# The R&T CONNECTION

*A Publication of the Research & Technology Directorate*

**Summer 2014**


## ECBC NEEDS YOU TO SHAPE THE FUTURE

As we look toward Fiscal Year 2015, it is the right time to reflect on our achievements while planning for the future. It is for that reason have asked for your feedback for the 2014 R&T Climate Survey. The Climate Survey helps us recognize your biggest concerns, and learn what some of your suggestions are for improving our Directorate. Your feedback is critical to the success of this Directorate, as each and every one of you are the ones working in the labs, building relationships with our customers and creating solutions to the world's biggest Chemical and Biological defense challenges.

Your survey responses are taken very seriously. When we last distributed the survey in late 2012, we were overwhelmed with responses. Fifty-six percent of you took the survey, and your concerns were centered on a desire for more Front Office interaction, increased communication and more transparency. We tried to address these through increasing the number of Town Halls with Q&A sessions, and increasing information dissemination.

We have personally read all of the open-ended responses. The results will be shared at our Town Hall this fall. Please look out for invitations to that.

If you have any questions or comments about the survey, please contact Kelly Outram, the R&T Communications Officer at Kelly.a.outram.ctr@mail.mil.

**Dr. Joseph L. Corriveau**
Director, Research & Technology Directorate

## ECBC's New IED Detection Technologies featured on *Applied Spectroscopy* cover

Noted for its unique role in combatting improvised explosive devices (IED) attacks on U.S. forces, the U.S. Army Edgewood Chemical Biological Center (ECBC) has been featured on the cover of the August 2014 *Journal of Applied Spectroscopy* for its work to exploit the spectroscopic signatures of explosives for the detection of IEDs.

As part of a three-year Army Technology Objective (ATO), ECBC has worked to advance the science of optical cross sections and spectroscopic signatures of explosives. These studies investigated spectral signatures of explosives in solid or liquid form, at bulk or trace levels, and when exposed to the environment. The goal is to integrate this information into algorithms for the benchmarking of spectroscopic-based sensors.

"The invitation to provide a Focal Point article in the internationally premier spectroscopy journal, *Applied Spectroscopy*, is a reflection of the high quality research conducted by the scientists and engineers that participated in the ATO. It is also a testament that ECBC has established itself as a credible expert in the area of explosives detection," said Augustus W. Fountain III, Ph.D., Senior Research Scientist for Chemistry at ECBC.

As part of this ATO, ECBC also worked jointly with the Army Research Laboratory to successfully use inkjet-printed explosives for ion mobility spectrometry analysis and a coupon methodology to quantitatively assess optical detection technologies in the laboratory and field environments.

In order to realize a future capability in standoff explosives detection, a full understanding of the spectral signatures is required.

ECBC continues to advocate for the scientific community to adopt standardized methods for the evaluation of standoff optical systems for explosives detection. A concerted effort is still required to develop the capability to detect an explosive threat prior to detonation in a complex, dirty environment; to identify activities associated with IED manufacture; and to conduct residue analysis for intelligence or attribution.

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### Do you have a story to share?

Have an item for the **R&T Connection**? Whether it's a technical accomplishment, an upcoming speech, an employee award or any other news story, please share it with R&T Communications Officer Kelly Outram at **Kelly.A.Outram.ctr@mail.mil** or 410.436.2262.





# CUSTOMER SERVICE OLYMPICS

These are the words we hear the television commentators use to describe the athletes competing in various Olympic sports. Aren't these the same words that we would love our customers to use to describe the customer service and experience that we deliver?

In business, the Olympics come every day. Companies win when they execute and fail when they don't. Each department, and even each member of that department, has his or her role in playing to the success of their company. Here are four ways that will help you earn the gold medal in customer service:

**Coaching:** Customer service starts with good leadership, setting the tone and example for others to follow.

**Preparation:** Companies train their employees in technical and soft skills that help them nail a gold medal performance. They practice those skills in role plays.

**Visualization:** Companies must visualize their customers' needs. Based on the customer's recent buying patterns – what they buy and how often they buy – you can deliver a more customized experience. You can anticipate your customer's needs.

**Competitive:** The best companies know how to compete, using customer service as one of their advantages to not just get, but keep the customer.

**Focus:** The best companies know what they are good at and know how to deliver it to their customer. They don't lose that focus and derail with distractions.

When we deliver Gold Medal-level customer service, we reap the benefits of repeat business, raving customer endorsements and customer loyalty. And, like the athletes, we are fulfilled and reap the rewards in knowing that we are playing at the top of our game.

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This customer service tip is from Shep Hyken's The Customer Focus http://www.thecustomerfocus.com. Hyken is a customer service expert, professional speaker and New York Times bestselling business author.

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The ECBC/NRL series is intended to build positive working relationships between PIs at ECBC and NRL.

## ECBC and NRL Facilitate Organizational Collaboration Through

# HOME-ON-HOME SEMINAR SERIES

The U.S. Army Edgewood Chemical Biological Center (ECBC) and the Naval Research Laboratory (NRL) plan to write the next chapter of defense technologies together. ECBC and NRL's Chemistry Division are laying the foundation for such a future through hosting a series of "home-on-home" style seminars where ECBC and NRL scientists present their research in an attempt to build broader relationships across the organizations and work together to build technology-based solutions for the warfighter.

With similar missions to provide technology solutions to some of the nation's most challenging national security problems, ECBC and NRL have a history of working together on Chemical, Biological, Radiation, Nuclear, and Explosives (CBRNE) problems. ECBC is the premier Department of Defense (DoD) organization for integrated lifecycle science, engineering and operations solutions to counter CBRNE threats to U.S. forces and the nation. NRL is the U.S. Navy's corporate research laboratory with a long history in solving the most challenging technological problems, including CBRNE.

"Dr. Corriveau [ECBC Research Director] was invited by Dr. Richard Colton [NRL Chemistry Division Superintendent] to participate in NRL's Chemistry Colloquium this past year, and I work with several scientists at NRL," said Christopher Karwacki Ph.D., ECBC Research and Technology Chief Scientist for Physical and Chemical Sciences. "Dr. John Russell [Head, Surface Chemistry Branch Chemistry Division of NRL] and I along with several other scientists at NRL wanted to find a way to create a broader dialogue between the organizations. We decided that a rotating seminar series would be the best structure and would provide opportunities to meet with bench-level scientists at their facilities."

> "Our hope is that this seminar series with an emphasis on one-on-one interactions between principal investigators at the respective institutions will foster a collegial community and opportunities for real collaboration."
>
> – Christopher Karwacki, Ph.D., ECBC Research and Technology Chief Scientist for Physical and Chemical Sciences

Roughly 40 members of the ECBC workforce attended the first of these seminars in March 2014 where Matthew Laskoski, Ph.D., from NRL, visited Edgewood and presented an overview of his research entitled "New Materials and Strategies for Advanced DoD Applications." Dr. Laskoski discussed NRL's recent work to evaluate the use of polyoxometalates for the oxidation reactions of chemical warfare agents and toxic industrial compounds.

"Starting the series with a discussion on material sciences was important to us," Karwacki said. "There is ample opportunity for us to partner due to the recent nanosciences approach to material design, so this is a good place to start."

In recent years ECBC has increased its research in the nanosciences with particular emphasis in the synthesis and characterization of materials for protection, decontamination and sensing of CBRNE. This new focus has been in support of the Defense Threat Reduction Agency (DTRA) Joint Science and Technology Office's strategic program goals to design multifunctional materials capable of responding to a broad spectrum of CBRNE hazards. Furthermore, ECBC has increased collaborations with academia and the service laboratories in the nanosciences, such as the Army Research Laboratory (ARL) and NRL, to address these emerging needs.

A key challenge in designing nanostructured materials is to employ high-end computational and experimental tools enabling guided synthesis and control of important active properties, such as morphology and surface chemistry. Scaling these primitive structures to a functional form is a formidable challenge. To aid in the design of these complex materials, NRL's Institute for Nanoscience, established in 2003, offers cutting-edge capabilities to manipulate structures in the nanometer size domain.

"Our hope is that this seminar series with an emphasis on one-on-one interactions between principal investigators at the respective institutions will foster a collegial community and opportunities for real collaboration through awareness of facilities and the skills and capabilities of personnel at both organizations (to the benefit of U.S. warfighters). Hopefully this forum will spawn new opportunities in DoD research with different partners," said Karwacki.

Nanosciences is just one of the disciplines where the seminar series can help ECBC and NRL build a partnership. NRL and ECBC anticipate that hosting these joint information sessions at both organizations will open the door for future collaborations and facilitate new concepts to solve complex chemical and biological defense problems.

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# ECBC TRANSITIONS BARCODED SPORES

## to Dugway Proving Ground for Operational Testing

**Barcoded spores, an ECBC developed method of aerosol testing, was transitioned to Dugway Proving Ground for its developmental phase where it will be evaluated for major defense and industrial use.**

Scientists at the U.S. Army Edgewood Chemical Biological Center in Edgewood, Md., have completed breakthrough testing on barcoded spores, which is poised to revolutionize the world of aerosol testing. Developmental testing done at ECBC will be transitioned to Dugway Proving Ground for operational testing, so that they can be used in major defense and industry testing.

Spores are a stage that allows some bacteria such as Bacillus to endure adverse conditions. When conditions improve, the spores transform into active bacteria and can survive in the environment for years. After years of operational testing using bacterial spore stimulants for Anthrax, bacteria can accumulate, making it difficult for scientists to identify the spores that were released in a current test, versus spores that are left from previous tests. Led by ECBC microbiologist Henry S. Gibbons, Ph.D., ECBC developed "barcoded" spores to help scientists differentiate among spore-forming bacteria. Their findings were published in *Journal of Applied & Environmental Microbiology* as well as in an op-ed piece in the *American Society for Microbiology*.

Barcoded spores are tagged biological spores that allow scientists to tell one bacteria apart from another. Scientists implant a specific code into the spore's DNA, making the spore "barcoded." Those codes give each spore a unique identify, allowing researchers to discern which spores belong to which test. This capability lets scientists track how each individual spore reacts and separates them from other spores that were left in the area from previous tests or other occurrences.

Now that ECBC has successfully completed the development and initial testing of the barcoded spores, ECBC transitioned barcoded strains of *B. thuringiensis* to Dugway.

"The background levels at Dugway from Mother Nature herself and years of testing add a dimension of difficulty to our testing," said Angelo Madonna, Ph.D., West Desert Test Center Chief of Life Sciences Division. "If we could eliminate the question of what was already on the ranges from the equation, it would make our testing faster, more efficient and more accurate."

ECBC has a long-standing history developing technologies in the areas of CB detection, protection and decontamination. It is due to the Center's inventiveness that ECBC's reputation and agency relationships remain strong today – such as the one that ECBC shares with Dugway.

"The barcoded spores are an ECBC success story," said Gibbons. "And now their legacy will continue, hopefully, as a Dugway testing success story."

Since its transition to Dugway, one of the barcoded strains has been successfully used in testing for the Department of Homeland Security's (DHS) SPORE program.

"The barcoded spores will enable the researchers at Dugway to test in a way that has not been possible in the past," said Peter Emanuel, Ph.D., ECBC Biosciences Division Chief. "First, the background clutter goes to zero. Second, the tests can be done over and over again, and third, there can be simultaneous releases."

Rather than needing to have different designated test dates for different bacteria, barcoded spores allow this to happen on the same day in the same testing period. Having the ability to perform test releases with two different sets of barcoded spores at the same time is resourceful and efficient.

"This has been a really good collaboration between Dugway and ECBC," shared Madonna. "There's so much more that we can test for now, and we now have a really valuable tool for doing our job – our mission – thanks to ECBC. "



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# TUNNEL VISION

## ECBC's Ambient Breeze Tunnel Upgrades Provide Unique Space For Safe, Effective Biological Testing

ECBC's Ambient Breeze Tunnel is one of the Center's most unique facilities for accurate aerosol testing.

Protecting the warfighter and nation from the threat of chemical and biological warfare is the U.S. Army Edgewood Chemical Biological Center's (ECBC) top mission. To achieve this mission, scientists and engineers at ECBC develop technologies that can detect and mitigate chemical or biological threats. All technologies are put through rigorous, extensive testing to measure the effectiveness of the equipment for use in real world situations. ECBC's ambient breeze tunnel (ABT) is one of the unique means used to characterize aerosol clouds.

ECBC's ambient breeze tunnel is a converted 1941 warehouse with a 14-feet wide by 14-feet tall, and 200-feet long test section. The ABT maintains the same temperature and humidity as the outside temperature, allowing testing to take place in actual environmental conditions but within a controlled space. Recent upgrades to the ABT filters permit scientists to test equipment in a more sophisticated, realistic and safe environment.

A large, variable-speed fan pulls air up to five miles per hour down the tunnel and through a HEPA filtration unit. "The wind speed only goes up to five or six miles per hour; however, that is roughly the average wind speed on a given day on Earth," said Jason Edmonds, Ph.D., the Aerosol Sciences Branch Chief.

Current projects in the tunnel are investigating reaerosolization of biological material. There are two other breeze tunnels commonly used for chemical and biological defense (CBD) studies; one is located at the Dugway Proving Ground, and the other is at the Battelle Memorial Institute in West Jefferson, Ohio. "We can hang things from the ceiling, or put them on a wall if we needed to. Other breeze tunnels probably would not be able to do that without damaging their structure," Edmonds said. The test section is coated with a rubberized paint that can withstand decontamination techniques such as bleach, Vaporized Hydrogen Peroxide and other reactive chemicals enabling decontamination efforts after each test.

Current ABT projects investigate the reaerosolization of biological material from complex surfaces of CBD interest. "The reaersolization tests are indicative of the type of tests within the ABT are typically performed," Edmonds said.

Aersolization looks at what happens to a biological agent when it is exposed into the air. Reaerosolization takes that a step further and explores what happens after an agent is exposed to the air and then lands on a surface such as a car hood or a window pane and then becomes airborne again. Research like this helps the U.S. Army and the Department of Defense to better understand the life cycle of biological agents in order to protect warfighters and the nation from them.

During reaersolization tests, vehicles or surfaces of interest are moved into the front section of the breeze tunnel where they are placed under a well-characterized and sealed canopy. Biological warfare agent simulant, or live vaccine strains of agent, is then disseminated within the canopy, and the particulate is allowed to settle and deposit onto the test surfaces. After dissemination, the canopy is removed, and the fan located at the end of the tunnel is powered on, generating a predetermined wind speed. Aerosol collection technologies, particle counters and sampling wipes can then be used to determine the amount of material that has reaerosolized from the test material.

While the fans are on and the test is in progress, team members can observe the testing from a safe location in one of the two observation rooms located in the breeze tunnel. The rooms have electrical and data ports to allow vendors and scientists network computers and equipment that allow them to see data in real time while observing the test in progress, which is a powerful capability if the need for troubleshooting arises.

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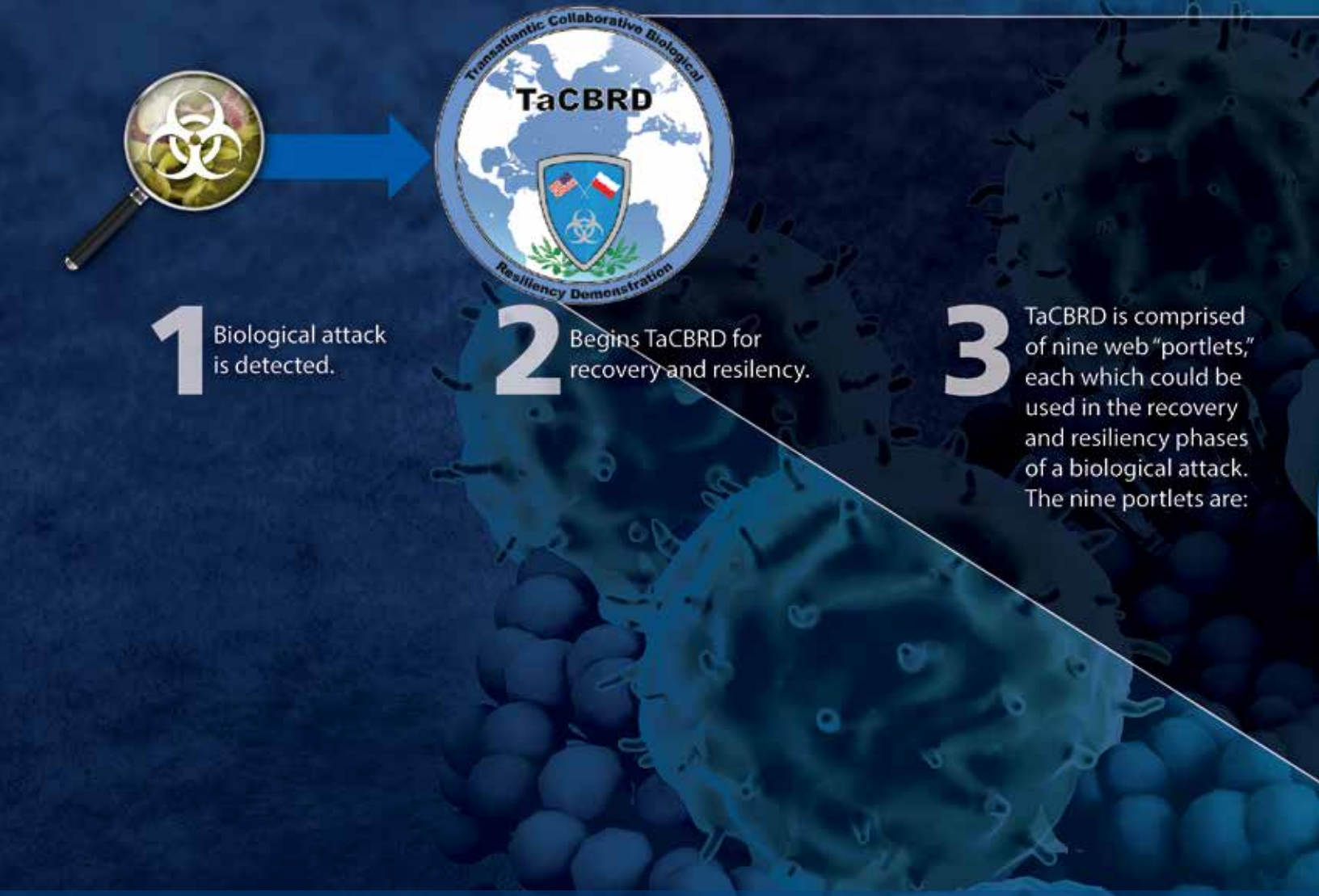


# MANAGING THE AFTERMATH:

## TaCBRD Creates a Path Forward Following a Biological Attack

The Untied States and the Republic of Poland partnered for the TaCBRD program to evaluate software for biological resiliency.

The Polish government just got word that local hospitals are seeing a high amount of patients coming in with symptoms that reflect the Bubonic Plague and Anthrax exposure. Experts and government officials are certain that there has been an exposure of the biological agents at a high-profile football match that recently took place. While there are teams investigating possible culprits, the government must now determine how to find and treat those who have been exposed before it spreads and how to identify and decontaminate all vulnerable areas in a timely fashion. Where do they begin?

The U.S. Army Edgewood Chemical Biological Center (ECBC), in collaboration with the Defense Threat Reduction Agency (DTRA) and the U.S.



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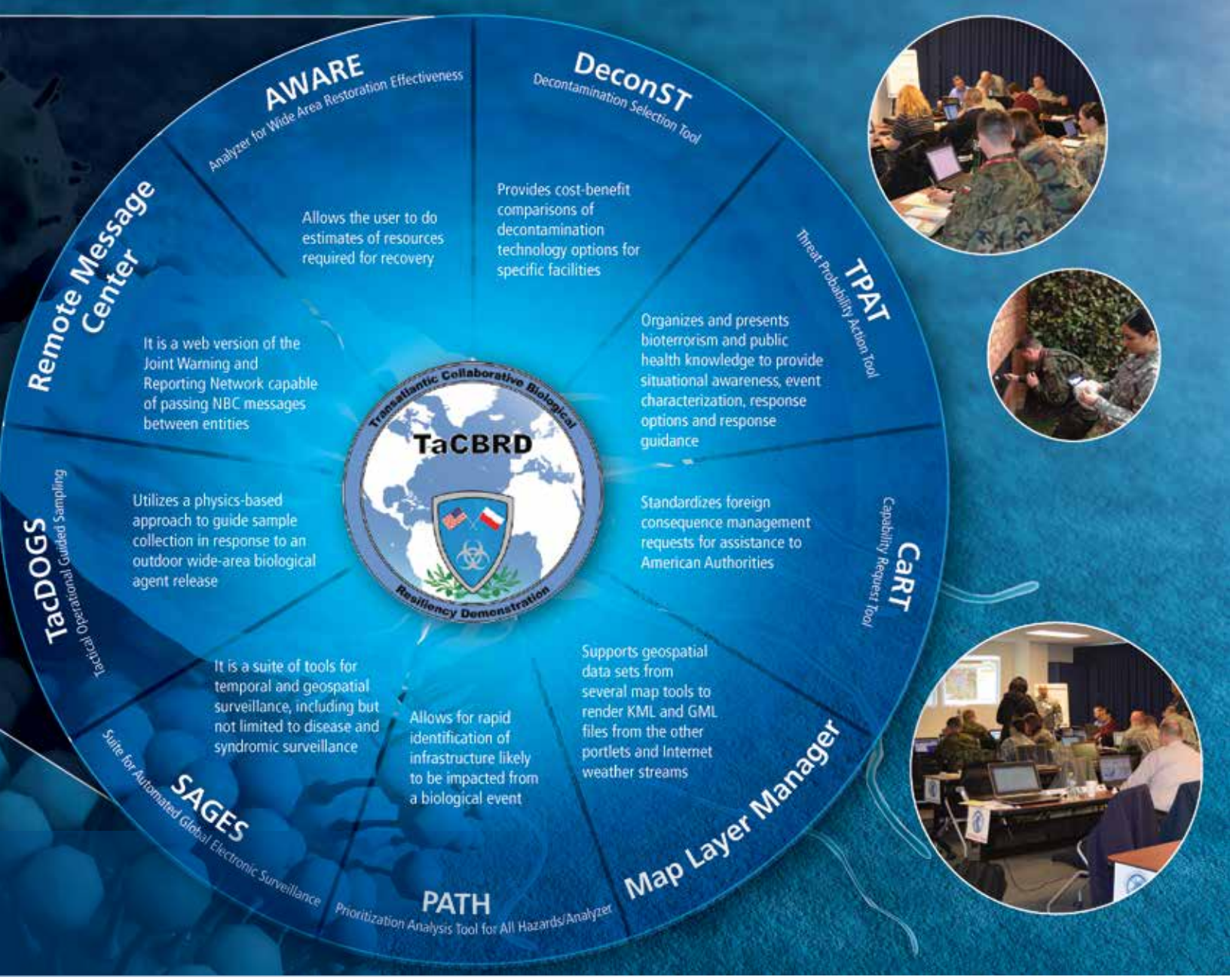


Army European Command (EUCOM), has spent the past two years developing and perfecting the Transatlantic Collaborative Dashboard (TaCBoaRD), a suite of decision analytics software that will help governments provide quick, decisive and effective answers to that question through a series of hands-on workshops, tools and demonstrations.

The series of demonstrations, called the Transatlantic Collaborative Biological Resiliency Demonstration (TaCBRD), is a collaborative program among the U.S. Department of Defense (DoD), the U.S. Department of State (DoS) and the U.S. Department of Homeland Security (DHS) to develop and demonstrate a U.S. government capability for resilience in countering a wide-area biological incident that impacts U.S. and partner nation civil and military personnel. In current demonstrations, the Republic of Poland is the partner nation.

"If there were a large fire in Denver, there are already plans in place to help the government contain the spread, rebuild following the damage and help displaced citizens; unfortunately, when it comes to something that is less common such as a biological incident, that type of plan might not exist, anywhere," said Bill Ginley, Technical Manager for TaCBRD and Branch Chief of ECBC's Nuclear, Biological and Chemical defense (NBC) Battlefield Management Branch. After the response phase concludes, issues of clean-up and resiliency become the focus for the contaminated area.

Resiliency focuses on what is the plan to rehabilitate an area after a biological incident has been identified. This includes methods of treating all who have been exposed to the agent; plans to handle any biological waste; how to remediate, getting the right infrastructure re-established in a timely fashion; and how to properly allocate resources, among many other considerations.

Ginley said discussions on resilience and long-term remediation began following the exposure of Anthrax in the Hart Senate Building in 2001. Since then, the DHS and the DoD launched the Interagency Biological Recovery Demonstration (IBRD) which examined the effects of biological incidents in Seattle. TaCBRD was follow-on to that initial IBRD exercise.

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Julie Renner (pictured second from left) had the opportunity to work alongside USFK personnel as a part of the JUPITR ATD in the Republic of Korea. Renner earned recognition for her commitment to the demonstration.

# EMPLOYEE SPOTLIGHT:
## Julie Renner Discusses Travels To South Korea With JUPITR

Julie Renner, an analytical toxicologist at the U.S. Army Edgewood Chemical Biological Center, has always enjoyed traveling and experiencing new cultures. Her most recent developmental assignment in the Republic of Korea (ROK) — supporting the Joint United States Forces Korea (USFK) Portal and Integrated Threat Recognition advanced technology demonstration (JUPITR ATD) — allowed her to expand her chemical and biological defense knowledge while learning about a different country. JUPITR ATD is a program led by the Joint Program Executive Office for Chemical and Biological Defense (JPEO) and supported by ECBC, to establish biological surveillance capabilities to the Korean Peninsula through four thrust areas.

JUPITR is unique in that it sends ECBC and Public Health Command (PHC) researchers to South Korea to work alongside USFK representatives to improve their laboratory capabilities. Renner was one of 10 ECBC scientists who made the journey so far, and one of two who have completed more than one rotation. Now, Renner shares some of her experiences in this role and how this assignment will shape her future at ECBC and with the Department of Defense in general.

- **What is your educational background, and how did you get started at ECBC?**
  I graduated from West Virginia Wesleyan College in 2003 with bachelor's degrees in biology and chemistry. After graduation, I really didn't know exactly what type of work I wanted to pursue. While I was in college, I worked a seasonal job at the West Virginia Department of Environmental Protection, Environmental Remediation; following graduation I returned there. One day, I came across a Monster.com job posting for a contractor position with ECBC's analytical toxicology team. It sounded intriguing, and after doing a little research, I realized how important ECBC's work is to the nation, so I applied. The interview went well and in November 2003, I was offered a position by Geo-Centers Inc. as a Scientist 1. I've worked with ECBC ever since, eventually making the move from contractor to government employee. Over the years I have had the opportunity to work for both the analytical toxicology and operational toxicology teams in different facets. I completed University of Florida's online master's program in forensic toxicology in 2007, with the help of my previous company.

- **How did you initially get involved with JUPITR?**
  I first heard about JUPITR when Peter Emanuel,Ph.D., [JUPITR Program lead] sent out a mass invitation to an informational meeting about the JUPITR ATD in Korea. I love traveling and am always looking for opportunities to learn, so it piqued my interest. Initially, I simply planned to attend the meeting to learn more information, but at the end of the meeting, Peter asked for volunteers to go to Korea, and I found myself signing up. I realized what an amazing developmental assignment this was and what an amazing opportunity this program would give me, so I did not hesitate to participate.

- **Why did you participate in two rotations? How did your first time there differ from the second?**
  I originally volunteered to go to ROK for two months, but my first rotation was only a month long. In that month, I had fallen in love with the job and Korea itself, so when I returned to the



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"The JUPITR ATD has a tangible and impactful end result: an improved bio-surveillance capability on the peninsula. I am honored to be a part of it all."

-Julie Renner, ECBC Toxicologist

U.S., I had made sure to let everyone know that I was available to go back if they needed me. As it turned out, they did need me to return and I gladly accepted the opportunity. Returning to Korea gave me an opportunity to re-engage with some of the projects I started during my first rotation. My first rotation went by quickly, and much of that time in the beginning was spent acclimating to my surroundings, learning local policies/procedures, and forming relationships with our contacts and lab/military personnel. On my second rotation with all of the adjustments out of the way, I could focus on the primary goal of the project: to improve the capability of USFK to respond to biological events.

Additionally, I think the Army and Air Force appreciated the continuity in personnel. Since it does take a while for scientists to get acclimated and build relationships, I think it provided them with relief to have someone who could jump in and be dedicated to the actual project work.

- **What were you responsible for while you were in Korea?**

I worked with Michelle Ziemski, an ECBC scientist, to upgrade the Biological Identification Capability Laboratory at the Yongsan Airbase lab to Biological Safety Level-2 (BSL-2) standards. BSL-2 allows the lab to safely accommodate the receipt and analysis of biologically hazardous environmental samples. This process included physical upgrades as well as policy and procedural changes, such as a concept of operations. In addition to establishing a BSL-2, we also demonstrated new laboratory instrumentation to both USFK and ROK personnel. These new laboratory capabilities will give the USFK/8th Army Surgeon the power to make informed decisions based on results obtained locally as opposed to depending entirely on CONUS support. In the past the lab would have to send samples back to the US for analysis, which takes a lot of time and resources. By setting up the instrumentation there in Korea, the soldiers can analyze these samples on their own and in a timely manner.

- **How has your experience with JUPITR differed from your experience with other projects while at ECBC or elsewhere?**

ECBC really has done and continues to do outstanding work. Recently, ECBC and JPEO have made history by assisting with destroying Syria's chemical stockpile by creating the Field Deployable Hydrolysis System, placing it on the Cape Ray and sending personnel on the Cape Ray to operate the machinery. Our role in supporting JUPITR through developing subject-matter experts and sending them to Korea to fulfill a critical biological surveillance mission is no less significant. This project will have a huge impact on the Korean peninsula and within the biosurveillance world. For all of my years at ECBC, I have always recognized ECBC's significance to the Department of Defense, but I have never had the opportunity to be a part of something so large-scale or highly visible until now. The JUPITR ATD has a tangible and impactful end-result: an improved bio-surveillance capability on the peninsula. I am honored to be a part of it all.

ⓘ To read more about Julie and her experiences, visit the ECBC blog at http:// edgewoodchembio.blogspot.com/2014/05/ecbc-employee-spotlight-julie-renner.html.

# BENEATH THE SURFACE:

## ECBC Studies Interactions of Chemical Agents on Surfaces

**Wesley Gordon, Ph.D. and Erin Durke Davis, Ph.D., built the surface science instrument, which can safely perform ultra high vacuum studies with CWAs**

Scientists at the U.S. Army Edgewood Chemical Biological Center (ECBC) designed a new instrument for the direct study of chemical warfare agent (CWA) interactions with surfaces of environmental materials and coatings designed for protection and decontamination. Working closely with a team of researchers at the Virginia Polytechnic Institute and State University (Virginia Tech) in Blacksburg, Va.; ECBC scientist Wesley Gordon, Ph.D., and Excet Inc. scientist Eric Durke Davis, Ph.D., built the surface science instrument, which can safely perform ultra high vacuum (UHV) studies with chemical warfare agents.

The surface science instrument was adapted for highly toxic compounds and successfully permits the study of interactions of CWAs on military surfaces and decontamination chemistries. The ability to conduct such testing had not been possible — until now. Combining infrared spectroscopy to track bond making and breaking on surfaces; mass spectrometry to detect gas-phase species; and X-ray photoelectron spectroscopy to study the elemental composition of surfaces — the surface science instrument is a versatile piece of equipment. Using it, researchers can monitor reactions in real time with IR spectroscopy and MS and take before-and-after images of surfaces using photoelectron spectroscopy.

The instrument can "measure desorption energy of a CWA bound to a surface," says Gordon, ECBC chemist and member of the team that led the instrument development at the university. In addition, the instrument has the ability to "confirm prediction of absorption energies on environmental materials."

Due to the risk associated with handling chemical warfare agents, like sarin and soman, the instrument's safety design alleviates these concerns and allows researchers to work closely with and test the chemical warfare agents. For example, polymeric seals have been replaced with metal seals to reduce the likelihood of a leak, all backing pumps have been located within engineering controls, and a custom Venturi tube for safe ventilation and a fully sealed burst disk have been added to the apparatus. "This UHV chamber can safely study CWAs using multiple instruments simultaneously, and that makes it very unique," says Davis.

Having the ability to perform fundamental surface science investigations on these chemicals provides valuable information to the chemical defense community. Few people work with toxic chemicals. "If something breaks, you'll need to be able to open up and fix [the instrument] without potential harm," says Gordon. "With this instrumentation, we can do that."

Research conducted with the surface science instrument is currently being funded by the Defense Threat Reduction Agency (DTRA). Originally funded by the ARO, the instrument was built and tested by Gordon and a team of academic researchers at Virginia Tech. Once testing and construction of the apparatus had been completed, the instrument was moved to the Advanced Chemistry Laboratory at ECBC in 2010. JSTO funds the program to help develop a better understanding of chemical warfare agents on military relevant surfaces.

Future research will develop a better understanding of how this instrument can advance understanding of CWA surface chemistry. "Research is fundamental," says Gordon. "We need research in order to understand the consequences [of a CWA event] and save lives."



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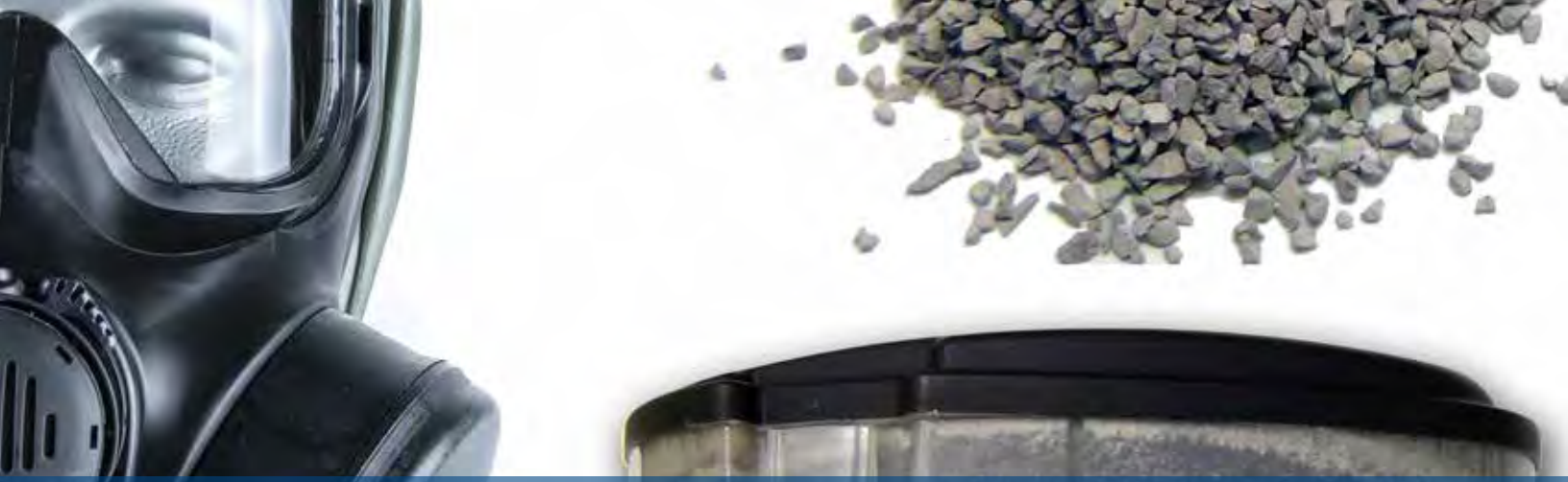

## ECBC Researchers Study the Future of

# FILTRATION WITH COZZAT MATERIAL

**ECBC developed a metal oxide composite developed from zirconium hydroxide and combined with cobalt (Co), zinc (Z), Silver (A), and triethylenediamine (T) additives (CoZZAT) to compliment current carbon filters and protect against more materials.**

This summer, the U.S. Army Edgewood Chemical Biological Center (ECBC) will solicit feedback from several members of the U.S. Navy on a new, advanced filter material called CoZZAT, a metal oxide composite developed from zirconium hydroxide and combined with cobalt (Co), zinc (Z), Silver (A), and triethylenediamine (T) additives (CoZZAT for short). The Defense Threat Reduction Agency's Joint Science and Technology Office (DTRA JSTO) funded the research of this breakthrough material.

For nearly 100 years, activated carbon has been used as filters in protective masks and in collective protection instruments. While carbon serves as an excellent material for this, researchers wanted to develop an improved material that can protect against additional threats unique to today's battlefield. In efforts to resolve these concerns, ECBC researchers found new ways to improve the chemical material without decreasing limitations of the protective mask. For example, researchers found that combining activated carbon with other materials resulted in a thick material that clogged the respirator of the gas mask.

Instead reactive chemical, such as cobalt, zinc, Silver and triethylenediamine additives were used to compliment the activated carbon.

"Replacing carbon wasn't a good idea," said Greg Peterson, Research Chemical Engineer with the CBR Filtration Branch, Research and Technology Directorate, ECBC. "We examined the activated carbon and asked, 'What do we like about this?' As a result, we made that into [new] materials with porous metal oxides, took a reactive compound and made it into new material. Instead, we used layering beds instead of the carbon and CoZZAT mixture to double the performance and performance concerns."

> "Carbon has worked great since its first use in 1914. But CoZZAT is the right kind of material for 2014 concerns."
>
> -Gregory Peterson,Research Chemical Engineer with the CBR Filtration Branch

The material has the ability to resist TICs in addition to traditional chemicals. CoZZAT increases reactivity against acid/acid-forming gases such as cyanogen chloride, hydrogen cyanide, hydrogen chloride, hydrogen sulfide, nitrogen dioxide, and sulfur dioxide; nerve and blister agents and others. CoZZAT also exhibits greater resistance to battlefield contaminants and weathering, allowing for extended service life.

The new system is revolutionary as prototype filters containing layering beds of CoZZAT and activated carbon provides unprecedented levels of protection against a wide range of contaminants. CoZZAT complements activated carbon, decreasing posed limitations as opposed to only utilizing carbon and greatly increasing effectiveness of the protective mask and overall protection for warfighters.

Currently in its fifth year of the program, the Office of the Secretary of Defense (OSD) Rapid Innovation Fund has contributed funding to mature the Manufacturing Readiness Level (MRL) of CoZZAT. Peterson and team has already sent prototype CoZZAT filters to the Joint Program Manager for Protection (JPM-P). JPM-P is researching these prototypes for future insertion into the Joint Service General Protective Mask (JSGPM), a protective mask currently being fielded to all of the U.S. Armed Forces. In FY15 and FY16, Peterson expects CoZZAT to be in its developmental testing phase, with hopes for a technology insertion.

"Carbon has worked great since its first use in 1914," Peterson said. "But CoZZAT is the right kind of material for 2014 concerns."

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## ECBC and UMB Partner to Launch

# THE CAREERS OF YOUNG SCIENTISTS

**Ashley Larsen (pictured above), was the first student to participate in the ECBC-UMB Student Internship Program in January 2014. Larsen graduated UMB in May 2014 with an M.S. in Molecular Medicine and specializing in physiology/ pharmacology, and completed the ECBC internship program at the same time.**

The U.S. Army Edgewood Chemical Biological Center (ECBC) has established an Education Partnership Agreement (EPA) with the University of Maryland, Baltimore (UMB) Graduate Program in Life Sciences and the UMB Graduate School. The ECBC-UMB Student Internship Program (EUSIP) allows students currently pursuing a master's degree in molecular medicine or toxicology at UMB an opportunity to work alongside experienced ECBC scientists at ECBC facilities and fosters a mutually beneficial technology transfer and collaborative relationship between the two parties.

Continuing into fiscal year 2014-2015, participating students will work on ongoing research projects with an ECBC Principal Investigator and conduct research that can be used toward fulfillment of their UMB degree requirements. Interns gain access to the state-of-the-art research facilities at ECBC, as well as experts who can also serve as career mentors. ECBC in turn benefits from the students' fresh scientific insights and techniques while enhancing their capability to recruit new talent into careers within the Department of Defense (DoD).

Robert Dorsey, the BioSensors Branch Chief, and co-lead Jeff Ballin, Ph.D., an Excet Inc., a research biologist working within the BioTechnology Branch, looked for new ways to improve recruitment and innovation into their projects . Previously, interns came from high schools or undergraduate institutions to work at ECBC during their summer break. However, as a large portion student time was often used for paperwork and training, many found the time spent by students doing actual laboratory work was often too short to make a significant impact.

Dr. Ballin said his main goal in selecting projects and PIs for this program was finding people who could serve as good career mentors for the students while providing research programs with strong opportunities for growth and development.

"This program relies on mentors who are more than just good researchers. We need good researchers who can also foster the growth of a student. The PIs serve on the student's thesis committee since the work done with the PI is the central focus of the thesis. A student must have the right support for their professional career to flourish," Ballin said.

One of the first students to participate in this program is Ashley Larsen. Larsen sat down with us to discuss some of her experiences thus far with ECBC.

- **How did you find out about ECBC's program?**
  I found out about the EUSIP program through my graduate school; I attended a presentation in which several representatives from ECBC provided brief overviews of the projects they are working on and which graduate students would be helpful and able to learn.

- **What is your academic background?**
  I completed my undergraduate studies at the University of Maryland, College Park in 2012, graduating with a B.S. in Biological Sciences with an emphasis on microbiology. More recently I just successfully completed my master's program at the University of Maryland, Baltimore, graduating with a M.S. in Molecular Medicine and specializing in physiology/ pharmacology.



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"This program relies on mentors who are more than just good researchers. We need good researchers who can also foster the growth of a student ... A student must have the right support for their professional career to flourish."

-Jeff Ballin, Ph.D., co-lead for ECBC-UMB Student Internship Program

Currently, Larsen is continuing her science career with ECBC as an Oak Ridge Institute for Science and Education (ORISE) fellow within ECBC's BioSciences Division.

- **What are you working on right now and with whom?**
  I am currently working with Dr. Henry S. Gibbons on a project that focuses on developing an ideal *Bacillus anthracis* surrogate strain to predict the behavior of potential biothreat agents within the environment. My current goal is to improve the efficiency of integration of a stable genetic tag into a surrogate organism in order to make its detection via specific PCR assays in environmental simulations easier.

- **What has been the most interesting part of your work so far?**
  The most interesting part of my work so far is being able to work towards a goal that I can visualize having real-world applications. In the past, my lab work has been focused mostly on academics and trying to understand particular biological phenomena rather than trying to create an end product that can be used to help people in real life.

- **How have you applied your work at ECBC to your coursework, and vice versa: how have you applied some of your coursework to this internship?**
  The core course that all life science graduate students are required to take at UMB provided me with a generalized overview of many advanced molecular biology techniques. I was able to use that knowledge extensively in the lab, as I am mostly performing molecular cloning and use several molecular diagnostic tests to verify my results. Additionally, I have been able to use what I have learned in the lab to further expand upon my basic molecular biology knowledge and revisit the microbiology aspect of my studies.

- **What are your plans for the future?**
  My future plans are currently undecided. I have always been extremely interested in the medical field, so applying to medical school or to a physician assistant program may be one option. On the other hand, I am fascinated by the current research that has been ongoing in the fields of biology and medicine, so I may decide to apply to a Ph.D. program and focus more on host-pathogen interactions within the next few years.

## Interested in hosting a Master's student for your research?

Please send **Jeff Ballin** a brief project description and desired skill set at jeff.d.ballin.ctr@mail.mil or call (410) 417-2687.

Students will be from Biochemistry & Molecular Biology, Epidemiology & Human Genetics, Molecular Medicine, Microbiology & Immunology, Neuroscience, Toxicology, plus availability of students from numerous other programs

*continued from page 5*

## Tunnel Vision: ECBC's Ambient Breeze Tunnel Upgrades Provide Unique Space for Safe, Effective Biological Testing

The recently upgraded the HEPA filtration system enhances the testing capabilities of the ABT through allowing biological material testing to safely take place. "Previously, we had a less than optimal filter bank at the end of the tunnel," said Edmonds. "The filters were very good, but there were a lot of leaks around the filters, so we never aerosolized anything here above Biosafety Level 1. With these upgrades, we can now do that."

The facility upgrade can now more closely accommodate the needs of the CBD community to support larger projects that need to test more applicable biological material such as *Bacillus anthracis*. "Over the last year we have been finding ways to accommodate programs interested in collecting data for live agents in an outdoor environment," Edmonds said. "The safety office has been a major support in this effort and has been working with the Aerosol Sciences Branch through these renovations." One of the final steps in getting the facility up and running was to have the filter system certified, which recently occurred.

One project the upgraded facility will support is a deposition efficiency of solid particulate basic science program and the Joint United States Forces Korea (USFK) Portal and Integrated Threat Recognition Advanced Technology Demonstration (JUPITR ATD). The JUPITR ATD is a program that seeks to give biosurveillance capabilities to the Republic of Korea. To support this mission, the Aerosol Science Branch will use the breeze tunnel to aerosolize a live non-virulent strain of *Bacillus anthracis* and attenuated preparations of other microorganisms to challenge a number of systems in their ability to collect and detect biological warfare agents. Being able to capture this type of data is important to serving ECBC's CBD mission and keeping warfighters and civilians safe.

In addition to supporting key projects, the Aerosol Sciences team also hopes to use the upgraded facilities to pave the way for more collaborative projects with organizations like the Dugway Proving Ground. Edmonds finds that the more ECBC can partner with Dugway, the quality and strength of testing efforts will improve greatly.

"We collaborate [with Dugway], but mostly it involves us exchanging best practices pertaining to testing and testing techniques," said Edmonds. "With our upgraded facilities and structural capabilities of the Breeze Tunnel, we can evolve that partnership into something where we can use our facilities to perform research and development on sensors with different agents and then transfer our solutions and technologies over to Dugway for testing and evaluation."

The facilities run by the Aerosol Sciences Branch, including the ambient breeze tunnel, are an asset to ECBC and the defense community as a whole. A number of personnel on the Aerosol Sciences Branch routinely give tours of the facilities and can accommodate personalized tours for individuals and large groups alike.

*continued from page 7*

## Managing the Aftermath: TaCBRD Creates a Path Forward Following a Biological Attack

During TaCBRD, participants simulate a wide-spread biological incident, and use the TaCBoaRD software suite to construct next step resilience plans.

TaCBRD is comprised of nine web "portlets," each of which could be used in the recovery and resiliency phases of a biological attack.

During TaCBRD, representatives from the Polish Epidemiologist Response Center, DHS, the Federal Bureau of Investigation (FBI), the Environmental Protection Agency (EPA), Johns Hopkins University, and many other organizations came together to use TaCBRD and provide real-time feedback to the software developers.

"There is not an integrated set of tools dedicated to resiliency out there right now," Ginley said. "What they do and how they do it have been greatly influenced by experts who worked to restore the Hart Building following the 2001 Anthrax attacks; many of their lessons learned are applied in these tools."

Four TaCBRD demonstrations will take place between August 2013 and February 2015, when U.S. and Polish representatives will meet to go through the scenarios and use the TaCBRD tools to draft resiliency plans. The four technical demonstrations alternate between U.S. and European locations; in August 2013 the demonstration was held in Edgewood, Md., in February 2014 it was held in Washington, D.C.; in May 2014 and October 2014 both will be held in Poland. The program will culminate with an Operational Demonstration in Germany in February 2015.



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# R&T Tech Reports

A number of R&T staff members and contractors have showcased their great work through technical reports. Here is a sampling from June 2014:

- **TR-1263** - Final Report for the Colorimetric Reconnaissance Explosives Squad Screening (CRESS) Kit. Authors: Fountain, Augustus W. III; Genovese, James; Steinert, Charles; Kreis, Richard; Lyons, Timothy; Cress, James M.; Fritz, Kevin M. (ECBC); and Murphy, Kevin (JRAD)
- **TR-1236** - Effective Screening Area Final Report: Bispectral Grenade Test Results. Authors: Robert Carestia, David Redding, Daniel Weber, John Stewart, D. Jeffrey Hale.
- **TR-1242** - A Review of Computational Efforts In the Design of Visible and Infrared Obscurant Particles. Author: Brendan G. DeLacy.
- **CR-137** - Field Measurement of Spectral-Wide Extinction Efficiencies. Authors: Charles W. Bruce, Michael Granado, Alejandro L. Gongora, Joseph R. Montoya, Jason Zwiebel, D. Jeffrey Hale, David R. Redding.
- **TR-1190** - (U) Raman Cross Sections and Infrared Absorption Signatures of Non-Traditional Agent Precursors. Author: Phillip Wilcox.
- **TR-1241** - (U) Toxicological Evaluation of EA 5680, EA 5761 (Bare Skin and Dry vs Wet Clothing), and GD (Dry vs Wet Clothing) in the Rabbit. Authors: James H. Manthei, Dale H. Heitkamp, William C. Starke, Robert D. Moore, Dean M. Bona, Kenneth P. Cameron.
- **TR-1251** - NIST-Traceable NMR Method to Determine Quantitative Weight Percentage Purity of Nitrogen Mustard HN-1 Feedstock Samples. Authors: David J. McGarvey, William R. Creasy.
- **TR-1256** - Performance of Redesigned Dual Cavity Respirator Test Beds Worn during Operationally Relevant Activities. Authors: David M. Caretti, Daniel J. Barker.
- **TN-065** - Method Number ADT-178, Revision 4: Method for Evaluating Detectors. Authors: Terri L. Longworth, Kwok Y. Ong.
- **CR-141** - Hollow Fiber Temperature Swing Adsorption: Part 1 Final Contractor Report. This report was produced by the Parker Hannifin Manufacturing Ltd., Hunter Filtration and Separation Division, U.K.

# ECBC Lab Receives Top Marks from Nobel Peace Prize Winner

The Forensic Analytical Center at the U.S. Army Edgewood Chemical Biological Center has once again received top marks in the annual proficiency test from the Organization for the Prohibition of Chemical Weapons (OPCW) – a multinational organization established to implement the Chemical Weapons Convention, which bans the production, stockpiling and use of such weapons. OPCW rose to international fame in 2013 when it was awarded the Nobel Peace Prize for its involvement in the agreement to destroy Syria's chemical weapons stores.

This year marked the 35th OPCW Proficiency Test and 20th time ECBC has scored an "A" grade over the years. In 1996, ECBC's Forensic Analytical Center became the first U.S. laboratory to become a designated OPCW laboratory. It is one of only two labs in the U.S. to provide forensic analysis for OPCW, monitoring the proliferation of weapons of mass destruction; the other is at Lawrence Livermore National Laboratory in California.

Based in The Hague, The Netherlands, OPCW has 21 laboratories worldwide certified to work with the organization to confirm the presence of nerve agents and other chemical weapons. To maintain their status as an OPCW-designated laboratory, these laboratories must successfully complete an international proficiency test every year. Of the 16 labs worldwide that participated in this year's test, ECBC was one of only four to receive an "A," with two laboratories receiving a "B," the minimum grade required for a laboratory to maintain their status as a designated laboratory.

"We feel extremely fortunate that we are able to work on such an important and exciting – although rather stressful at times – project that demonstrates that the U.S. has internationally recognized expertise in accurate detection and identification of chemicals related to the Chemical Weapons Convention in complex sample matrices," said Alex Jestel, the chemist who led the team of 16 ECBC scientists in the proficiency test effort. "Our continued successful completion of these proficiency tests ensures that if samples suspected of containing chemicals related to the Chemical Weapons Convention are analyzed by the ECBC Forensic Analytical Center, the results will have greater scientific reliability when viewed by the international community. This is especially important during this time of increased awareness and usage of chemical weapons," he added.

In the proficiency test, a designated laboratory – this year from Iran – prepared challenging but realistic samples for other laboratories to analyze. A different designated laboratory – this year from Finland – evaluated the test reports prepared by the laboratories to validate their conclusions and recommend scoring to the Director General, who issues the official scores. Of the 16 labs participating this year, ECBC was among only four labs that earned an "A" grade, two of which received the automatic grade for preparing and scoring samples; two labs received a "B"; four received a "C"; four received a "D"; and two labs were trial participants, working toward designation.

# R&T in the News

ECBC R&T has been featured in many media outlets this quarter. Here is a sampling of where your stories have been published:

**Topic: U.S. Army Air-Conditioned Head Gear**

- **Fox News (15 May 2014 )**
  http://www.foxnews.com/tech/2014/05/15/us-army-air-conditioned-helmet-helps-soldiers-keep-their-cool/
- **The Washington Times (15 May 2014)**
  http://www.washingtontimes.com/news/2014/may/15/cooler-heads-prevail-us-army-developing-air-condit/
- **Businessweek.com (13 May 2014)**
  http://www.businessweek.com/articles/2014-05-13/u-dot-s-dot-armys-creepy-sci-fi-helmets-come-with-built-in-a-c

**Topic: JUPITR Program**

- **Fox News (15 May 2014)**
  http://www.foxnews.com/health/2014/05/14/us-seoul-health-experts-team-up-to-contain-north-korean-pandemic-risk/?intcmp=latestnews

**Topic: Detection Connection**

- **FLC Mid-Atlantic Region**
  http://www.flcmidatlantic.org/news-letter/2014/spring/single.php?id=3

**Topic: Smoke Screen Composites**

- **R&D (22 May 2014)**
  http://www.rdmag.com news/2014/05/army-develops-smoke-screens-future-battles

**Topic: Surface Science Instrument**

- **Virginia Tech (30 June 2014)**
  http://www.vtnews.vt.edu/articles/2014/06/063014-science-surfaceagents.html

**Topic: Mass Spectrometry Proteomics Method**

- **Army Times (8 July 2014)**
  http://www.armytimes.com/article/20140708/NEWS/307080058/Latest-food-safety-effort-starts-mashed-potatoes

# Chemical and Biological Defense Program Remembers a Friend

ECBC, the Joint Program Executive Office for Chemical and Biological Defense (JPEO CBD) and the Defense Threat Reduction Agency (DTRA) came together on 16 June to remember Dr. Ngai Wong. Dr. Wong was a senior physical scientist with DTRA. He spent 20 years working in the Chemical and Biological defense community. Dr. Wong was instrumental in standing up the mandated Joint Science and Technology Panel for CB defense (not DTRA JSTO). He was known as the "corporate knowledge archive" in CB research, development, test and evaluation. To honor him, the organizations planted a Red Maple Tree at the Dr. Billy Richardson Center for CBRNE Excellence. The Red Maple tree symbolizes Dr. Wong's bright, stand-out personality that will be missed.

# Patents

ECBC personnel are identified in CAPS. Parentheses indicates a contractor to ECBC.

- **Nanotubular Titania For Decontamination of Chemical Warfare Agents and Toxic Industrial Chemicals**
  *Inventors: GEORGE WAGNER, YUE WU, ALFRED KLEINHAMMES*
  Provides an effective sorbent for surface decontamination of CWAs and TICs while minimizing creation of secondary hazards during decon process.
- **Zirconium Hydroxide For Decontaminating Toxic Agents**
  *Inventors: GREGORY PETERSON, JOSEPH ROSSIN, GEORGE WAGNER*
  Provides an effective sorbent for surface decontamination which exhibits higher effectiveness and rapidity than other decontamination methods against certain CWAs.
- **Light-Emitting Element Based on Laser Carbonized Polymer Substrate**
  *Inventors: JOHN INGRAM, AUGUSTUS FOUNTAIN, THOMAS SPUDICH*
  Provides a durable, low power infrared emitter with potential use in a variety of military and law enforcement applications, such as ordnance targeting.
- **Vapor Sampling Adapter for Direct Analysis In Real Time Mass Spectroscopy**
  *Inventors: (John Nilles), (Theresa Connell), H. DUPONT DURST*
  Provides a means to utilize more precise and reliable equipment such as DART-MS during surface scans of contaminated areas in order to better assess, decontaminate, and verify decontamination of areas prior to reoccupation.
- **Molecularly Imprinted Polymer-Denuder Based Sensors**
  *Inventors: LEONARD BUETTNER, (Amanda Jenkins)*
  Provides an alternative method and apparatus for sensing of chemical and biological agent solutions, gases, aerosols, and vapors.
- **Glovebox Air Intake Emergency Safety Shutoff**
  *Inventors: GEORGE NOYA, LUIS FAURE*
  Provides a means to shutoff a glovebox containment volume in the event of power failure or exhaust blower malfunction, increasing safety of glovebox operators.
- **Synthesis of Intermediate Anilino Methyl Esters Used In the Production of Synthetic Opioid Analgesics**
  *Inventors: ANDREW WALZ, FU-LIAN HSU*
  Provides means to improve synthesis of certain analgesics and their intermediates.



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