI:** 10.1016/j.synbio.2020.07.006 **Published:** DEC 20 2020 **ISSN:** 2405-805X

Title: Effect of Carbon Dioxide on the Degradation of Chemical Warfare Agent Simulant in the Presence of Zr Metal Organic Framework MOF-808 **Author(s):** Plonka, AM; Grissom, TG; Musaev, DG; Balboa, A; Gordon, WO; Collins-Wildman, DL; Ghose, SK; Tian, YY; Ebrahim, AM; Mitchell, MB; Hill, CL; Morris, JR; Frenkel, AI **Source:** CHEMISTRY OF MATERIALS **Volume:** 31 **Issue:** 23 Pages: 9904-9914 **DOI:** 10.1021/acs.chemmater.9b04565 **Published:** DEC 10 2019 **ISSN:** 0897-4756

Title: Organism Engineering for the Bioproduction of the Triaminotrinitrobenzene (TATB) Precursor Phloroglucinol (PG) **Author(s):** Meyer, A; Saaem, I; Silverman, A; Varaljay, VA; Mickol, R; Blum, S; Tobias, AV; Schwalm, ND; Mojadedi, W; Onderko, E; Bristol, C; Liu, ST; Pratt, K; Casini, A; Eluere, R; Moser, F; Drake, C; Gupta, M; Kelley-Loughnane, N; Lucks, JP; Akingbade, KL; Lux, MP; Glaven, S; Crookes-Goodson, W; Jewett, MC; Gordon, DB; Voigt, CA **Source:** ACS SYNTHETIC BIOLOGY **Volume:** 8 **Issue:** 12 Pages: 2746-2755 **DOI:** 10.1021/acssynbio.9b00393 **Published:** DEC 2019 **ISSN:** 2161-5063

Title: Insights into the solvent-assisted degradation of organophosphorus compounds by a Zr-based metal-organic framework **Author(s):** Harvey, JA; Pearce, CJ; Hall, MG; Bruni, EJ; DeCoste, JB; Gallis, DFS **Source:** DALTON TRANSACTIONS **Volume:** 48 **Issue:** 43 Pages: 16153-16157 **DOI:** 10.1039/c9dt03710a **Published:** NOV 21 2019 **ISSN:** 1477-9226

Title: Synthesis and mu-Opioid Activity of the Primary Metabolites of Carfentanil **Author(s):** Hsu, FL; Walz, AJ; Myslinski, JM; Kong, L; Feasel, MG; Goralski, TDP; Rose, T; Cooper, NJ; Roughley, N; Timperley, CM **Source:** ACS MEDICINAL CHEMISTRY LETTERS **Volume:** 10 **Issue:** 11 Pages: 1568-1572 **DOI:** 10.1021/acsmedchemlett.9b00404 **Published:** NOV 2019 **ISSN:** 1948-5875

Title: Negative Thermal Expansion of Mercurous Halides **Author(s):** Amarasinghe, PM; Kim, JS; Trivedi, S; Qadri, SB; Gorzkowski, EP; Imler, G; Soos, J; Gupta, N; Jensen, J **Source:** JOURNAL OF ELECTRONIC MATERIALS **Volume:** 48 **Issue:** 11 Special **Issue:** SI **DOI:** 10.1007/s11664-019-07518-7 **Published:** NOV 2019 **ISSN:** 0361-

Title: Multivariate CuBTC Metal-Organic Framework with Enhanced Selectivity, Stability, Compatibility, and Processability **Author(s):** Peterson, GW; Au, K; Tovar, TM; Epps, TH **Source:** CHEMISTRY OF MATERIALS **Volume:** 31 **Issue:** 20 Pages: 8459-8465 **DOI:** 10.1021/acs.chemmater.9b02756 **Published:** OCT 22 2019 **ISSN:** 0897-4756

Title: A Method for Cost-Effective and Rapid Characterization of Engineered T7-Based Transcription Factors by Cell-Free Protein Synthesis Reveals Insights into the Regulation of T7 RNA Polymerase-Driven Expression **Author(s):** McManus, JB; Emanuel, PA; Murray, RM; Lux, MW **Source:** ARCHIVES OF BIOCHEMISTRY AND BIOPHYSICS **Volume:** 674 **Article Number:** 108045 **DOI:** 10.1016/j.abb.2019.07.010 **Published:** OCT 15 2019 **ISSN:** 0003-9861

Title: Composition-dependent multicomponent diffusivity of 2,5-lutidine with acetonitrile in polyurethane **Author(s):** Varady, MJ; Boyne, DA; Pearl, TP; Lambeth, RH; Mantooth, BA **Source:** POLYMER **Volume:** 180 **Article Number:** UNSP 121697 **DOI:** 10.1016/j.polymer.2019.121697 **Published:** OCT 10 2019 **ISSN:** 0032-3861

Title: Scalable and Template-Free Aqueous Synthesis of Zirconium-Based Metal-Organic Framework Coating on Textile Fiber **Author(s):** Ma, KK; Islamoglu, T; Chen, ZJ; Li, P; Wasson, MC; Chen, YW; Wang, YF; Peterson, GW; Xin, JH; Farha, OK **Source:** JOURNAL OF THE AMERICAN CHEMICAL SOCIETY **Volume:** 141 **Issue:** 39 Pages: 15626-15633 **DOI:** 10.1021/jacs.9b07301
Published: OCT 2 2019 **ISSN:** 0002-7863

Title: Two-dimensional MS/MS scans on a linear ion trap mass analyzer: Identification of V-series chemical warfare agents **Author(s):** Snyder, DT; Demond, PS; Szalwinski, LJ; Dhummakupt, ES; McBride, EM; Cooks, RG; Glaros, T; Mach, PM **Source:** INTERNATIONAL JOURNAL OF MASS SPECTROMETRY **Volume:** 444 **Article Number:** UNSP 116171 **DOI:** 10.1016/j.ijms.2019.06.007 **Published:** OCT 2019 **ISSN:** 1387-3806 **eISSN:** 1873-2798

PATENTS

Low toxicity, environmentally friendly red smoke generating composition and method of making the same
Patent number: 10,759,720
Issued: September 1, 2020

Lateral media flow microtiter plate
Patent number: 10,751,716
Issued: August 25, 2020

Self-indicating colorimetric response materials for removal and sensing of toxic chemicals and narcotics
Patent number: 10,732,098
Issued: August 4, 2020

Pyrotechnic smoke obscurants containing metal-organic frameworks and composites thereof
Patent number: 10,717,685
Issued: July 21, 2020

Low toxicity, environmentally friendly violet smoke generating compositions and methods of making the same
Patent number: 10,663,272
Issued: May 26, 2020

Enhancement of adsorption via polarization in a composite material
Patent number: 10,610,851
Issued: April 7, 2020

Pyrotechnic iodine smoke generation for counter biological applications
Patent number: 10,609,924
Issued: April 7, 2020

Solutions

U.S. Army Combat Capabilities Development Command
Chemical Biological Center

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