# The R&T CONNECTION

*A Publication of the Research & Technology Directorate*

**Spring 2014**


## DIRECTOR'S NOTE: THE PURSUIT OF INNOVATION

Earlier in 2014, I hosted a Town Hall about the importance of innovation in our line of work here at Edgewood Chemical Biological Center (ECBC). We research and develop solutions to potential chemical and biological threats. That act alone requires us to think outside of the realm of what we're used to, infuse a bit of creativity and consider the possibilities.

Now, as Secretary of Defense Chuck Hagel proposes his Department of Defense (DOD) budget for FY15, I think the importance of innovation –working together to anticipate chemical and biological defense needs, creating new Chemical and Biological defense solutions and continuing to develop multiple uses of some of our products and equipment – is becoming even clearer.

The work we do at ECBC is an integral part of the DOD's refined focus on developing Army technologies. Every day, we research some of the world's most dangerous chemical and biological threats in order to create solutions that ensure the survivability of our warfighters and national security. Every day, we perfect and develop novel testing methods and equipment necessary for warfighter and homeland safety.

Every day we position the nation to be stronger and more aware, through our commitment to developing superior defense technologies.

It is half way through FY14, and so far this year we have seen the Field Deployable Hydrolysis System set sail on the Cape Ray to destroy Syria's chemical stockpile, the Joint United States Forces Korea Portal and Integrated Threat Recognition Advanced Technology Demonstration (JUPITR ATD) continue to revolutionize biological surveillance in the Asia-Pacific region, a new seminar series spark dialogue between ECBC and the Navy Research Laboratory, as well as countless other examples of ECBC entrepreneurship leaving an impact. We were fortunate enough to continue our Section 219 Innovative Project Proposals program and begin a brand new effort, the Grand Challenge program. Both of these programs give our engineers and scientists internal funding to develop their high-potential CB defense ideas into full projects.

I am incredibly proud of the work we are doing and what is to come from the Center. I thank you all for your dedication and encourage you to keep working hard, and keep thinking about the possibilities. The safety of our loved ones and our nation depends on it.

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

ECBC's Fred Berg, Ph.D. accepts USDA's Secretary Honor Award on behalf of ECBC. Pictured above (left to right) Tom Vilsack, US Secretary of Agriculture, Berg, and Krysta Harden, Assistant Secretary of Agriculture.

### ECBC researchers earn top honors for mission-critical food inspection efforts: Cross-directorate team awarded USDA Secretary's Honor Award

A team of researchers from the U.S. Army Edgewood Chemical Biological Center (ECBC) received the United States Department of Agriculture (USDA) Secretary's Honor Award at the 65th Annual Secretary Honor Awards Ceremony. The team was recognized for partnering with the USDA to conduct critical chemical threat agent research to ensure that the Nation's food supply is safe and reliable.

Led by principal investigators Dr. Sue Bae and Dr. Mark Winemiller of the Agent Chemistry Branch, the ECBC team made significant contributions to meeting a USDA goal to Protect Public Health by Ensuring Food is Safe. In order to protect public health and ensure food safety, USDA must be able to identify and ensure it can respond to new and emerging sources of food contamination.

*continues on page 12*

## IN THIS ISSUE

Director's note **page 1**

ECBC researchers earn top honors for mission-critical food inspection efforts: Cross-directorate team awarded USDA Secretary's Honor Award **page 1**

A tip from the ECBC customer goal
Five Ways to Lose a Customer **page 2**

ECBC repurposes printer to accurately deposit chemical, explosive test material **page 3**

Projecting the transparent future: ECBC Partners with MIT, Harvard to develop innovative display paper **page 4**

Choosing wisely: ECBC and PHC analyze the presence of biological agent in mashed potatoes **page 5**

Detection connection: Partnerships, innovation help develop Army-specific CB smartphone detector **page 6**

JUPITR program takes shape on the Korean peninsula **page 8**

Announcement: Section 219 innovative project proposals selected **page 10**

Technical Reports **page 12**

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# A TIP FROM THE ECBC CUSTOMER GOAL

## Five Ways to Lose a Customer

Want to lose your customer? Deliver a bad customer service experience. And it doesn't really have to be that bad. Sure, if it's flat out abysmally terrible customer service you'll most likely lose the customer, but sometimes it's much less obvious. It can be an attitude of indifference. Here are five ways that are guaranteed to make your customers question if they made a good decision to do business with you.

1. **Don't acknowledge the customer.** Give credit where credit is due and acknowledge the input of your customer, no matter how miniscule their contribution may seem. Many of our customers provide the financial backing to support our research; without them we would not exist. Make sure you acknowledge your customer when briefing your research, on presentation material, and on deliverables you prepare. This makes the customer feel as if they are part of the team; which they are. If we fail to acknowledge our customers, they may take their business elsewhere.

2. **Don't care about the customer.** There's an expression that is attributed to John Maxwell that says, "People don't care how much you know until they know how much you care." If there is one important part of customer service, it is that you care – and the customer knows it. Apathy kills the relationship and true caring and concern for the customer trumps all.

3. **Don't listen to the customer.** Customers want to be heard, and equally as important, understood. It's one thing to make an error on an invoice. It may irritate the customer a bit to have to call and spend time getting it resolved. But if you have a problem that is due to a breakdown in communication, well that is the worst Moment of Misery you can have with your customer. The customer will say, "I don't like doing business with them. They just don't listen and understand me."

4. **Don't respond to the customer.** It is so frustrating to leave a message on the phone, send an email or a Tweet, and get no response. A bad customer service situation gets worse when the company doesn't respond to the complaint or problem.

5. **Don't appreciate the customer.** A fundamental need of most, if not all people is to feel appreciated. Customers want to be appreciated for sending their scarce resources to your place of business. So, let your customers know you appreciate them by providing the best service possible.

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

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## ECBC repurposes printer to

# ACCURATELY DEPOSIT CHEMICAL, EXPLOSIVE TEST MATERIAL

**A refined inkjet printer model provides a new methodology for depositing chemical or explosive material on surfaces.**

Scientists from the U.S. Army Edgewood Chemical Biological Center (ECBC) have redesigned a standard inkjet printer to be able to deposit precise amounts of chemical and explosive testing material on any surface, allowing for better testing calibration standards. To determine threshold sensitivity of systems which detect chemical, biological, and explosives materials, precise accurate quantities must be deposited without any additional interference. The refined inkjet printer model provides a new methodology for quantitatively depositing chemical or explosive materials on surfaces.

This new technique allows scientists and industry for the first time to accurately assess detection limits of potential chembio detection systems at proximal and standoff ranges. Previous testing methods required using a "drop and dry" methodology where the sample would be deposited from a pipette onto the desired surface and allowed to dry in the ambient atmosphere. This method made it difficult for scientists to control the mass, distribution of particles, shape, area, etc. of the sample, which in turn lead to potentially inaccurate quantitative and qualitative results for systems being assessed in the field.

To ensure accurate material deposition, ECBC has led an interagency working group to develop an on-demand inkjet printing and aerosol sprayer method that allows precise control of droplet volume, droplet size and dots-per-inch. Raphael Moon and Jason Guicheteau of ECBC along with Ashish Tripathi (Leidos), worked with Hung Technology Solutions LLC and Green Technologies Solutions LLC to develop inkjet printing and aerosol sprayer methodology to transfer samples to surfaces. Their research was funded under Army Technical Objective R.FP.2010.01 "Detection of Unknown Bulk Explosives."

"We knew testing in the field had an issue of accurately presenting standoff targets to systems," said Moon. "So we wanted to come up with a better method to benefit all types of potential sensors that would be quantitatively accurate with minimal statistical error. In doing so, we can now evaluate standoff surface detectors more precisely to determine low limits of detection, which is something that we could not do before."

A modified Direct Jet 1309 flat bed inkjet printer is used to deposit various chemicals on surfaces such as bare aluminum, Teflon, painted aluminum car panels, microscope slides, and others. Concentrations from 1 µg/cm² to150 µg/cm² are deposited in a single pass with increased amounts using multiple coatings. The maximum substrate size of the printer is 13"× 9"× 2," with maximum substrate weight 10 pound, resolution range from 720 dpi to 5760 dpi, droplet size from 1.5 to 21 picoliters, and the print head hole diameter is approximately 23 microns.

For larger concentration samples between the 150 µg/cm² to 2000 µg/cm² range, the team developed an aerosol spray deposition method. This method incorporates accelerated droplet evaporation to uniformly deposit the sample. A stationary airbrush spray in conjunction with a two-axis stage is used to generate an aerosol plume. The aerosol plume is deposited on the sample surface and is rapidly dried to prevent a "coffee-ring" effect. The process results in evenly distributed solid sample residue on the surface. The aerosol sprayer prints directly on concrete, metal, glass, plastic, and other surfaces. Its maximum substrate size, 13"× 13"× 5," with maximum substrate weight 50 pounds, and contains two-axes movement with 10" of travel per axis.

*continued on page 11*

PHOTO COURTESY OF MIT NEWS

# PROJECTING THE TRANSPARENT FUTURE

## ECBC Partners with MIT, Harvard to develop innovative display paper

**Silver nanoparticles embedded on display paper allow for images to be projected on transparent surfaces. This method also allows for a wider viewing angle and the ability to scale the materials onto large display areas.**

An Air Force pilot follows a map projected on his aircraft's cockpit windshield to safely navigate to a location. Warfighters in the field display vital information on an armored vehicle window. Even a company can utilize the window space on skyscrapers or subway trains to advertise a new product. All of these scenarios are on their way to becoming real-life situations due to a research collaboration between the U.S. Army Edgewood Chemical Biological Center (ECBC), the Massachusetts Institute of Technology's Institute for Soldier Nanotechnologies (MIT-ISN), and the Harvard University Department of Physics. The collaboration led to the development of a novel transparent display technology.

Through ECBC's In-House Laboratory Independent Research program, ECBC researchers are able to collaborate with the MIT-ISN on various projects. One of those projects is to explore how particles scatter and absorb light efficiently. Work like this is especially important in the development of Warfighter obscurants, which utilize particles to absorb or scatter light in order to block a warfighters' visibility over several bands of light. As the team researched the use of nanoparticles in obscurants, Marin Soljacic, a physics professor at MIT and leader of the team, had the idea of putting this technology to use in a different setting.

"The work on nanoparticles in the obscurants project is closely related to the development of this transparent display technology," said Brendan DeLacy, an ECBC researcher in the Toxicology and Obscurants Division. "In our obscurants project, MIT provides computational models that predict the optimum size and shape of nanoparticles that are required to absorb and scatter light. ECBC is responsible for creating the particles that are predicted by those models."

Typically, when an image is projected onto a transparent material such as glass, it simply goes through the glass and the image cannot be viewed. By coating the glass with a polymer containing silver nanoparticles with the appropriate size, images can be reflected back and viewed as it if were on a screen. Additionally, the transparency of the glass is still retained. Advantages of this technology also include a wide viewing angle and the ability to scale the materials onto large display areas.

Each of the silver nanoparticles used in this technology is designed to scatter or reflect one color while rejecting the rest. In the current technology, blue light was successfully displayed, but researchers are working to be able to display red and green colors in the future. In order to create the additional colors, researchers will need to control the size and shapes of the nanoparticles. Each observable color is actually scattered light from a nanoparticle with a specific shape, size, and composition. Currently, a silver particle is used for scattering and imaging blue light. In order to simultaneously scatter red, green, and blue light, DeLacy said, researchers have one of two options: they can use three different nanoparticles for scattering red, green and blue, or they can create a clever particle with the correct properties that can display all three of the colors.

"The best part about this technology is how inexpensive it is. It costs much less than the other transparent display technologies and it can be coated onto virtually any material that is transparent," DeLacy said. "It's such a great opportunity to be able to work with MIT and Harvard to develop this type of technology that could make an impact across so many different disciplines."

While the team is working on the next step in evolving the transparent display technology, their research was recently described in the paper, "Transparent Displays Enabled by Resonant Nanoparticle Scattering," which was published in *Nature Communications*.

MIT-ISN serves as one of the U.S. Army's University Affiliated Research Centers (UARC). This status means that the Army funds these university centers to research and develop new technology for them. The research for this project was funded by the U.S. Army Research Office and by the National Science Foundation.



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PHOTO ILLUSTRATION COURTESY OF JASON WOJCIK, GRAPHIC DESIGNER

# CHOOSING WISELY

## ECBC and PHC analyze the presence of biological agent in mashed potatoes

ECBC used the Mass Spectrometry Proteomics Method to correctly identify the presence of salmonella in 150 mashed potato samples. The team will now analyze the presence of toxins in the same food.

According to the Centers for Disease Control and Prevention (CDC) estimations, 1 in 6 Americans (roughly 48 million people) get sick, 128,000 are hospitalized, and 3,000 die of food borne diseases annually. For men and women in the U.S. Army who are exposed to countless threats and unpredictable conditions, these numbers could dramatically increase. That is why one of the U.S. Army Public Health Command's key missions is to ensure the safety of food and water for the U.S. Army. PHC recently completed a successful project with the Edgewood Chemical Biological Center (ECBC) to demonstrate the use of a Mass Spectrometry Proteomics Method (MSPM) to identify and classify bacterial pathogens in food.

Scientists at the US Army PHC Region South, Food and Diagnostic Laboratory (FADL) which is located in San Antonio, Texas, sent 150 blind samples of mashed potatoes to ECBC for testing. Within these samples, 75 of them were spiked with Salmonella. ECBC utilized the MSPM to identify and differentiate which samples contained the bacterium and which did not. Using the MSPM, ECBC scientists Rabih Jabbour, Ph.D, Samir Deshpande, Ph.D, and Pat McCubbin, all of ECBC's Point Detection Branch, were able to correctly identify all of the 150 samples and distinguish the contaminated samples from the non-contaminated ones.

This successful outcome has led to two significant next steps in the development of this technology for food detection. First, PHC has funded the team to expand their work to detect toxins in mashed potato samples, a project currently underway. Second, the team will be transitioning the MSPM equipment to a PHC laboratory in Camp Zama, Japan to support the ECBC and Joint Program Manager for Chemical and Biological Defense Joint United States Forces Korea Portal and Integrated Threat Recognition program (JUPITR ATD).

"The team had not undertaken a study with a sample set quite this large before," said Mary Wade, Ph.D, ECBC Point Detection Branch Chief. "We have received and analyzed blind samples from outside organizations, but not 150 samples at once. This program was a great validation for robustness and capabilities of the MSPM."

MSPM is a technique that provides structured sequence information of a given protein. All proteins consist of amino acids arranged in a specific sequence; changing the arrangement generates a new protein. Mass-spectrometry interrogates digested protein fragments (peptides) and provides structural information about the exact arrangement of the peptides in the sample. Then using the detection and identification algorithm known as ABOid, the sample peptides are compared to its theoretical proteins present in the protein sequence database, which is curated from various public sequence repositories like the National Center for Biological Information (NCBI), European Molecular Biology Laboratory (EMBL), and DNA Data Bank of Japan (DDBJ), to distinguish whether bacteria, toxins, fungi or viruses are present. The MSPM and ABOid were able to both detect and identify that Salmonella was present, as well as other organisms that were present in the background matrix.

"We screened first specifically for Salmonella, and Dr. Samir Deshpande, especially spent a lot of time delving into what else we could find within those samples," Wade said.

As opposed to other detection methods, MSPM takes minutes to detect and identify

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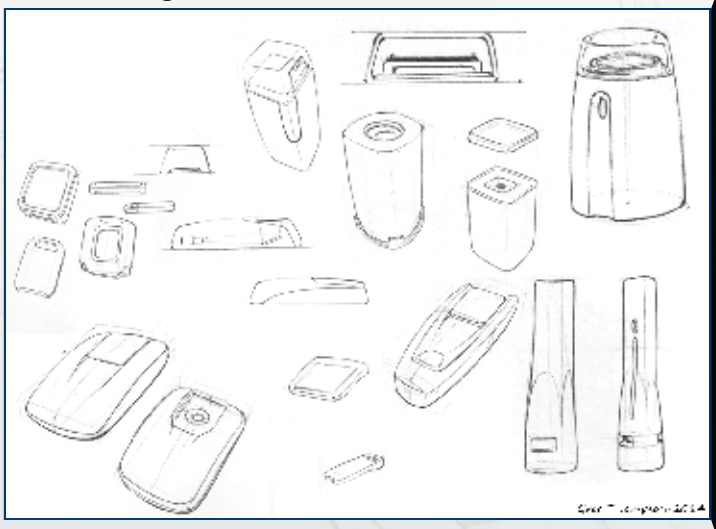
## Earliest Design Studies

- Hand drawn sketches by ECBC Industrial Designer
- Focused on user interface design and ergonomics
- Studies references
  - Water bottles
  - Soda cans
  - Flashlights
  - Smart phones
  - Condiment lids



## VOCs Box

- Reusable VOCs optics
- Single use cartridge
- Chem/Bio sampling
- Simple one-touch design (power/run)
- Small and discreet (approx 3"x3"x5" with cartridge attached)

# DETECTION CONNECTION

## Partnerships, innovation help develop Army-specific CB smartphone detector

**The chemical and biological smartphone detector will utilize CERDEC's Net Warrior System and Volatile Organic Compound strips to detect and geographically tag potential threats.**

A warfighter is performing a mission in a dangerous area where civilians are showing signs of a possible chemical or biological agent exposure. Without the luxury of a full laboratory at his fingertips, it would be difficult for him to investigate the situation right then and there, prolonging any type of additional effort, possibly putting his life and the civilians' lives in jeopardy. Thanks to the strong partnership between scientists and engineers at U.S. Army Edgewood Chemical Biological Center (ECBC), iSense, LLC., U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC) and the Defense Threat Reduction Agency (DTRA), this dangerous scenario would not occur. ECBC, iSense, CERDEC and DTRA are working together to give warfighters a quick, new way to evaluate potential CB threats using smartphones and an encrypted network within minutes.

The program first began when ECBC researchers were awarded $27,000 through ECBC's Innovative Projects Proposal Program, an internal program that funds innovative ideas generated by ECBC principal investigators, to conduct a series of tests on Volatile Organic Compound (VOC) strips. VOCs are postage stamp-sized, colorimetric sensor assays with 88 different indicator dyes developed by iSense LLC (Boston, MA). The project set out to explore VOC's potential for detection, presumptive identification or chemical dosimetry. After a successful testing period, ECBC established a cooperative research and development agreement (CRADA) with iSense LLC., to develop defense-focused VOC technology. One of these developments is the mobile CB detection program.

"The VOC strips are the core technology of this project. They are inexpensive, easy to manufacture and compare data within the library," Emanuel said.

If a warfighter is in a potentially dangerous area, he could investigate the situation by gathering an environmental (such as soil) or biomedical (such as urine) sample and place it on a VOC strip. Then the strip is loaded on a device called the Biotouch. From there, the warfighter can leave the potentially contaminated area for a safer spot and receive the test results on a separate device called the Nett Warrior phone, through a secure and encrypted Army network. Results from the VOC will be geographically tagged (geo-tagged) and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## VOCs Reader App

- Connects wirelessly to VOCs Reader
- Connect to multiple VOCs devices
- On board Chem/Bio analysis
- Archived tests and Metadata
- DoD IA compliant

added to a secure cloud system. Both the Biotouch and Nett Warrior phones are rugged enough for use in-theater, but light enough for easy transport.

The Biotouch is a 3"x3"x5" discreet object that can fit into a pocket. It's design was modeled after small objects such as condiment lids and flashlights.

"The idea is to have two smartphones: the Biotouch that could test the VOC and the Nett Warrior phone that would receive the information from a different location. The two will be able to communicate with each other through a phone portal within the encrypted network," explained Emanuel.

The Nett Warrior phone is a Military-adapted version of the commercially available Samsung GALAXY Note II.

CERDEC has worked extensively with the Nett Warrior phone over the past year under their Research and Development Mission program called Multi Access Cellular Extension. CERDEC is developing the interface for the Nett Warrior to communicate and obtain readings from the Biotouch. ECBC engineers are using their in-house industrial 3-dimensional printing capability to develop the Biotouch colorimetric assay reader. The construct of the two phones will allow for easy software updates. The Biotouch is a static device with proven technology while the Nett Warrior phone would evolve with technical advances.

Other styles of mobile detectors allow smartphones to double as microscopes and hand-held assay (HHA) readers, but there were several challenges. When ECBC initially tested these methods during demonstrations, Warfighters commented that this style was not suitable for Army use. In this style, users attached an external reader to their phone and then placed the assay on the reader and read the results right there on the mobile device, many times civilian phones that were not rugged enough for in-theater use. Also, a typical civilian cellular network is not compliant with Army networks; geo-tagged information was unprotected. Finally, the all-in-one style reader required the user to be near the sample the entire time –a practice that has potential to be dangerous. The new Army-compliant system addresses these issues.

Emanuel said that the mobile detector program is a great example of how different organizations can come together to create impactful solutions. CERDEC representatives agree.

"This is the first time our group has collaborated with ECBC. The experience has been great so far and relationships with other ECBC groups are being fostered as a result of this partnership as well," said Marianne Lazzaro, Acting Branch Chief of CERDEC's Commercial Technology Integration & Evaluation Branch. The Commercial Technology Integration and Evaluation Branch supports multiple projects with their smartphone and cellular applications, and oversees multiple R&D programs that bring commercial mobile technologies to the battlefield.

Prototypes of the CB mobile detection system will be completed in May 2014 for use in two projects, the Joint United States Forces Korea (USFK) Portal and Integrated Threat Recognition advanced technology demonstration (JUPITR ATD) and in a medical countermeasures project with Telemedicine & Advanced Technology Research Center (TATRC).

JUPITR ATD is a program led by the Joint Program Executive Office for Chemical and Biological Defense (JPEO-CBD) and supported by ECBC, which will provide unique biological detection capabilities to address the demand for stronger biosurveillance capabilities on the Korean Peninsula. The prototypes will be used in the Republic of Korea to capture air samples and be tested as viable biological detectors for the program. TATRC will use the devices to read and analyze commercial off-the-shelf assays that can then be sent to networks used in military hospitals and possibly civilian hospitals as well. The goal is also for this data to be free of personally identifiable information.

"I am very excited to be collaborating with new people from across RDECOM on this project," said Jeff Warwick, ECBC Conceptual Modeling and Animation Branch Chief and lead engineer on the mobile technologies project. "It's especially great to be able to work with TATRC, which is a new organization to us."

Emanuel envisions that this new Army-compliant mobile CB detector capability could be applicable to organizations outside of the Department of Defense, including civilian hospitals, Customs and Border Protection and the Food and Drug Administration.

"Imagine a cargo of bananas arrives into an American port. To ensure optimal safety of the shipment, a Biotouch is placed in the box to collect some samples. All an inspector has to do is monitor the results coming into the reader to ensure that the cargo is safe from harmful CB agent," Emanuel said. "That's just one example that could have a big impact. There are so many more possibilities for this type of technology, and I'm glad that we're building it for the Army."

*MICHELLE ZIEMSKI (ECBC), MIKE KREPPS (ECBC), JULIE RENNER (ECBC), CHIEF WARRANT OFFICE 2 LEANNA LESTER (USFK), AND CAPTAIN AMANDA GERBOTH (USFK).*

# JUPITR PROGRAM TAKES SHAPE ON THE KOREAN PENINSULA

**Since October 2013, several ECBC scientists have traveled to the Republic of Korea to work alongside to support the JUPITR ATD project. The traveling scientists have been helping the USFK achieve stronger biosurveillance capabilities.** *PICTURED ABOVE: MICHELLE ZIEMSKI (ECBC), MIKE KREPPS (ECBC), JULIE RENNER (ECBC), CHIEF WARRANT OFFICE 2 LEANNA LESTER (USFK), AND CAPTAIN AMANDA GERBOTH (USFK).*

The Joint United States Forces Korea (USFK) Portal and Integrated Threat Recognition advanced technology demonstration (JUPITR ATD) – is underway and already making a huge difference to the Korean Peninsula. JUPITR, a program led by the Joint Program Executive Office for Chemical and Biological Defense (JPEO-CBD) and supported by the U.S. Army Edgewood Chemical Biological Center, will provide unique biological detection capabilities that will address the demand for stronger biosurveillance capabilities on the Korean Peninsula.

JUPITR supports the Homeland Security Presidential Directive-21, which is a policy stating that biological threats could take many forms, including naturally occurring disease outbreaks. This policy led to the National Strategy for Countering Biological Threats in 2009 which recognized that an outbreak of disease could impact national security just as much as an overt attack on US forces. In 2012, the first ever National Strategy for Biosurveillance was established with the goal, "to achieve a well-integrated national biosurveillance enterprise that saves lives by providing essential information for better decision making at all levels." The JUPITR program introduces new instrumentation that increases speed and ease of biosurveillance equipment for the USFK. The instrumentation also comes at lower cost, less training and burden to the soldier with higher performance results. JUPITR's presence on the Korean Peninsula aligns with the Joint Force's strategy to rebalance military efforts toward the Asia-Pacific region.

"Our long standing commitment to the security of South Korea and the Department of Defense Pivot to the Pacific" made the choice of basing the JUPITR ATD within the Republic of Korea a straight forward selection," said Peter Emanuel, Ph.D, JUPITR ATD Team Lead and ECBC Biosciences Division Chief.

As a part of the program, researchers from ECBC and JPEO-CBD will be traveling to South Korea on short-term rotations. The first rotation started in summer 2013 and will continue for the next two years. In these rotations, the ECBC/JPEO-CBD representatives help the USFK build advanced laboratory capabilities in-house, and personally train and demonstrate the JUPITR instrumentation.



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"This in-person JUPITR method is innovative," said James Wright, a biologist in ECBC's BioScience's Division and among one of the first researchers to travel to South Korea. "It allows us to acquire the results quickly, get direct feedback from the soldiers and efficiently see our results first hand. It's very exciting and a great developmental assignment for us to participate in as laboratory scientists."

So far, the groups have worked directly with the 121st Medical Group, the 106th Veterinary Support and the 51st Air Force Medical Group in South Korea. ECBC/JPEO representatives were able to provide USFK with new capabilities that enhance the efficiency and functionality of their labs. For example, new equipment such as the BioFire Film Array, can run Dry Filter Unit (DFU) samples in five to six hours compared to the current system which would run samples in a couple days.

ECBC training team, was able to teach a course about basic Chemical and Biological defense to USFK personnel during his time in South Korea.

"I taught a course for 18 soldiers. While they were familiar with the Army, they didn't know too much about the chemical and biological defense program and the work we were doing, so I had the opportunity to give them a crash course that they found very rewarding," Thermos said.

JUPITR combines advanced communications with cutting-edge detection capabilities to design a program that will bring rapid and efficient biosurveillance. The program is comprised of four "legs" that work simultaneously to achieve JUPITR's goal. The first leg is an information portal that is similar to a health surveillance web management tool. This portal will house a library of identified biological substances in a cloud library that authorized personnel can access.

"Our long-standing commitment to the security of the Republic of Korea and the DoD's 'Pivot the Pacific' made the choice of basing the JUPITR ATD within the Republic of Korea a straight forward decision"

– Peter Emanuel, Ph.D JUPITR Program Manager

Specifically, the ECBC/JPEO-CBD representatives are helping to certify the 106th Food Safety Laboratory in South Korea with a BioSafety Level 2 (BSL 2) laboratory standard in Youngsan AG. This certification will allow this lab to safely receive and analyze real-world contaminated samples. The traveling group started their work by demonstrating the power of the BioFire Film Array, the IQUUM Liat and the 3M Focus, all of which are new biosurveillance analysis instruments.

This level of interaction with the end-users in South Korea ensures that ECBC and JPEO can gain rapid feedback, make quick adjustments and ensure that the biosurveillance equipment functions properly in the South Korean environment. ECBC/JPEO-CBD representatives are also able to train one-on-one and build important relationships with the USFK.

Julie Renner, a toxicologist from ECBC has already completed two rotations in South Korea. When Renner saw how JUPITR's instruments could obtain results faster than it took USFK to prepare a sample for the current equipment, she realized the true impact of JUPITR. "The imminent need for these new instruments and capabilities they offer became apparent," Renner said. "Also, in meeting with and creating a relationship between the 106th and the 501st CBRNE (chemical, biological, radiological, nuclear and explosives) Tech Escort, we were able to bridge a huge and long-overdue gap that is necessary for future exercises across the peninsula and for real-world bio-threat readiness."

The projects that ECBC/JPEO representatives led while in South Korea, range across many disciplines from instrumentation training to classroom training. Marcus Thermos, a member of the

The second leg sends ECBC researchers to South Korea to work alongside USFK representatives to improve their laboratory capabilities. This allows the USFK to conduct analysis at their own facilities rather than shipping samples back to the U.S. The third leg, called the "Shoot-Off" tests a number of biological detectors, and sends the best one to South Korea. The last leg, called Integrated Base Defense, is a large multi-functional, all seeing sensor that can rapidly design a defensive perimeter. Together, these legs form a dynamic, multifaceted program that will advance the biological detection capabilities of the Korean Peninsula.

Supporting organizations for JUPITR include the Department of Homeland Security, Office of the Assistant Secretary of Defense for Health Affairs, Health Affairs and Defense Threat Reduction Agency.

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ANNOUNCEMENT

# SECTION 219 INNOVATIVE PROJECT PROPOSALS SELECTED

Eight proposals have been selected for ECBC's Section 219 Innovative Project Proposal call, soliciting 50 proposals from across the Center. The Section 219 Innovative Project Proposal is an internal program where the Center provides funding to its researchers and engineers to develop projects that are currently unfunded by customers. The funding is made possible through the 47 United States Code, Section 219 funding that provides a mechanism for the Department of Defense laboratories to invest in infrastructure, training and research and development.

For the FY14 call, 50 proposals were submitted from across the Center and eight of them were selected. These eight projects highlighted below meet the objectives to push current chemical and biological defense technology to meet customer needs, and to expedite transitions to the Warfighter. Thanks to all who participated and congratulations to the selected proposal teams.

### Application of Comparative Secreted Metabolites of Bacillus sp.

*PIs: Rabih Jabbour (R&T), Raymond Sullivan (20th CBRNE Command)*

Next generation sequencing of biothreat agents is burgeoning, but a gap exists in knowing the genotype-phenotype relationship. Our studies may lead to new understanding of the bacterium's ecological niche as well as the discovery of new natural products useful in their own context. This effort will involve collaboration with 20th CBRNE and Public Health Commands, who are interested in outcomes of such work for their own applications. This project will study the secreted metabolites (metabolome) of Bacillus anthracis in order to identify potential biomarkers potentially leading to easier and more informative agent identification to gain insight into B. anthracis' lifestyle by discovering new, possibly novel secreted products. They serve as direct indicators of biochemical activity and therefore correlate directly with phenotype.

### Carbon Nanotube, Carbon Fiber, and Mineral Filled Polymers for Additive Manufacturing (3D Printing)

*PIs: Bradley Ruprecht (ENG), Rick Moore (ENG), and Lester Hitch (ENG)*

The proposal will explore the enhancement of engineering polymers used in the Fused Deposition Modeling additive manufacturing (3D Printing) process incorporating Carbon Nanotubes, Carbon Fiber, and Wollastonite. These fillers will potentially impart improved physical and mechanical properties to the polymer, opening a new realm of manufacturing possibilities using multi-material additive manufacturing.

### Development of Aerosol Matrix Assisted Ionization Mass Spectrometry (AMAIMS)

*PIs: Thomas Hughes (ENG), Rod Fry (ENG)*

Aerosol Matrix Assisted Ionization Mass Spectrometry (AMAIMS) is a new way to introduce samples into a mass spectrometer designed for use with liquid chromatography/mass spectrometry systems. In this system, samples will be collected and introduced to the mass spectrometer as an aerosol rather than in a bulk liquid. The potential advantages include higher sensitivity to target analytes and near real-time analysis of air samples. Ultimately, the system will be used to turn any mass spectrometer into a near real-time, continuous air monitor for vapor and aerosol chemical threats, as well as aerosolized biological threats.

### Evaluation of IP Filters against Challenge Profiles

*PI: Amy Maxwell (R&T)*

The Joint Project Manager-Protection and several test and evaluation agencies have expressed interest in pursuing testing filters against a challenge profile versus a constant challenge concentration. Therefore, this 219 proposal will conduct a study on M61 Joint Service General Purpose Mask prototype filters to evaluate filter performance against Sarin and Ammonia challenge profiles identified through modeling efforts done at ECBC and other government agencies. Methodology will be developed as a result of this study and shared with the Chemical and Biological Defense community.

### Integrated Respiratory and Eye Protective Scarf (IREPS)

*PI: David Caretti (R&T) Daniel Barker (R&T) Jason Adamek (ENG) Gregory Peterson (R&T)*

Beard growth is commonplace among select warfighter groups so they can blend in with indigenous populations and be as inconspicuous as possible. Since facial hair negatively impacts protective capabilities of respirators, the ability of available devices to protect those with beard growth is compromised. This project aims to develop a respiratory and eye protective scarf that integrates with head borne equipment and can be readily used by bearded warfighters for protection from nuisance particulate matter, riot control agents, and certain low-level chemical vapor threats for short duration missions.

### Non-Pyrotechnic, Non-Explosive, Non-lethal Riot Control Disseminator

*PI: Elias W. Yoon (R&T)*

Current U.S. inventories of non-lethal teargas (CS) munitions (M7A3) rely on pyrotechnics for dissemination. A recent ECBC study of commercial items both pyrotechnic and non-pyrotechnic, showed a lack of overall performance when compared to the M7A3. The U.S. Army Military Police and the U.S. Air Force Security Forces have expressed interest in a non-pyrotechnic, non-explosive CS dissemination device that reduces the risk of fire and shrapnel injury, and can be handled and stored as a non-munition. This Section 219 proposal will address this need by investigating several non-pyrotechnic, non-explosive disseminator concepts. The deliverable will be the development of a prototype design to demonstrate feasibility with the goal of meeting the yield performance of the M7A3.



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*continued from page 3*

## ECBC Repurposes printer to accurately deposit chemical, explosive test material

"A controlled amount of sample can give you controlled results, and that is what the government wants when evaluating new technologies," Moon said. "Accurate testing is the most important to determine how well these instruments can actually perform and can ensure that they are effective."

Moon said that the ECBC Laser Spectrometry Branch has been using the inkjet and aerosol sprayer method for all of their testing. "For quality control, we send test samples from each run of printed substrates to John Tokarz and Joy Ginter at the ECBC Forensic Analytical Center to perform quantitative analyses. To date results consistently showed that the printer produced uniform distributions as well as quantitatively accurate samples within seven percent of the predicted amount. Through these precise depositions, we are able to find sensitivities, identify low limits of detection levels and ultimately improve technology evaluation process on standoff surface detectors."

- **Selectable Color Single Canister Smoke Hand Grenade**
  *PI: Amee LaBonte (ENG)*
  Current smoke grenades contain a single smoke color in one of four choices (yellow, green, red, and violet). The selectable color single canister smoke hand grenade aims to provide soldiers with a single grenade capable of providing six distinct colors through the use solid state fluid logic and three separate dye chambers (yellow, red, and blue). This will drastically reduce the logistical and weight burdens imposed on the soldier by the current four grenade requirement.

- **Tac-Bio II Detector for Emerging Threats**
  *PI: Anna Wong (R&T)*
  This 219 project proposes to modify sensors from the TAC-BIO Generation 2 program to detect the fluorescence from chemicals of interest (COI) by converting the units to excite at 265 or 250 nanometers. The modified sensor will gather data during the "Dissemination Studies," in Spring 2014, to determine if a combined chemical-biological sensor is feasible.

*continued from page 5*

## Choosing Wisely: ECBC and PHC analyze the presence of biological agent in mashed potatoes

rather than days, which is an important function in food detection. Other than its current validation in food, the MSPM has been successful with detecting viruses, toxins and bacteria in buffers, microbial media as well as more complex environmental and medical matrices such as water, air, soil and blood.

With identifying Salmonella in mashed potatoes as a starting point, PHC is now funding the Point Detection Branch to use MSPM to identify toxins, specifically Botulinum Toxin, in mashed potato samples. Wade said once the team can successfully validate toxin detection in mashed potatoes, she would like them to begin testing samples of more complex foods such as milk or peanut butter, which has higher fat and protein contents, and meats or sandwiches which are not uniform. At the moment, mashed potatoes are being used as a proof concept.

"Mashed potatoes are the commonly used food type for evaluating a diagnostic technique for identifying pathogens in food," said Wade. "It is a starch-based consistent food type that is best for proof-of-concept experiments as the target and the mashed potatoes can be easily homogenized for equal distribution throughout the sample."

In addition to expanding the type of testing, Wade said the team is excited to demonstrate how Mass Spectrometry can support the JUPITR ATD Program. The JUPITR ATD program is a multi-year program geared toward providing biological surveillance capabilities to the Asia-Pacific region. The team will be showing PHC personnel in Camp Zama, Japan how the system works and helping their laboratories get their own system up and running for use in that region of the world. The team will demonstrate how Mass Spectrometry can identify biological pathogens through doing the same blind test with mashed potatoes. Additionally, the team will also demonstrate how Mass Spectrometry can be used to prove false positive results from hand held assays.

Although current MSPM food application testing is with the US Army, the method could easily transition to civilian applications by organizations such as the Centers for Disease Control, the Food and Drug Administration or the U.S. Department of Agriculture.

The Point Detection Branch plans to publish their findings from the Salmonella blind test in an upcoming Technical Report and peer-review journal publication, both currently being drafted. They expect to be completed with the blind toxin testing in September 2014 and plan to publish those results as well.

*Visit the ECBC public website at https://www.ecbc.army.mil for more information about the people and projects of ECBC.*

*continued from page 1*

# ECBC researchers earn top honors for mission-critical food inspection efforts

## Cross-directorate team awarded USDA Secretary's Honor Award

ECBC USDA team poses with Krysta Harden, Deputy Secretary of Agriculture (front, center)

The USDA lacked the capabilities and facilities to conduct the critically needed research that would ensure its mission was accomplished. As a result, the USDA contacted ECBC, which committed to forging a partnership with the USDA. ECBC's expertise and infrastructure to work with traditional and non-traditional chemical threat agents helped USDA meet their mission-critical needs.

ECBC has also played a significant role in ensuring the USDA met its Initiative to Enhance USDA Homeland Security and Emergency Preparedness to Protect USDA Employees and the Public. In the event of an attack against the food supply, ECBC's efforts have enabled USDA to understand the concentrations of these chemical threat agents that will result in adverse health effects. This will ensure that USDA has the ability to determine what food in commerce is safe, and to make sure that safe food will continue to be supplied and available to feed Americans and the world. Through its Memorandum of Agreement (MOA) with the USDA, ECBC will continue to provide support to the USDA in the event of an intentional food contamination event involving chemical threat agents.

Thomas J. Vilsack, U.S. Secretary of Agriculture, and Deputy Secretary of Agriculture Krysta Harden, presented the award to the team at the 11 December ceremony, which was held in Washington, D.C. The Secretary's Honor Award is a prestigious honor awarded by the Secretary of Agriculture each year. The award is open to all 26 agencies of the USDA. Undersecretary for Food Safety, Dr. Elisabeth Hagen, nominated ECBC for the award.

The ECBC team supporting this effort consists of: Dr. Frederic Berg, Dr. Mark Winemiller, Dr. Sue Bae, Dr. David Tevault, Dr. Joseph Corriveau, Mr. James Manthei, Mr. Jeffry Forster, Ms. Ruth Moretz, Mr. Carl Phillips, Ms. Bernadita Gaviola, Mr. Brian MacIver, Mr. Juan Cajigas, Mr. Michael Sheely, Dr. Fu-Lian Hsu, Ms. Leslie McMahon, and Dr. Bruce King.

# Technical Reports

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

- **ECBC-TR-1140** - Class-Based Approach for Toxic Industrial Chemical Filtration by ZZAT Sorbent Media Peterson, Gregory W. (ECBC); Smith, Shirmonda; Napolitano, Amedeo; and Weller, Edward (SAIC)
- **ECBC-TR-1129** - Vapor Pressure of Bis-(2-chloroethyl)ethylamine (HN1) Williams, Barry R.; Hulet, Melissa S. (SAIC); Samuels, Alan C.; and Miles, Ronald W., Jr. (ECBC)
- **ECBC-TR-1178** - Metabolomic Analysis of the Secretome of Human Embryonic Stem Cells Following Methyl Parathion and Methyl Paraoxon Exposure, Phase II: Metabolite Downselection for Structural Confirmation, Madren-Whalley, Janna S.; Sekowski, Jennifer W. (ECBC); West, Paul R.; Donley, Elizabeth L. R.; Burrier, Robert E. (Stemina)
- **ECBC-TR-1120** - Characteristics of Anvil Insecticide Aerosols Regarding Interference with Detection and Identification of Biological Warfare Agents, Kesavan, Jana (ECBC); Pongrance, Karen; Bottiger, Jerold; Schepers, Deborah (EXCET); and McFarland, Andrew R. (A. R. McFarland)
- **ECBC-TR-1125** - Science of Decision Making: A Data-Modeling Approach Deshpande, Samir V. (STC); and Jabbour, Rabih E. (ECBC)
- **TR-1214** - (U) Characterization of Selected Microencapsulated Emerging Threat Agents, Kenneth T. Hoang, Erica R. Valdes, George Hondrogiannis, David B. Cullinan, Stanley A. Ostazeski.
- **ECBC-TR-1147** - Study of Agent-Related Mixed-Waste Decontamination Part 1: GA, GB, GD, HD, and VX with Solids/Liquid Mix Henderson, Vikki D.; Ellzy, Michael W.; O'Connor, Richard J.; Hoffland, Soren; Clayton, Stephanie; Sohrabi, Ai Khanh; Gustafson, Teresa M.; and Wolf-Pulpa, Jennifer
- **ECBC-TR-1148** - Headgear Concept Development for a Next Generation Respiratory Protection System Grove, Corey M.; Barker, Daniel J. (ECBC); Alden, Tor; Capar, Paul; and Simantiras, Stephen (HS Design)
- **ECBC-TR-1202** - Modeling for Standoff Surface Detection Moon, Raphael P.; Christesen, Steven D. (ECBC); Hung, Kevin (HTS); Corriveau, Paul (ITT); and Green, Norman (STC)
- **ECBC-TR-1218** - Hot Air Decontamination for the Removal of Chemical Warfare Agents Myers, Joseph; Willis, Matthew P.; Mantooth, Brent; and Lalain, Teri (ECBC); Ruth, Jill; and Barry, Ryan (SAIC)



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