

*The official eBook of the Defense Threat Reduction Agency's (DTRA) Chemical and Biological Technologies Department, in its role as the Joint Science and Technology Office (DTRA-JSTO)*

# INHERENTLY DISRUPTIVE.

DTRA-JSTO on the front lines of  
chemical and biological defense.

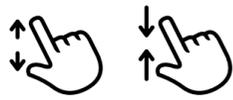
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# WELCOME

Dynamic and emerging threats present great challenges to the United States and its interests here and abroad. Our investments help protect the U.S. warfighter and enable force readiness. At the Defense Threat Reduction Agency's (DTRA) Chemical and Biological Technologies Department, in its role as the Joint Science and Technology Office (JSTO), our civilian and military workforce is focused on safeguarding our warfighters and the nation from the chemical and biological threats of today and tomorrow. We cannot afford to fail. We seek disruptive and innovative scientific and technical advances to protect the warfighter and promote growth in the country's private sector.

Due to the rapid pace of innovation, the weaponization of technology presents a greater challenge today than ever before. From synthetic biology to social media platforms, seemingly innocent tools are becoming weapons. As these new commercial technologies emerge, they will not only change society but also change the nature of war. These dynamic and evolving threats present a challenge both abroad and at home.

Our commitment is to create a world-class science and technology organization that is prepared to respond to future chemical and biological threats. As an organization dedicated to disruptive, game-changing thinking, innovation, and critical thinking, we deliver needed technological solutions.

We work closely with other U.S. government agencies to ensure that resources are used efficiently and complement the advances necessary to provide whole-of-government solutions where appropriate. We must have the best possible science and technology capabilities to protect the warfighter and the United States from threats. To do so, we must actively engage with scientific communities in industry and academia. We are committed to providing innovative solutions in support of U.S. warfighters and our nation.

**Ronald Hann, Ph.D.**

*Ronald K Hann, Jr.*

Director, Chemical and Biological Technologies Department

Director, Joint Science and Technology Office for Chemical and Biological Defense

Defense Threat Reduction Agency

THANK  
YOU.



*Photo caption: Ronald Hann, Ph.D., Director, Chemical and Biological Technologies Department and Director, Joint Science and Technology Office for Chemical and Biological Defense, addresses the audience at the Chemical and Biological Defense Science & Technology Conference in November 2019. (Photo courtesy of DTRA CB)*



**The Chemical and Biological Defense Program (CBDP) is a U.S. Department of Defense-wide effort to develop and acquire capabilities that counter weapons of mass destruction (WMD). As part of an integrated and layered defense, the capabilities are for use in missions ranging from combat operations to domestic incident prevention and response efforts supported by the Department of Defense (DoD).**

The threat posed by chemical, biological, radiological, and nuclear (CBRN) weapons is real and continues to evolve. The threats are asymmetric and more sophisticated than ever and are carried out by traditional state actors and nontraditional actors. For example, sustained use of chemical weapons in the Middle East and the increasing threat of WMD on the Korean peninsula not only illustrate the reality of threats our nation faces but also undermine the societal norms that protect civilians and security forces from WMD.

## CBDP Vision

A Joint Force ready to fight and win a chemical- or biological-contested environment through a coordinated and integrated effort that systematically neutralizes the chemical and biological threats presented by our adversaries.

## CBDP Mission

To anticipate future threats and deliver capabilities that enable the Joint Force to fight and win in chemical- or biological-contested environments.

OPTIMIZE THE  
ENTERPRISE.



**CBDP  
LINES OF  
EFFORT**

MEET CURRENT AND  
EMERGING THREATS.



STRENGTHEN  
RELATIONSHIPS.



# SCIENCE AND TECHNOLOGY INVESTMENT STRATEGIES

To render CBRN threats ineffective through knowledge and actionable, innovative technology by focusing on DoD's Lines of Effort:

“Rebuilding military readiness as we build a more lethal Joint Force; strengthening alliances as we attract new partners; and reforming the Department's business practices for greater performance and affordability.”

Excerpt is from the *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge*.



Photo caption: A U.S. Army soldier with the 863rd Engineer Battalion at the Argonne National Laboratory. (Photo courtesy of U.S. Army)



# DTRA



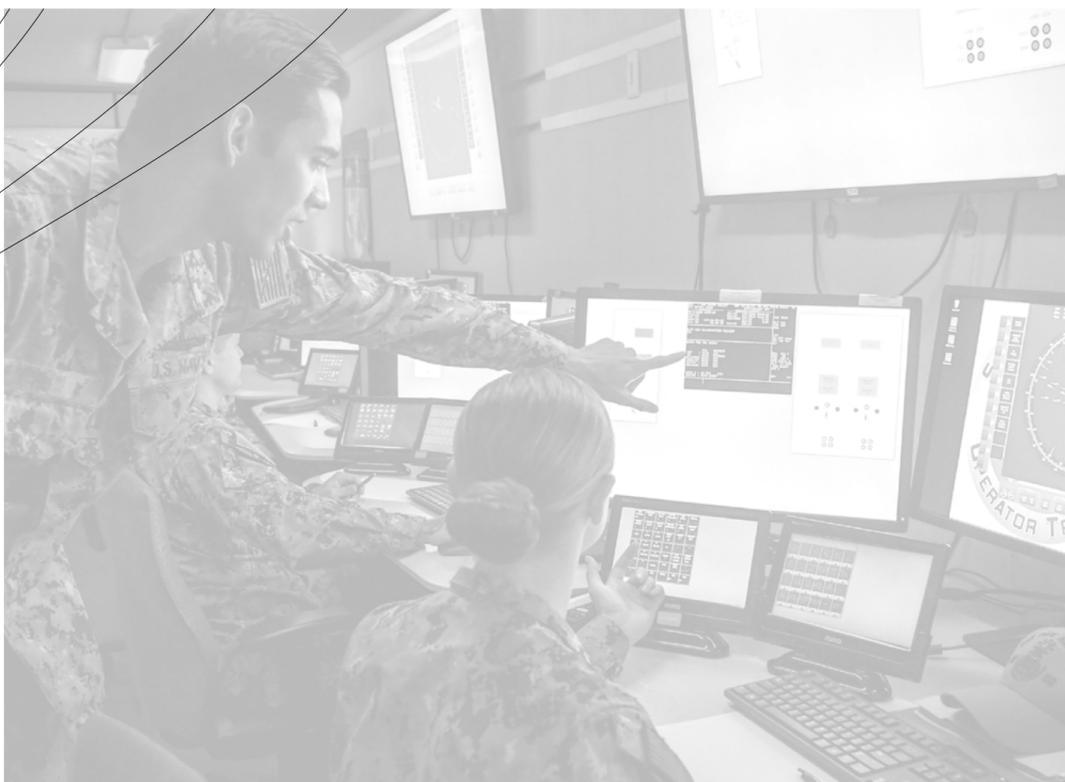
## Defense Threat Reduction Agency (DTRA)

*Detect the threats.*

*Deter the actions.*

*Defeat the enemy.*

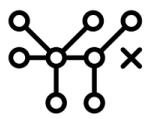
The Defense Threat Reduction Agency (DTRA) enables the DoD, the U.S. government, and international partners to counter and deter WMD and improvised threat networks.



# DTRA is a combat support agency and a defense agency with a three-pronged mission:



Counter threats posed by the full spectrum of weapons of mass destruction, including chemical, biological, radiological, nuclear, and high-yield explosives.



Counter threats posed by the growing, evolving categories of improvised threats, including improvised explosive devices, car bombs, and weaponized consumer drones, as well as the tactics, technologies, and networks that put the threats on the battlefield.



Ensure that the U.S. military maintains a safe, secure, effective, and credible deterrent for nuclear weapons.

DTRA facilitates innovation by combining traditional research with unconventional means to develop and quickly field solutions to counter the most complex, deadly, and urgent threats facing the United States and the rest of the world.



# DTRA

## DTRA Mission Directorates



### COOPERATIVE THREAT REDUCTION DIRECTORATE

The Cooperative Threat Reduction Directorate prevents the proliferation or use of WMD by working with partner nations to secure, eliminate, detect and interdict WMD-related systems and materials.



### RESEARCH AND DEVELOPMENT DIRECTORATE

The Research and Development Directorate provides science, technology, and capability development investments that maintain the U.S. military's technological superiority in countering WMD and asymmetric threats, mitigate the risks of technical surprise, and respond to the warfighter's urgent technical requirements.

### NUCLEAR ENTERPRISE DIRECTORATE

The mission of the Nuclear Enterprise Directorate is to provide capabilities that enable DoD warfighters, interagency stakeholders, allies, and partners to ensure a credible U.S. nuclear deterrent.

## **OPERATIONS AND INTEGRATION DIRECTORATE**

The Operations and Integration Directorate provides operational understanding and analytic support in order to coordinate, integrate, and synchronize agency operations, activities, and investments and their effects against National Defense Strategy threats.

## **ON-SITE INSPECTION AND BUILDING CAPACITY DIRECTORATE**

The On-Site Inspection and Building Capacity Directorate enables DoD, the U.S. government, and international partners to counter and deter WMD and improvised threat networks by conducting Arms Control Treaty Verification and Countering Weapons of Mass Destruction Building Partner Capacity Activities.

## **STRATEGIC INTEGRATION DIRECTORATE**

The Strategic Integration Directorate shapes DTRA's response to the challenges and priorities set forth in the National Defense Strategy, focusing the agency's operations, activities, and investments in a manner that maximizes their cumulative effect in support of our warfighting customers.

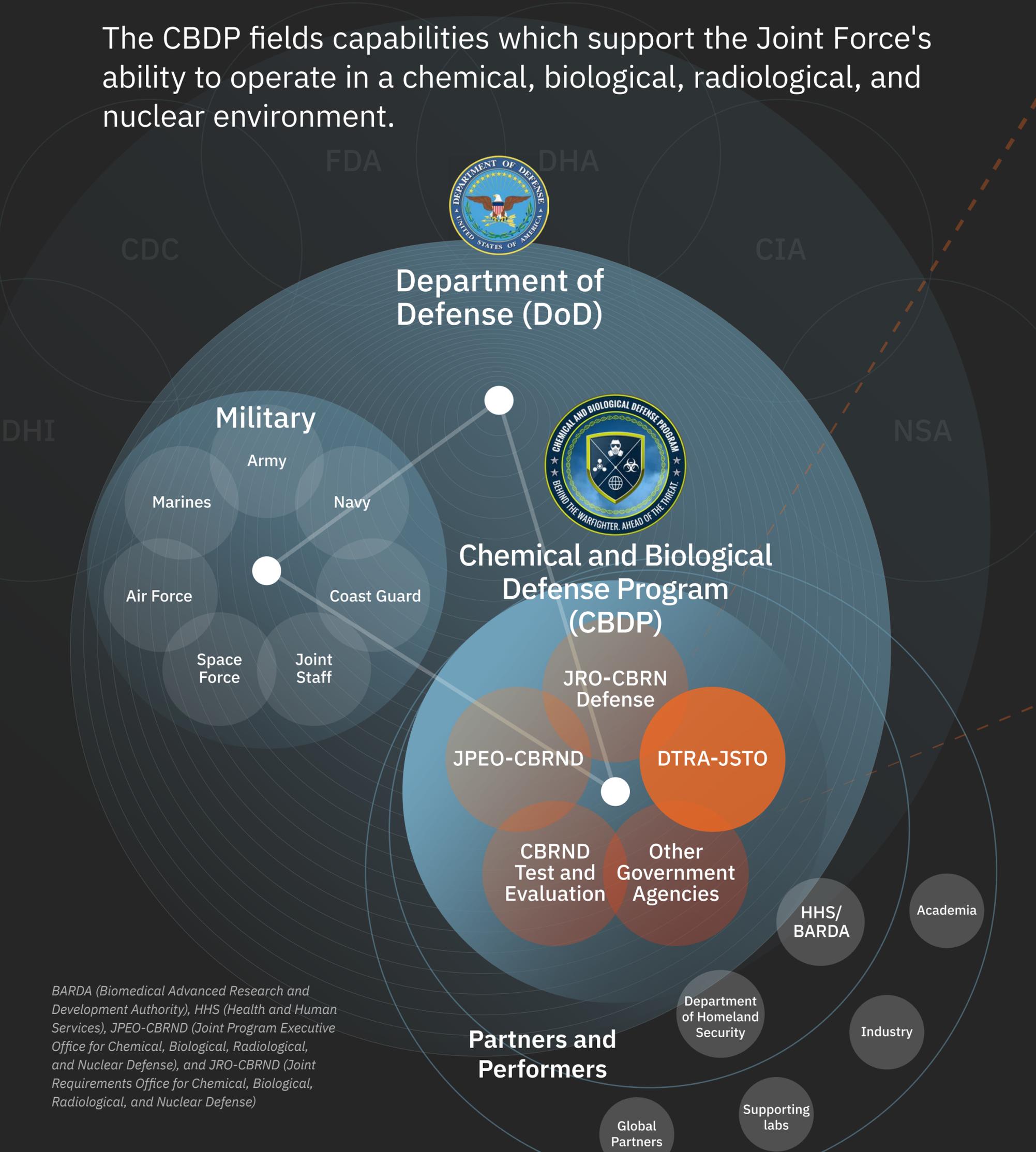
## **INFORMATION INTEGRATION AND TECHNOLOGY SERVICES**

The Information Integration and Technology Services projects knowledge and capabilities in order to combat the threat of WMD and improvised threats and to ensure nuclear deterrence.

# OPERATING AS A SINGLE UNIT

## DTRA's Chemical and Biological Technologies Department, in its role as the Joint Science and Technology Office (JSTO) for Chemical and Biological Defense

The CBDP fields capabilities which support the Joint Force's ability to operate in a chemical, biological, radiological, and nuclear environment.



*BARDA (Biomedical Advanced Research and Development Authority), HHS (Health and Human Services), JPEO-CBRND (Joint Program Executive Office for Chemical, Biological, Radiological, and Nuclear Defense), and JRO-CBRND (Joint Requirements Office for Chemical, Biological, Radiological, and Nuclear Defense)*



DTRA's Chemical and Biological Technologies Department (CB), in its role as the Joint Science and Technology Office (JSTO), is DoD's hub for chemical and biological technical expertise. DTRA-JSTO is part of DoD's effort in the CBDP and leads the defense community in anticipating and preparing for chemical and biological threats.

DTRA-JSTO and its partners provide cutting-edge technology solutions to build a more lethal force while empowering warfighters to achieve their missions in dangerous environments. In addition, DTRA-JSTO has the dual responsibility of protecting against known threats of today and anticipating major threats of tomorrow.

“The only way to counter the threats associated with technological progress is to ‘out-science’ the enemy with disruptive power. We want to disrupt the threat before we face it. We want to change the game and how we fight. Our enemies — whoever they may be and whatever their threat may be.”

— Ronald Hann, Ph.D.



# Mission, Vision, and Mindset of DTRA CB

## Mission

Lead DoD science and technology efforts to anticipate, defend, and safeguard against chemical and biological threats for the warfighter and the nation.

## Vision

Our nation, and its warfighters, safe from chemical and biological threats.

## Mindset

In the tradition of DoD's continuous strides in research and development — such as developing penicillin for our troops during World War II — DTRA CB is to further advance the world of medicine by investing in transformational ideas, innovative people, and actionable technologies to defend against chemical and biological warfare.

To help fulfill this responsibility, DTRA CB is managing innovation as an integrated system to find solutions against difficult problems, build a collaborative community, and balance investment portfolios against enterprise-wide strategy and requirements.



Photo caption: A soldier cuts away clothing from a civilian acting as a simulated casualty at a decontamination site during an exercise at Muscatatuck Urban Training Center. (Photo courtesy of U.S. Army National Guard).

## DTRA CB is:



### **Strategy driven**

DTRA CB executes according to the DoD's Lines of Effort published in the *National Defense Strategy*.



### **Innovation driven**

DTRA CB is focused on transformational results through innovation.



### **Product driven**

DTRA CB invests in efforts directed at producing an actual product — not simply knowledge for knowledge's sake.



### **Performance driven**

DTRA CB tracks and measures results, both within the team and in the research it invests in. DTRA CB assesses its defined progress against set milestones to produce measurable results.



### **Warfighter driven**

DTRA CB's primary goal is to protect the warfighter from attacks of chemical and biological warfare agents.



### **Collaboration driven**

DTRA CB works with other government agencies, academic institutions, and industries to collaborate on ideas that will save and improve lives.

# Core Capability Areas

DTRA CB's capabilities span a spectrum of needs to protect warfighters and are grouped into three overarching categories of protections, understand, protect, and mitigate.

**UNDERSTAND**: Provides the Joint Force the ability to positively identify hazards from traditional and emerging chemical and biological threats to improve the timeliness and confidence of information for decision makers.

**PROTECT**: Provides the Joint Force the ability to prevent the effects of chemical and biological hazards.

**MITIGATE**: Provides the Joint Force the ability to respond to and remediate chemical and biological hazards.

DTRA CB focuses on all three aspects of an event — before, during, and after — to better equip and protect U.S. warfighters. DTRA CB must have the best possible science and technology capabilities to protect the warfighter and the United States from threats.

Cd

UNDERSTAND

Chemical  
detection

Da

UNDERSTAND

Decision analysis  
and management

Md

UNDERSTAND

Medical  
diagnostics

Bt

MITIGATE

Biological  
therapeutics

Ct

MITIGATE

Chemical  
therapeutics

Mc

MITIGATE

Material contamination  
mitigation

# Bd

UNDERSTAND

Biological  
detection

# Bp

PROTECT

Biological  
prophylaxis

# Cp

PROTECT

Chemical  
prophylaxis

# Cw

UNDERSTAND

CBRN warning  
and reporting

# Es

PROTECT

Expeditionary  
collective protection

# Pp

PROTECT

Percutaneous  
protection

# Ts

UNDERSTAND

Threat-agent  
science

# Ro

PROTECT

Respiratory and  
ocular protection

# Hd

GENERAL

Homeland  
defense

# Pc

MITIGATE

Personnel  
contamination  
mitigation

# Tw

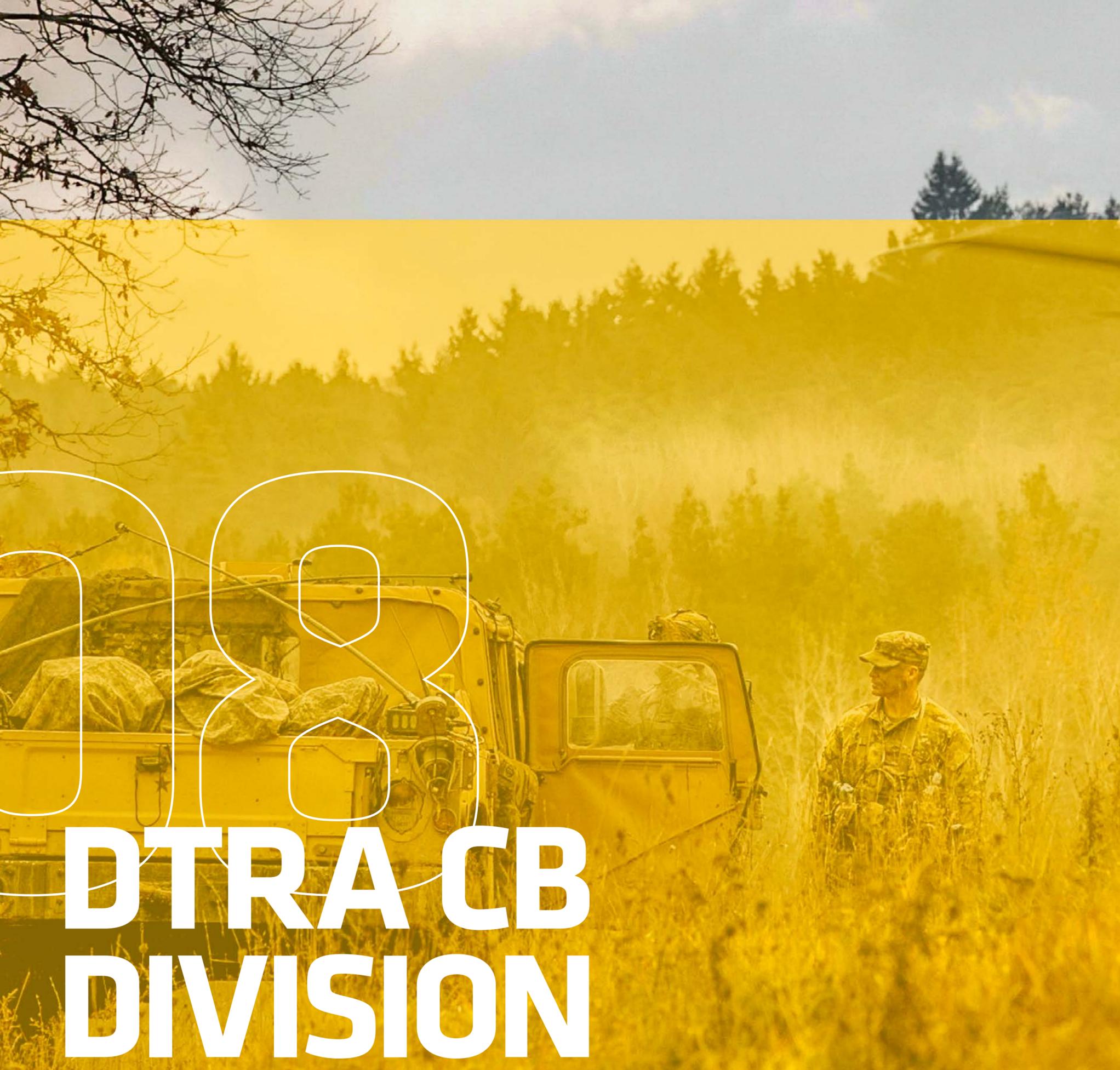
MITIGATE

Tactical WMD  
disablement

# Br

GENERAL

Basic  
research



# DTRA CB DIVISION

# OVERVIEWS



*Photo caption: An AH-64 Apache attack helicopter takes off near soldiers participating in the Allied Spirit VII training exercise. The U.S. Army, along with its North Atlantic Treaty Organization allies and partners, continue to forge a dynamic presence with a powerful land network that simultaneously deters aggression and assures the security of the region. (Photo courtesy of U.S. Army).*

DTRA CB has eight divisions. Each division is charged with a set of responsibilities that contribute to DTRA CB's mission, vision, and mindset. These divisions are: Advanced and Emerging Threat, Detection and Diagnostics, Digital Battlespace Management, Protection and Hazard Mitigation, Research Center of Excellence, Strategic Communication and Outreach, Vaccines and Therapeutics, and Warfighter Integration.

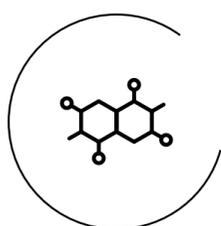
## Advanced and Emerging Threat Division

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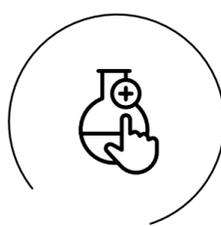
The Advanced and Emerging Threat Division provides critical chemical and biological agent property and reactivity data and determines toxicological mechanisms to inform risk assessment and support deterrence, response, and attribution for major biological or toxic chemical events. The division also develops and transitions chemical warfare agent pretreatments and therapeutics to address current and emerging threats to protect the lives of our warfighters. The following pages contain summaries of a few articles that illustrate the work of the division.



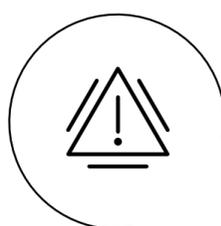
*Photo caption: A simulated crime scene during a training exercise at Joint Base McGuire-Dix-Lakehurst, N.J., on October 23, 2019. (Photo courtesy of U.S. National Guard)*



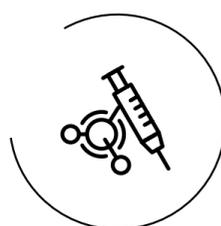
**BIOLOGICAL  
MARKERS**



**TOXICOLOGY  
ANALYSIS**



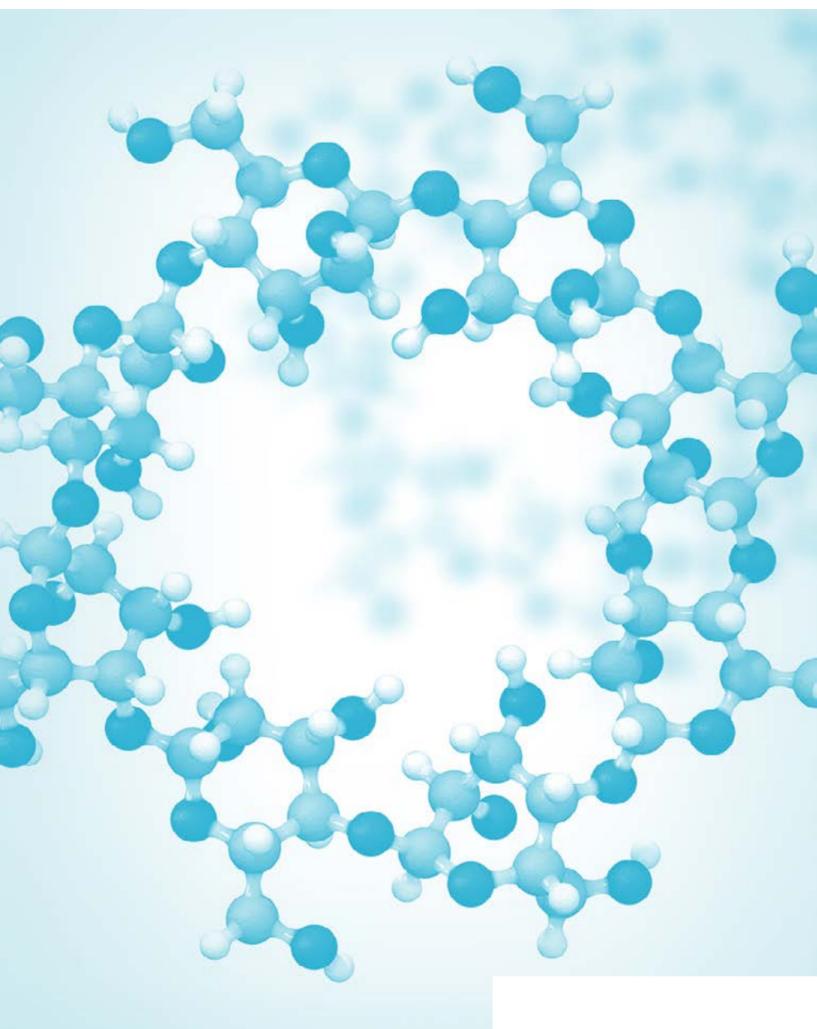
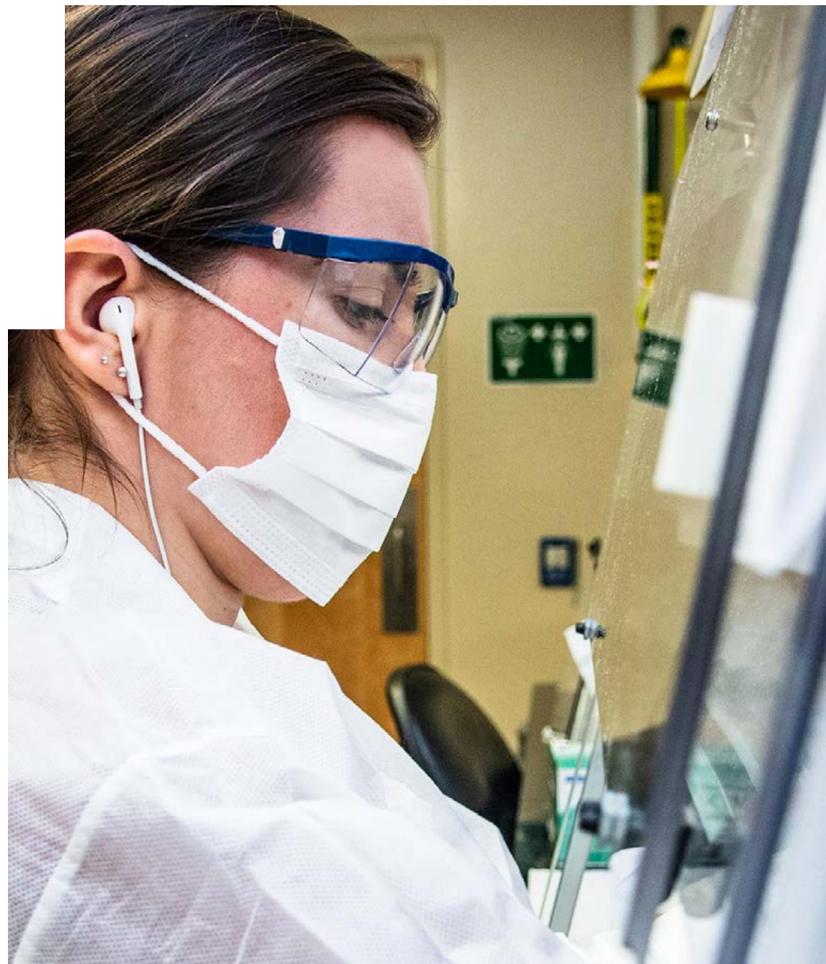
**RISK  
ASSESSMENT**



**THERAPEUTICS**

## **A “Humanized” Mouse Colony for Screening Early Developmental Drugs**

DTRA-JSTO supported the development of a new humanized mouse model to study and help produce medical countermeasures for the treatment of intoxication due to an inhibition of acetylcholinesterase.

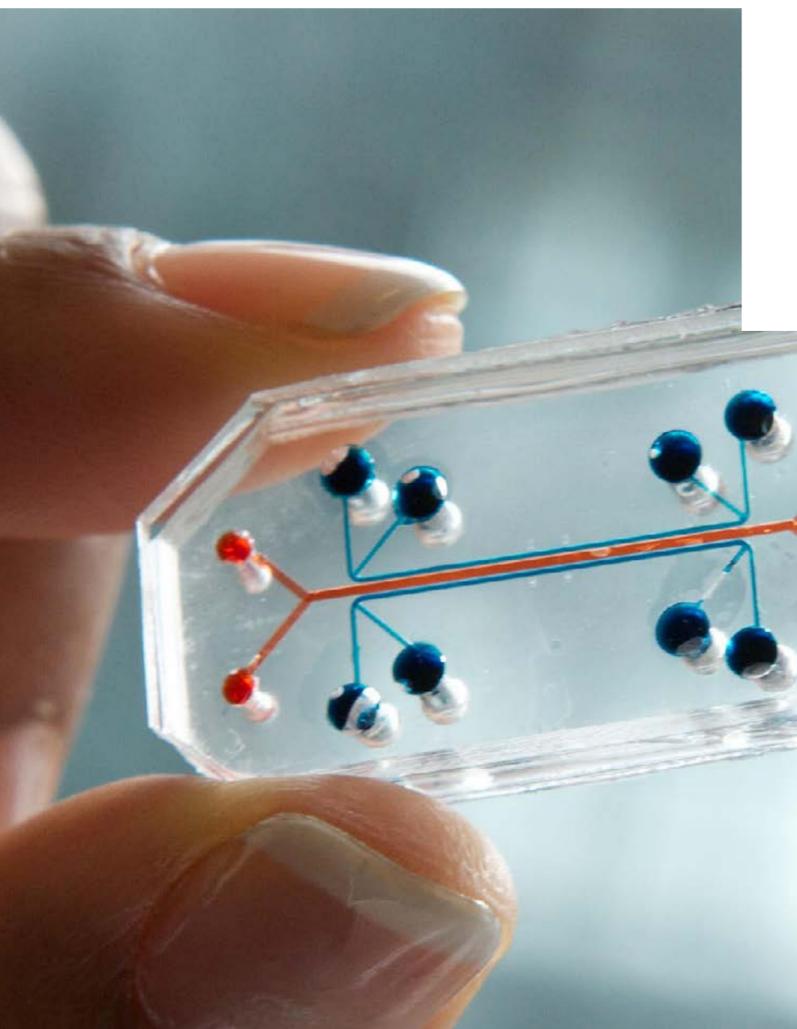
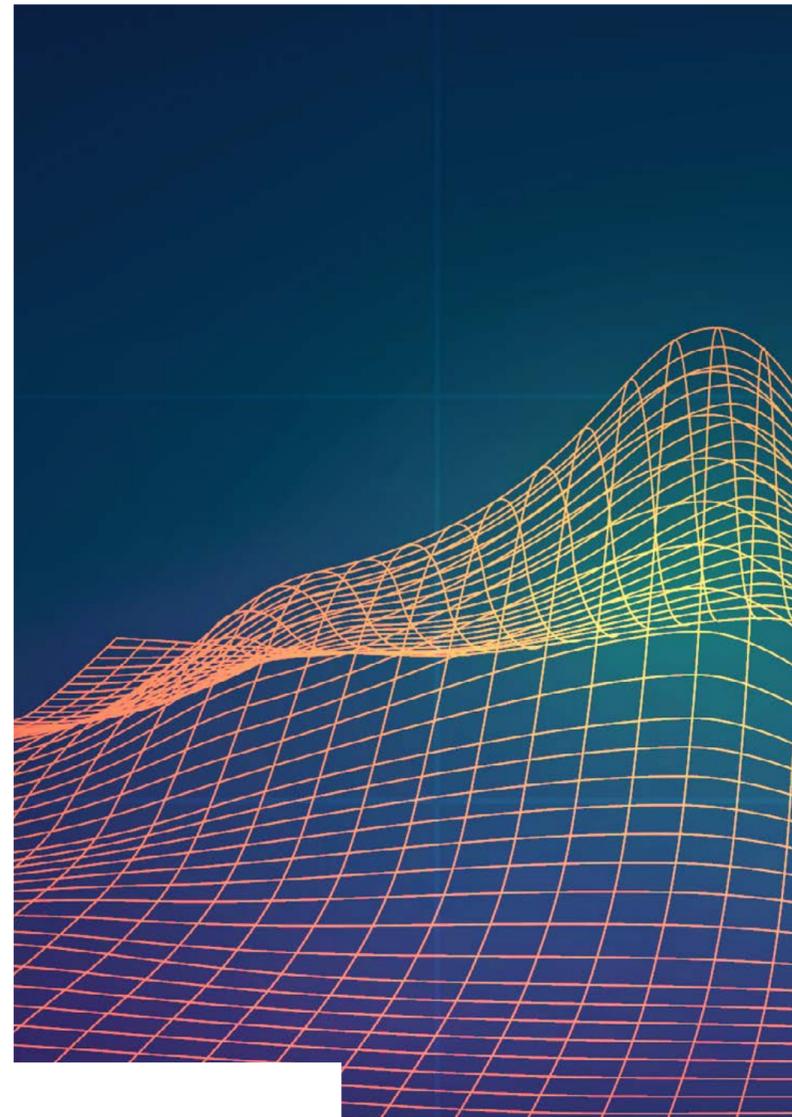


## **Removing Chemical Threats from the Body**

Most Americans are familiar with commercial air fresheners. The effectiveness of those products is made possible by ring-shaped molecules called cyclodextrins. DTRA-JSTO is supporting research that explores how cyclodextrins can be turned into protective or therapeutic medical countermeasures by adding functional groups that allow them to target, sequester, and break down chemical weapons. These novel cyclodextrins will neutralize such chemical threats as organo-phosphate-based nerve agents and opioids.

## Preventing Technical Surprise from a Changing Threat Landscape

With the emergence and spread of synthetic biology and other revolutionary technologies, we face unprecedented danger from the proliferation of advanced and emerging chemical and biological threats. Working with partners from DoD laboratories, DTRA-JSTO is establishing horizon-scanning capabilities to assess the impact of these technologies, which might lower the barriers to develop, produce, and employ an advanced threat. The horizon-scanning efforts will help identify the early use of tools that can lead to the proliferation of advanced threats, preparing United States to counter the nefarious use of those tools by enemy forces.



## Humanoid Cells Testing: Predictive Toxicology Capabilities

Research studies typically take months or years to yield data on how a new chemical and biological threat agent can hurt the human body. However, scientists have learned that by combining select state-of-the-art computer tools and organ-on-a-chip technologies, warfighters, frontline responders, and developers of countermeasures will more quickly receive improved information on the hazards posed by chemical and biological threat agents.

## Detection and Diagnostics Division

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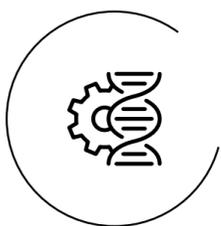
The Detection and Diagnostics Division pursues novel approaches in developing an advanced capability to inform and protect the warfighter from chemical and biological threats.

The division also pursues novel approaches to enable the warfighter to see all threats in the environment and in the body by developing innovative detection and diagnostic capabilities to prepare, anticipate, and respond to chemical and biological threats. The following pages contain summaries of a few articles that illustrate the work of the division.





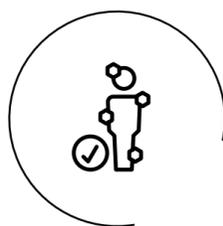
*Photo caption: A U.S. Army soldier takes photos of simulated radioactive material during exercise Vigilant Guard at the North Dakota Air National Guard Base, Fargo, N.D. Vigilant Guard is a joint agency emergency response exercise. (Photo courtesy of U.S. Air National Guard)*



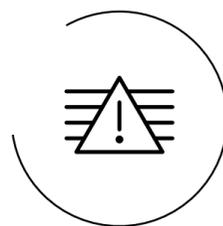
**RAPID DNA SEQUENCING**



**LOCATION DETECTION**



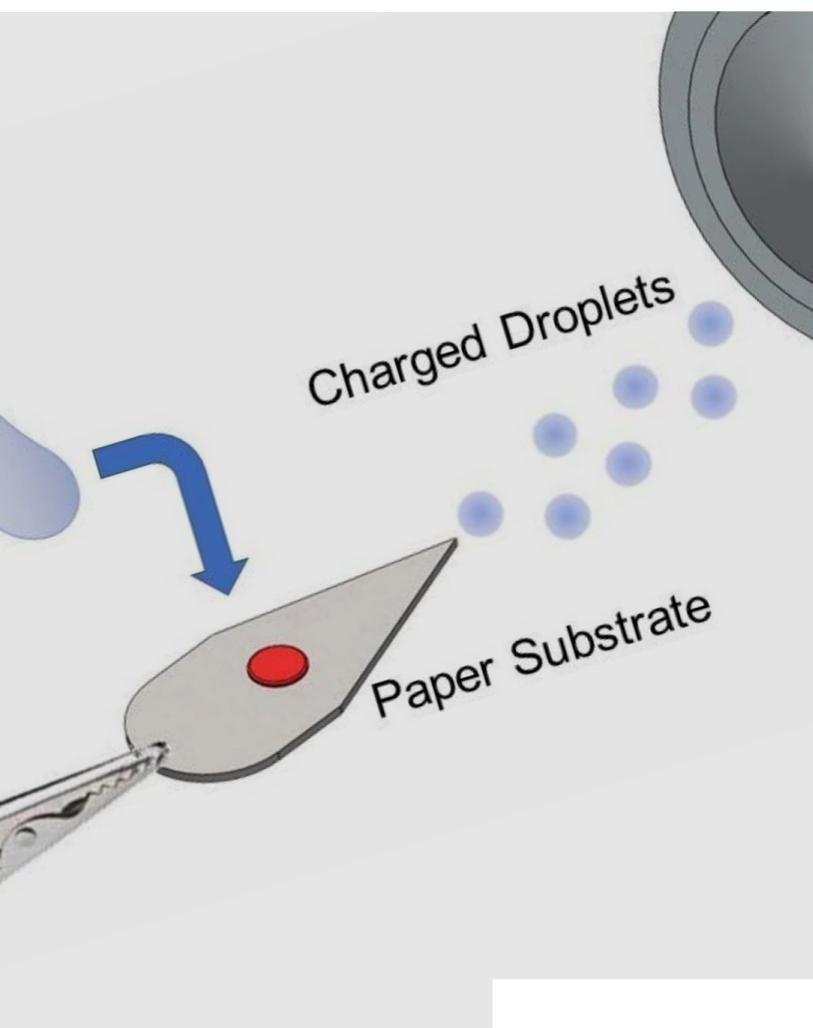
**DIAGNOSIS**



**INTEGRATED EARLY WARNING**

## **Blurring Science and Data Offers Clear Results in the Field**

Since the mother of bioinformatics, Margaret Oakley Dayhoff, first published her comprehensive, computerized collection of protein sequences in 1965, bioinformatics has continued to evolve and enhance our understanding of biological data.



## **Following the Paper Trail to Identify Threats**

In the fight to combat chemical and biological threat agents, every resource, even common household items, is utilized to protect warfighters. DTRA-JSTO uses paper and glass to improve chemical and biological agent detection capabilities for U.S. warfighters.



## Compact Vapor Chemical Agent Detector

DTRA-JSTO analyzes light reflected from butterfly scales to detect trace amounts of chemical warfare agents with increased precision and speed.



## Next-Generation Genetic Sequencing

In February 2019, the Office of Deputy Assistant Secretary of Defense for Chemical and Biological Defense (DASD-CBD) requested an Opportunities Assessment of commercial technologies that perform next-generation genetic sequencing (NGS). DTRA-JSTO responded to DASD-CBD's request by hosting a workshop to engage stakeholders in the analysis and applicability of NGS technologies in biological warfare.

## Digital Battlespace Management Division

The Digital Battlespace Management Division provides the warfighter with comprehensive chemical and biological data fusion and analysis capabilities to support situational awareness, decision making, and threat management. The division provides tools that accurately assess risk from CBRN hazards and identify courses of action at the speed of relevancy. The division's technological tools enable users to share information and capabilities across connected components for near real-time input into command and control systems.

The division pushes the boundaries of data processing and management. By exploiting end-user device technology, such as neural processing units, the division incorporates high-performance, machine-learning operations that deliver results in faster-than-real time. By pushing advancements in automation and connectivity, the division is providing the Joint Force with enhanced CBRN decision-support tools on the battlefield and beyond.



Through the combination of advances in science and modeling technology, the division ensures greater chemical and biological threat awareness among warfighters. The division leverages threat-agent science data to ensure the Joint Force has the ability to characterize new chemical and biological threats and mitigate their effects on mission success. Advances in technology allow users to quickly assess traditional and novel threat agents and their dissemination pathways and predict the agents' effects on humans and the environment.

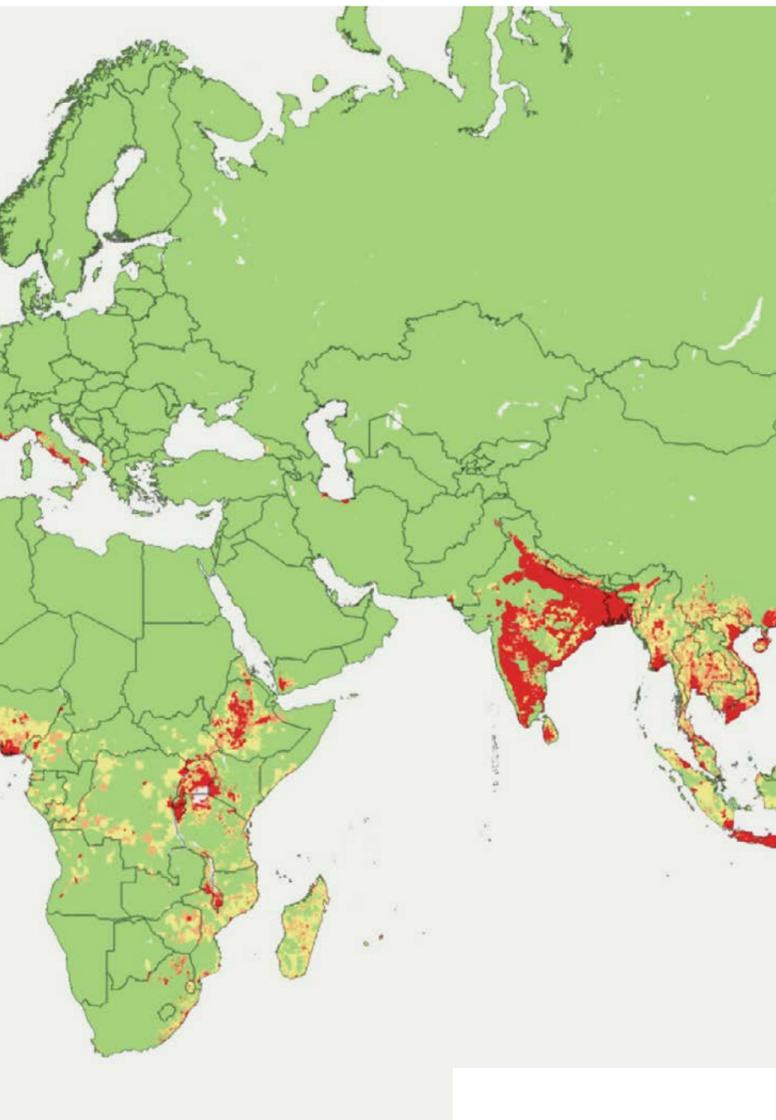
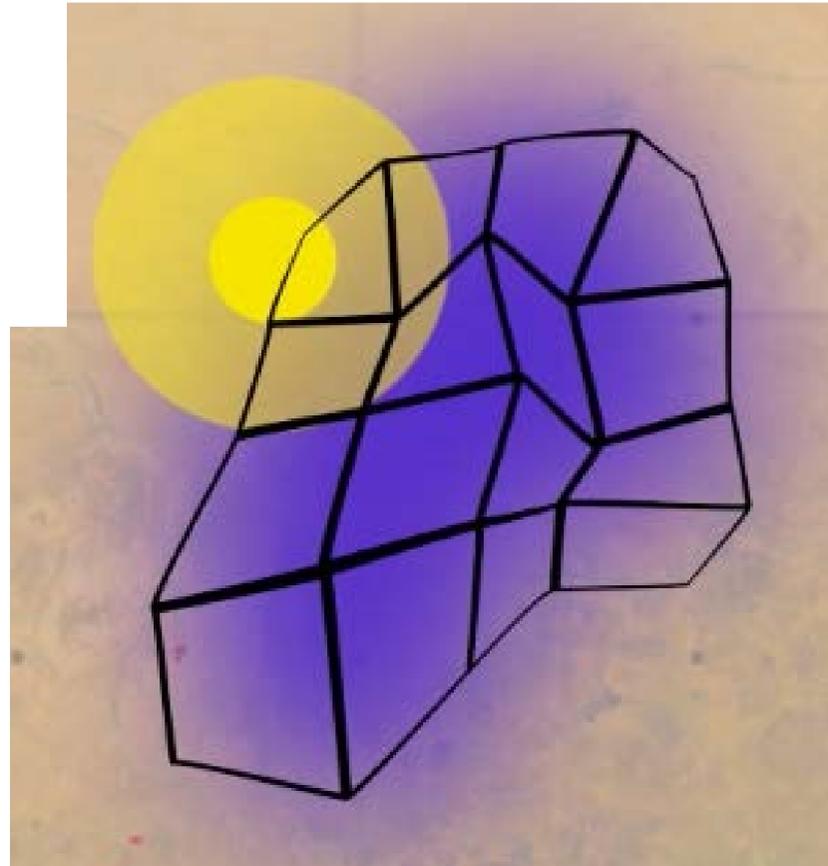
The division exploits synthetic training environments and provides warfighters with CBRN-specific cognitive, collective multi-echelon training and mission-rehearsal capabilities. Augmented reality, such as head-mounted displays, allow warfighters greater access to a high-fidelity, real-time picture of the operating environment. They are improving CBRN battlespace sensing, alerting, and response capabilities by advancing algorithm development and connectivity with the help of artificial intelligence and other advanced computational tools.

The division is creating new algorithms to generate and disseminate warnings faster than ever before — helping prevent or limit exposure to personnel and improve medical countermeasure response times. Through a combination of partnerships and the collection of chemical and biological trials, physiological, and other environmental data, the division developed the Rapid Analysis of Threat Exposure algorithm, which allows users to predict an infection 48 hours before clinical suspicion with better than 85% accuracy.

The division is using tools such as artificial intelligence to evaluate algorithm fidelity and connectivity, as well as identify key indicators, combinations of indicators, and sensing modalities. These advances reduce the occurrence of false alarms and better predict the likelihood of exposure to chemical and biological threats. The following pages contain summaries of a few articles that illustrate the work of the division.

## Oasis of Data in the SAHARA

DTRA-JSTO supported researchers at the National Center for Atmospheric Research to develop the Self-Organizing Map-Assisted Hazard Area Risk Analysis (SAHARA) tool. SAHARA reduces large climate datasets into manageable sizes while accurately modeling CBRN events.



## CHIKRisk: Mapping the Next Chikungunya Outbreak

A new computer application — called CHIKRisk — uses statistical modeling to help predict the risk of an outbreak of the chikungunya virus, a disease transmitted by mosquitoes, which produces symptoms that include fever, rash, and severe joint pain. DTRA-JSTO collaborated with the Universities Space Research Association (USRA) to develop the application that maps and monitors the risk of acquiring the virus anywhere in the world. The Armed Forces Health Surveillance Center's Global Emerging Infections Surveillance is using CHIKRisk to inform warfighters and decision-makers on the areas where future outbreaks of the chikungunya virus may occur.

## **ATAK in the Field: Forging a Tactical Edge**

Through collaboration and innovation, DTRA-JSTO has integrated its powerful, hazard-awareness-and-response tools into the Android Tactical Assault Kit (or the Android Team Awareness Kit, ATAK). ATAK is a digital application available to warfighters throughout the DoD. ATAK offers warfighters geospatial mapping for situational awareness during combat — on an end-user device such as a smartphone or a tablet. Warfighters can now use ATAK to guide themselves to safety when confronted with a release of CBRN threats.



## **RATE Algorithm Can Predict Illness 48 Hours Before Symptoms Show**

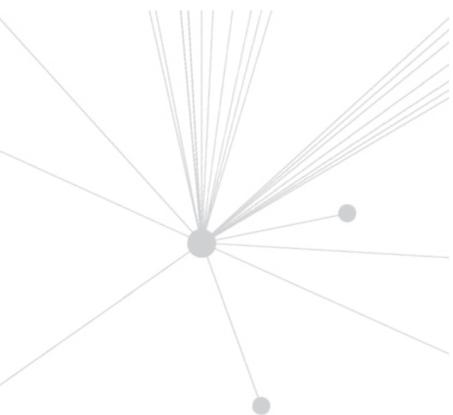
When a U.S. warfighter gets sick, that illness can have serious repercussions on the unit's ability to execute critical missions. DTRA-JSTO is developing a predictive algorithm to identify when a service member is falling ill — due to anything from a cold to an exposure to biological weapons — up to 48 hours before they start to show any symptoms.



## Protection and Hazard Mitigation Division

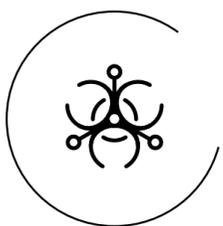
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The Protection and Hazard Mitigation Division enhances warfighters' protective equipment through advances to weight, material performance, contamination mitigation, cost, and more. The following pages contain summaries of a few articles that illustrate the work of the division.





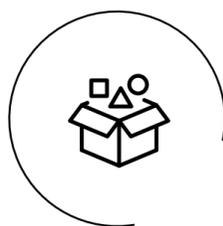
*Photo caption: A U.S. Army Reserve soldier with the 369th Chemical Company performs chemical, biological, radiological and nuclear operations in full chemical gear. (Photo courtesy of U.S. Army)*



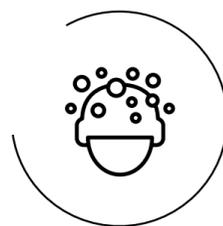
**CHEMICAL AND  
BIOLOGICAL  
HAZARDS**



**DECONTAMINATION**



**EQUIPMENT  
AND TOOLS**



**WARFIGHTER  
RESPONSE**

## **Sprayable Slurry Offers the Missing Piece of the Decontamination Puzzle**

Quickly and safely decontaminating mission-critical equipment from chemical warfare agents is a complicated puzzle. Warfighters must piece together chemistry, equipment, resources, and logistics — and it must be immediate — to ensure combat effectiveness.



## **Keeping Your Cool: The Personal Thermal Management System**

Impermeable protective suits prevent CBRN hazards from touching skin, but they retain body heat, which has been a concern of the DoD for some time. The heat retention makes the warfighter vulnerable to heat exhaustion or heat stroke. Industry researchers, supported by DTRA-JSTO, have developed the Personal Thermal Management System (PTMS) to actively cool warfighters wearing impermeable protective suits.

## CBART: When You Have Skin in the Game

Protective gear can safeguard the warfighter from exposure to chemical warfare agents; however, current garments are bulky, poorly ventilated, and hot to wear. DTRA-JSTO is improving protective garments.



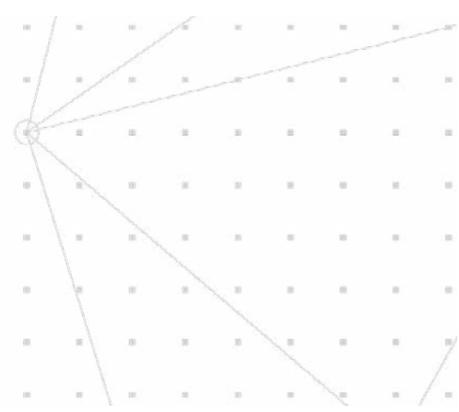
## It's Getting Hot and Humid in Here

High heat and humidity kill biological warfare agents, such as anthrax, that could directly threaten the health and security of our warfighters. A joint effort between DTRA-JSTO and the Naval Surface Warfare Center Dahlgren Division is optimizing the use of hot, humid air to decontaminate sensitive equipment that warfighters use, such as an aircraft.

## Research Center of Excellence Division

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The Research Center of Excellence Division serves as a research component of DTRA-JSTO and provides capabilities and competencies to DoD laboratories. The division executes the vision of DTRA-JSTO by creating opportunities to collaborate with DoD laboratories and increase communication between DTRA-JSTO and stakeholders of the CBDP. An overall goal of the division is to help recruit and mentor young talent to serve as the next generation of the scientific workforce in chemical and biological defense.





*Photo caption: The Rapid Area Sensitive-Site Reconnaissance (RASR) is a remote-controlled robot, based on commercial, off-the-shelf technology, and is designed to protect warfighters in areas where chemical threats are not known. (Photo courtesy of DTRA CB)*

Activities that support division's goals include personnel recruitment for term-employment positions in the government. Employees work in DoD laboratories with other government scientists to support cooperative research and development projects. DoD laboratories include those located at the U.S. Army Combat Capabilities Development Command Chemical Biological Center, U.S. Army Medical Research Institute of Chemical Defense, U.S. Army Medical Research Institute of Infectious Diseases, and the Naval Medical Research Center.

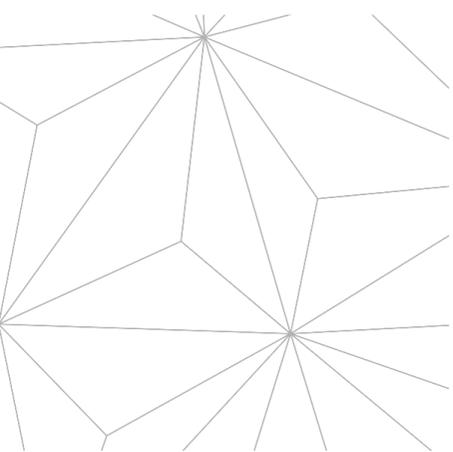
The division supports the NRC Research Associateship Programs, which provides postdoctoral research opportunities in chemical and biological defense at DoD laboratories and centers. Another effort is the Service Academy Research Initiative that directs funding to the Service Academies for small research projects, which provides opportunities for talented, young scientists and engineers to perform laboratory research in chemical and biological defense.

# DTRA CB DIVISIONS

## Research Operations Division

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The Research Operations Division is responsible for the management and daily operations of DTRA-JSTO. The division focuses on business processes, acquisition, strategic communication, workforce management and science, technology, engineering and math (STEM) activities. The division hosts several outreach events and has four primary responsibilities, which are presented in the following pages.



### ***JSTO in the News*** **recurring publication**

*JSTO in the News* is a recurring publication that highlights DTRA-JSTO's science and technology efforts in chemical and biological defense. Each issue emphasizes DTRA-JSTO as a research investment agency and an agency of interdisciplinary subject matter experts who engage scientists in academia, industry, and the government to benefit the warfighter and the nation.

### **CBD S&T Conference**



Keyword:  
[@cbdstconference](#)

Join the most innovative and influential members of the chemical and biological defense community at the premier chemical and biological defense conference! By exploring the potential of today's technologies and the emerging threats of tomorrow, **CBD S&T Conference** offers an important experience for anyone committed to improving our world through chemical and biological defense.

### **STEM Outreach**

DTRA CB supports STEM education and outreach activities throughout the nation, from elementary school through graduate school, to inspire and cultivate a diverse pool of talent to meet future defense technological challenges. Supported programs include the Joint Science and Technology Institute and the U.S.A. Science and Engineering Festival, the nation's largest STEM event.

### **University Engagement Webinar Series**

DTRA CB hosts ongoing university engagement webinars to engage with students, faculty, and researchers across academia. The goal of these webinars is to create awareness for DTRA and DoD opportunities, as well as dialogue with active participants interested in the DTRA CB mission. Subject matter experts within DTRA present on various topics in each webinar.

## Program Development and Strategic Analysis

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1. Increasing efficiency and effectiveness of our business processes.
2. Purposeful and decisional meetings/reviews.
3. Knowledge management capability that identifies the issues and supports both leadership and the science and technology manager.
4. Chemical and biological program funding — more efficient use of the withhold and unfunded requirement process.
5. Formalizing quarterly Unfunded Requirement process.
6. Managing monthly technology watch engagements with service/national laboratories, industry, and academia to be connected with outside scientific developments.

## Governance

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1. Ensure Managers' Internal Control Program and Statement of Assurance meet all *Standards for Internal Control in the Federal Government* that sets the standards for an effective internal control system for federal agencies.
2. Maintain the Research Oversight Board, including integration of the U.S. Army Medical Research and Development Command Human Research Protection Office and Animal Care and Use Review Office review and approval process for all of DTRA.
3. Ensure DTRA-JSTO's Issuances and Directives are updated regularly and reflect current policy and procedures.
4. Ensure compliance of funded research with Dual Research of Concern policies and procedures as mandated by Office of the Secretary of Defense/National Institutes of Health/Office of Science and Technology Policy.

## Strategic Communication and Innovation

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1. Proactive communication and purposeful messaging.
2. Congressional eyes and ears.
3. Strategic communication road map.
4. STEM and Historically Black Colleges and Universities/ Minority Institutions road map.

## DTRA-JSTO Mission Support

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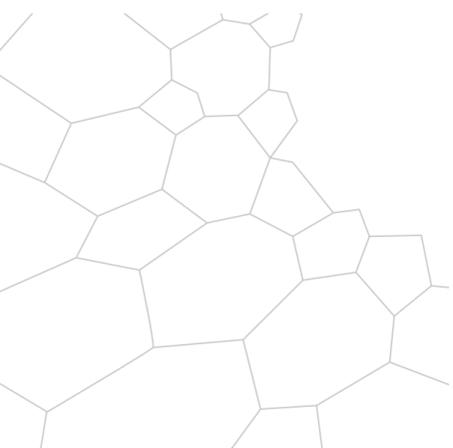
1. Complete position description.
2. Try to reduce the administrative burden where possible.
3. Have more active professional development programs.
4. Manage the Enterprise Information Systems/Correspondence and Task Management System Tasker for DTRA-JSTO, and insure appropriate, vetted responses are submitted on time.



## Vaccines and Therapeutics Division

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The Vaccines and Therapeutics Division supports the discovery, development, transition, and delivery of medical countermeasure products to protect the lives of warfighters and enable their recovery from exposure to current and emerging biological threats. The following pages contain summaries of a few articles that illustrate the work of the division.





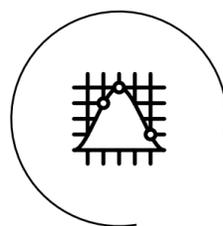
*Photo caption: A Navy Seaman prepares a needle with a flu vaccination aboard the USS Gerald R. Ford. (Photo courtesy of U.S. Navy)*



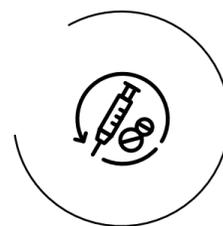
RESEARCH



LABORATORY TESTING



COMPUTER MODELING



COUNTERMEASURES

## **The Smell of Victory: Aerosolized Melioidosis Vaccine in Development**

Melioidosis is real: it's a category B bioterror agent that kills more than half of the people it infects. To shield warfighters from the disease, DTRA-JSTO is supporting the research of a vaccine.

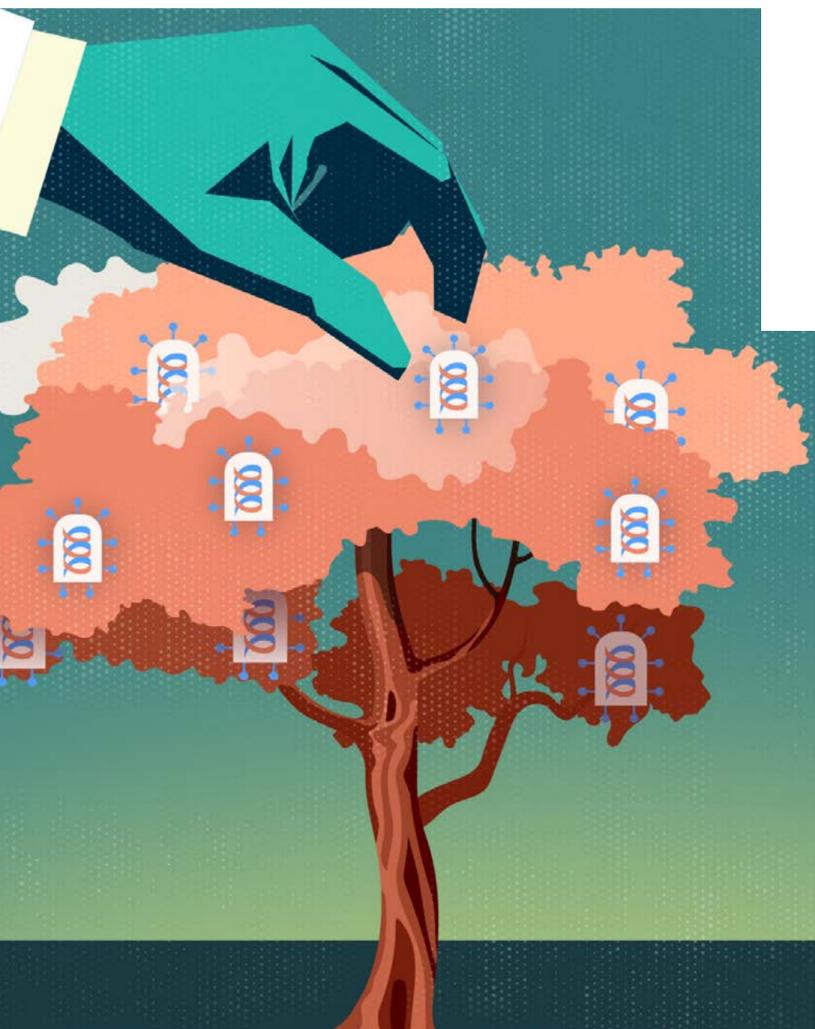
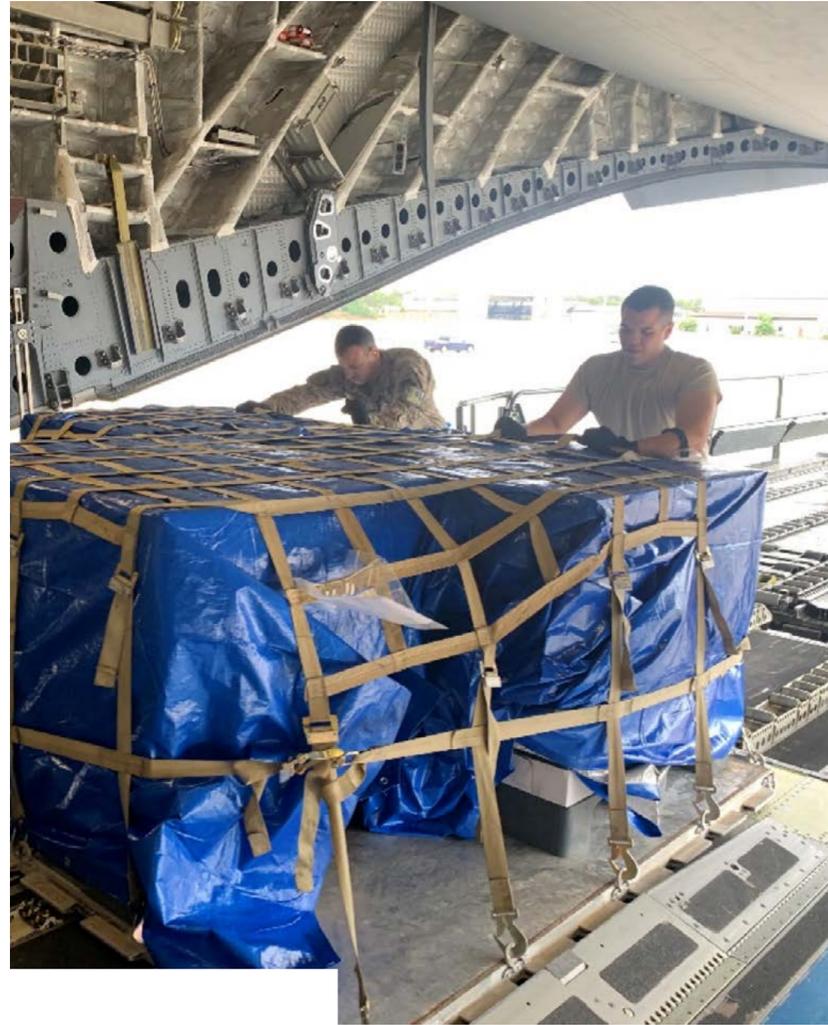


## **Micromotor Nanotoxoid: A Novel Delivery Vehicle for Oral Vaccines**

Though tiny in stature, a nano-sized particle boasts a large surface area and can be manipulated to deliver drugs to a specific site in the body.

## A Cargo Plane Saves Lives

Sometimes, a U.S. Air Force C-17 Globemaster III airlifter can be just what the doctor ordered to help prevent the spread of Ebola virus disease. In August 2019, DTRA-JSTO assisted in transporting a bulk quantity of Ebola vaccine material from Germany to Pennsylvania.



## The Ebola Vaccine and DTRA-JSTO's Role

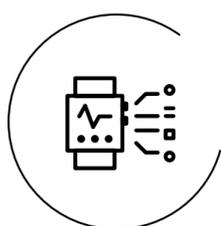
In December 2019, the U.S. Food and Drug Administration approved the use of the world's first vaccine against Ebola virus disease. DTRA-JSTO funded the vaccine's initial development. The newly approved Ebola vaccine, called Ervebo, is more than 97% effective in preventing the disease caused by the species *Zaire ebolavirus*.

# DTRA CB DIVISIONS

## **Warfighter Integration Division**

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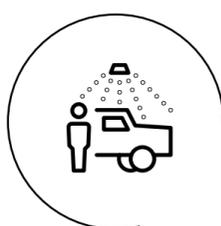
The Warfighter Integration Division fosters strategic partnerships with the warfighter community involved in science and technology for chemical and biological defense. The division helps enhance technologies and delivers innovative DoD operational capabilities that address real-world challenges. The following pages contain summaries of a few articles that illustrate the work of the division.



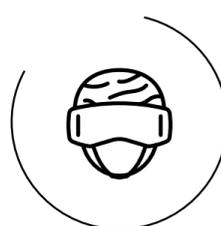
WEARABLES



LOCATION  
DETECTION



DECONTAMINATION



UNIFORMS

*Photo caption: Members of 2-263rd Air Defense Artillery Battalion, South Carolina National Guard, participated in an International Joint Force assessment of the first generation Chemical Agent Detector Colorimetric Reader (CADCoR) prototype. (Photo courtesy of U.S. Army)*

## **Warfighters Test Drive Tomorrow's Technology**

To evaluate new chemical and biological defense tools, DTRA-JSTO recently hosted the first large-scale event specifically designed to assess technologies in near-operational conditions. Warfighters — those who will be relying on the equipment in the field — were on hand to provide real-time feedback in order to ensure they are armed with effective protective equipment.

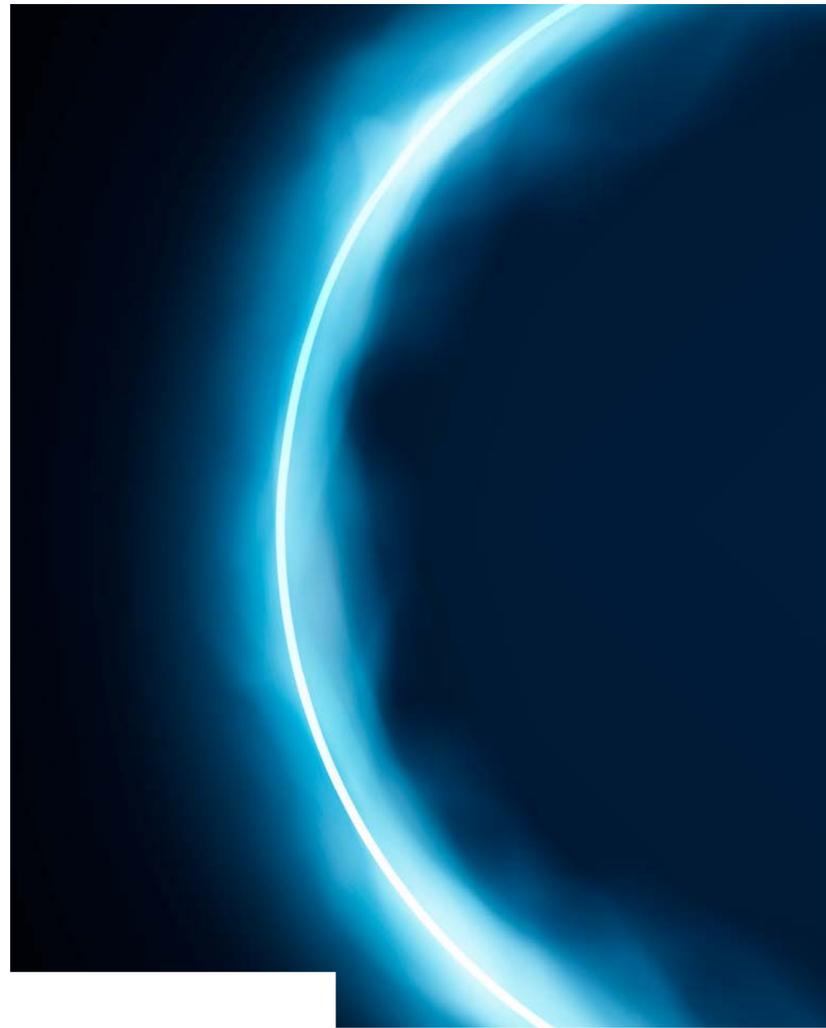


## **Perceptive Dragon 2: Honing Integrated Early Warning Capabilities**

Time and space to maneuver saves lives on the modern battlefield. More information, with more time to decide, allows commanders to make quick decisions that protect warfighters and allow them to accomplish their mission.

## OPTing for Real-Time Detection

Warfighters must be prepared for the unthinkable, such as the release of a chemical or biological threat agent. But characterizing a particular harmful agent in the air can be difficult, delaying response time. The Optical Particle Trap (OPT), developed by DTRA, is changing that by providing warfighters with accurate, real-time detection of airborne chemical and biological agents.



## Clinicians Evaluate Prototypes for Administering Nucleic Acid-Based Vaccines

DTRA-JSTO routinely engages warfighters in the evaluation of potential new products that counter chemical and biological threats. Recently, at a User Feedback Event in Camp Bullis, Texas, U.S. Army medics and physician assistants evaluated new devices that administer nucleic acid-based vaccines. DTRA-JSTO supported this event, which was administered by the U.S. Army Medical Department Board.



Ronald K. Hann, Jr., Ph.D.  
Director Joint Science and Technology Office

[Click to watch the DTRA-JSTO, CB 101 video.](#)

# JOIN THE DTRA TEAM OF PROFESSIONALS

DTRA employees address the number one national security threat the United States faces. The threat of WMD can change everything about the way in which U.S. citizens live their lives.

DTRA's mission — enabling DoD, the U.S. government and international partners to counter and deter WMD and improvised threat networks — is of paramount importance for defending the United States. DTRA plays a critical role in the effort to detect, deter, and defeat those who seek to harm the United States and its allies.

**DTRA has unique opportunities for students, recent graduates, and experienced professionals seeking a career change.** For more information about positions at DTRA, visit the following websites:

**USA Jobs**

[www.usajobs.gov](http://www.usajobs.gov)

**DTRA.mil**

[www.dtra.mil](http://www.dtra.mil)

Whether nuclear surety and forensics, arms control, developing field technology for warfighters, or support to the combatant commands, DTRA exists to provide solutions that destroy, contain, or neutralize WMD before they can be used against the United States or its allies.

When DoD seeks technical and operational expertise and proficiency in efforts to counter WMD, it contacts DTRA.

DTRA seeks a diverse, innovative, and multitalented military and civilian workforce to accomplish our mission. DTRA personnel are guided daily by the agency's values: trustworthy, empowered, agile, mission focused, innovative, and selfless.

To achieve its long-term goals that are critical to national security, DTRA seeks high-performing, dedicated professionals who have a passion for making the world safer. Consider becoming part of a team with responsibilities that span the full range of activities necessary to counter and respond to WMD proliferation and use.

# Doing Business With DTRA

As an agency on the cutting-edge of defense against the threat of WMD, DTRA frequently leverages the capabilities and expertise in the private sector. Therefore, DTRA strongly advocates relations with businesses, including small and disadvantaged business enterprises, and relevant entities.

Organizations interested in conducting business with DTRA can find information regarding procurement and business opportunities on the websites linked below. Additionally, information regarding contracts awarded, including justifications and approvals, are also available on these websites.

## **DTRA Contracts**

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Organizations can engage in procurement and business opportunities with DTRA.

## **DTRA Broad Agency Announcement**

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DTRA funds research across the technology spectrum from basic science to full-scale technology development.

## **Other Transaction Authority**

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The Other Transaction Authority provides federal agencies with increased flexibility to enter agreements with new industry partners on solutions that provide warfighters with safe and effective countermeasures for WMD.

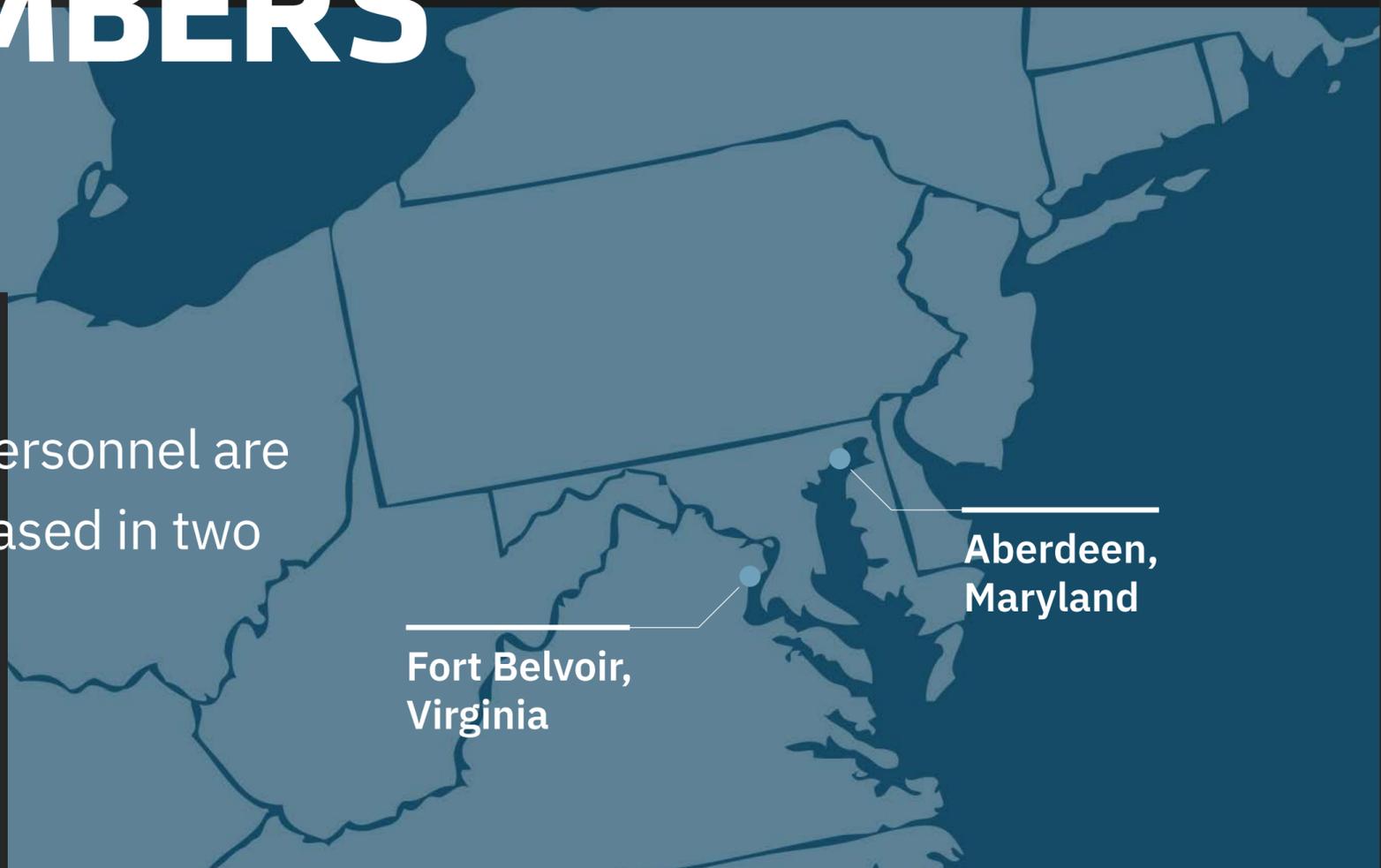
## **Defense Acquisition University's Other Transaction Guide**

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# DTRA CB BY THE NUMBERS

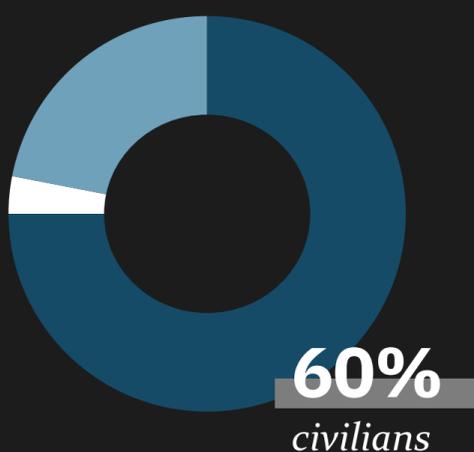
DTRA CB personnel are primarily based in two locations:



DTRA CB employs approximately 200 individuals whose expertise include science, program management, and administration:

**35%**  
contractors

**5%**  
active members of the armed forces



DTRA CB employs a highly educated group of individuals, with nearly **80%** possessing at least a bachelor's degree. Among the 80%:

highest level completed 1 dot = 1 person

doctorates



master's degrees



bachelor's degrees



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## Users

We support a wide variety of government agencies, including:

- [Office of the Secretary of Defense](#)
- [DoD Joint Staff](#)
- [Military service branches](#)
- [Combatant commands](#)
- [Defense Field Offices](#)
- [Joint Requirements Office](#)
- [Joint Program Executive Office](#)
- [Service members](#)
- [Chemical and Biological Defense Program](#)

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## Partners

The DTRA CB team partners with other government and nongovernment entities to advance its vital work. Partners include, but not limited to:

- [Foundations and nonprofit organizations](#)
- [National and international health organizations](#)
- [Department of Homeland Security](#)
- [Department of Health and Human Services](#)
- [Food and Drug Administration](#)
- [Biomedical Advanced Research and Development Authority](#)
- [Defense Advanced Research Projects Agency](#)
- [U.S. Army Medical Research and Materiel Command](#)
- [Federal Bureau of Investigation](#)
- [Department of Energy laboratories](#)
- [U.S. Intelligence Community](#)

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## Performers

The work of DTRA CB is accomplished by a team of high-performing organizations, including:

- [DTRA CB team](#)
- [Corporate sector members \(e.g., biotechnology\)](#)
- [Commercial sector members \(biotechnology industry, pharmaceutical companies, etc.\)](#)
- [U.S. national laboratories](#)
- [Universities and colleges across the country](#)
- [Nonprofit organizations](#)
- [International research organizations](#)

# Peer-Reviewed Publications Affiliated with DTRA-JSTO

Journal impact factors are from Web of Science's Master Journal List. Only those publications from 2019 and with journal impact factors greater than 10 are listed below.

Beginning on this page is a list of peer-reviewed publications that include an investment from DTRA-JSTO.

| Journal                              | Journal Impact Factor | Citation   |
|--------------------------------------|-----------------------|--|
| <i>Accounts of Chemical Research</i> | 21.661                | Chen W, Glackin CA, Horwitz MA, et al. 2019. Nanomachines and other caps on mesoporous silica nanoparticles for drug delivery. <i>Accounts of Chemical Research</i> . 52(6):1531–42.                                       |
| <i>ACS Central Science</i>           | 12.837                | Cafferty BxJ, Ten AS, Fink MJ, et al. 2019. Storage of information using small organic molecules. <i>ACS Central Science</i> . 5(5):911–16.  |
| <i>ACS Central Science</i>           | 12.837                | Grant J, O'Kane PT, Kimmel BR, et al. 2019. Using microfluidics and imaging SAMDI-MS to characterize reaction kinetics. <i>ACS Central Science</i> . 5(3):486–93.  |
| <i>ACS Nano</i>                      | 13.903                | Chen W, Cheng CA, Zink JI. 2019. Spatial, temporal, and dose control of drug delivery using noninvasive magnetic stimulation. <i>ACS Nano</i> . 13(2), pp.1292–1308.   |
| <i>ACS Nano</i>                      | 13.903                | Swearer DF, Robotjazi H, Martirez JM, et al. 2019. Plasmonic photocatalysis of nitrous oxide into N <sub>2</sub> and O <sub>2</sub> using aluminum-iridium antenna-reactor nanoparticles. <i>ACS Nano</i> . 13(7):8076–86. |
| <i>ACS Nano</i>                      | 13.903                | Renard D, Tian S, Ahmadivand A, et al. 2019. Polydopamine-stabilized aluminum nanocrystals: aqueous stability and benzo [a] pyrene detection. <i>ACS Nano</i> . 13(3):3117–24.   |
| <i>Advanced Functional Materials</i> | 15.621                | Jeerapan I, Sempionatto JR, Wang J. 2019. On-body bioelectronics: wearable biofuel cells for bioenergy harvesting and self-powered biosensing. <i>Advanced Functional Materials</i> . 1906243.                             |
| <i>Advanced Science</i>              | 15.804                | Zhang L, Baker SL, Murata H, et al. 2019. Tuning butyrylcholinesterase inactivation and reactivation by polymer-based protein engineering. <i>Advanced Science</i> . 1901904.  |
| <i>Annual Review of Immunology</i>   | 21.429                | Klein RS, Garber C, Funk KE, et al. 2019. Neuroinflammation during RNA viral infections. <i>Annual Review of Immunology</i> . 37:73–95.  |
| <i>Biomaterials</i>                  | 10.273                | Chen J, Su FY, Das D, et al. 2019. Glycan targeted polymeric antibiotic prodrugs for alveolar macrophage infections. <i>Biomaterials</i> . 195:38–50.  |
| <i>Cell</i>                          | 36.216                | Davis CW, Jackson KJ, McElroy AK, et al. 2019. Longitudinal analysis of the human B cell response to Ebola virus infection. <i>Cell</i> . 177(6):1566–82.  |
| <i>Cell Host &amp; Microbe</i>       | 15.753                | Bornholdt ZA, Herbert AS, Mire CE, et al. 2019. A two-antibody pan-ebolavirus cocktail confers broad therapeutic protection in ferrets and nonhuman primates. <i>Cell Host &amp; Microbe</i> . 25(1):49–58.                |

|   |        |   |
|---|--------|---|
| <b>Cell Host &amp; Microbe</b>                  | 15.753 | Wec AZ, Bornholdt ZA, He S, et al. 2019. Development of a human antibody cocktail that deploys multiple functions to confer pan-ebolavirus protection. <i>Cell Host &amp; Microbe</i> . 25(1):39–48.                    |
| <b>Chemistry of Materials</b>                   | 10.159 | Lyu J, Zhang X, Li P, et al. 2019. Exploring the role of hexanuclear clusters as Lewis acidic sites in isostructural metal-organic frameworks. <i>Chemistry of Materials</i> . 31(11):4166–72.                          |
| <b>Chemistry of Materials</b>                   | 10.159 | Goswami S, Noh H, Redfern LR, et al. 2019. Pore-templated growth of catalytically active gold nanoparticles within a metal-organic framework. <i>Chemistry of Materials</i> . 31(5):1485–90.                            |
| <b>Coordination Chemistry Reviews</b>           | 13.476 | Chen Z, Hanna SL, Redfern LR, et al. 2019. Reticular chemistry in the rational synthesis of functional zirconium cluster-based MOFs. <i>Coordination Chemistry Reviews</i> . 386:32–49.                                 |
| <b>Coordination Chemistry Reviews</b>           | 13.476 | Drout RJ, Robison L, Farha OK. 2019. Catalytic applications of enzymes encapsulated in metal-organic frameworks. <i>Coordination Chemistry Reviews</i> . 381:151–60.  |
| <b>Journal of the American Chemical Society</b> | 14.695 | Chen W, Cheng CA, Cosco ED, et al. 2019. Shortwave infrared imaging with J-aggregates stabilized in hollow mesoporous silica nanoparticles. <i>Journal of the American Chemical Society</i> . 141(32):12475–80.         |
| <b>Journal of the American Chemical Society</b> | 14.695 | Chen Z, Li P, Zhang X, et al. 2019. Reticular access to highly porous aca-MOFs with rigid trigonal prismatic linkers for water sorption. <i>Journal of the American Chemical Society</i> . 141(7):2900–05.              |
| <b>Journal of the American Chemical Society</b> | 14.695 | Aulakh D, Liu L, Varghese JR, et al. 2019. Direct imaging of isolated single-molecule magnets in metal-organic frameworks. <i>Journal of the American Chemical Society</i> . 141(7):2997–3005.                          |
| <b>Journal of the American Chemical Society</b> | 14.695 | Luo TY, Liu C, Gan XY, et al. 2019. Multivariate stratified metal-organic frameworks: diversification using domain building blocks. <i>Journal of the American Chemical Society</i> . 141(5):2161–68.                   |
| <b>Journal of the American Chemical Society</b> | 14.695 | Clark BD, DeSantis CJ, Wu G, et al. 2019. Ligand-dependent colloidal stability controls the growth of aluminum nanocrystals. <i>Journal of the American Chemical Society</i> . 141(4):1716–24.                          |
| <b>MMWR Recommendations and Reports</b>         | 14.874 | Bower WA, Schiffer J, Atmar RL, et al. 2019. Use of anthrax vaccine in the United States: recommendations of the Advisory Committee on Immunization Practices, 2019. <i>MMWR Recommendations and Reports</i> . 68(4):1. |
| <b>Nano Letters</b>                             | 12.279 | Wei X, Beltrán-Gastélum M, Karshalev E, et al. 2019. Biomimetic micromotor enables active delivery of antigens for oral vaccination. <i>Nano Letters</i> . 19(3):1914–21.   |
| <b>Nano Letters</b>                             | 12.279 | Gan XY, Keller EL, Warkentin CL, et al. 2019. Plasmon-enhanced chemical conversion using copper selenide nanoparticles. <i>Nano Letters</i> . 19(4):2384–88.  |
| <b>Nature Biomedical Engineering</b>            | 17.135 | Yamankurt G, Berns EJ, Xue A, et al. 2019. Exploration of the nanomedicine-design space with high-throughput screening and machine learning. <i>Nature Biomedical Engineering</i> . 3(4):318–27.                        |
| <b>Nature Cell Biology</b>                      | 17.728 | Skamagki M, Correia C, Yeung P, et al. 2019. Author correction: ZSCAN10 expression corrects the genomic instability of iPSCs from aged donors. <i>Nature Cell Biology</i> . 21(4):531–2.                                |

## Peer-Reviewed Publications Affiliated with DTRA-JSTO (continued)

|  |        |   |
|--|--------|---|
| <i>Nature Chemical Biology</i>                   | 12.154 | Huang J, Liu S, Zhang C, et al. 2019. Programmable and printable <i>Bacillus subtilis</i> biofilms as engineered living materials. <i>Nature Chemical Biology</i> . 15(1):34–41.  |
| <i>Nature Communications</i>                     | 11.878 | Sichtig H, Minogue T, Yan Y, et al. 2019. FDA-ARGOS is a database with public quality-controlled reference genomes for diagnostic use and regulatory science. <i>Nature Communications</i> . 10(1):1–3.   |
| <i>Nature Communications</i>                     | 11.878 | Casulli J, Fife ME, Houston SA, et al. 2019. CD200R deletion promotes a neutrophil niche for <i>Francisella tularensis</i> and increases infectious burden and mortality. <i>Nature Communications</i> . 10(1):1–9.   |
| <i>Nature Communications</i>                     | 11.878 | Purcell O, Wang J, Siuti P, et al. 2019. Publisher correction: encryption and steganography of synthetic gene circuits. <i>Nature Communications</i> . 10(1):1–1.   |
| <i>Nature Communications</i>                     | 11.878 | Brannan JM, He S, Howell KA, et al. 2019. Post-exposure immunotherapy for two ebolaviruses and Marburg virus in nonhuman primates. <i>Nature Communications</i> . 10(1):1–10.   |
| <i>Nature Communications</i>                     | 11.878 | King LB, West BR, Moyer CL, et al. 2019. Cross-reactive neutralizing human survivor monoclonal antibody BDBV223 targets the ebolavirus stalk. <i>Nature Communications</i> . 10(1):1–8.   |
| <i>Nature Communications</i>                     | 11.878 | Baker SL, Munasinghe A, Kaupbayeva B, et al. 2019. Transforming protein-polymer conjugate purification by tuning protein solubility. <i>Nature Communications</i> . 10(1):1–2.  |
| <i>Nature Microbiology</i>                       | 14.633 | Kim AS, Austin SK, Gardner CL, et al. 2019. Protective antibodies against Eastern equine encephalitis virus bind to epitopes in domains A and B of the E2 glycoprotein. <i>Nature Microbiology</i> . 4(1):187–97.   |
| <i>Nature Neuroscience</i>                       | 21.126 | Garber C, Soung A, Vollmer LL, et al. 2019. T cells promote microglia-mediated synaptic elimination and cognitive dysfunction during recovery from neuropathogenic flaviviruses. <i>Nature Neuroscience</i> . 22(8):1276.   |
| <i>Nature Reviews Cancer</i>                     | 51.848 | Wu MR, Jusiak B, Lu TK. 2019. Engineering advanced cancer therapies with synthetic biology. <i>Nature Reviews Cancer</i> . 19(4):187–95.  |
| <i>Nature Structural &amp; Molecular Biology</i> | 12.109 | West BR, Wec AZ, Moyer CL, et al. 2019. Structural basis of broad ebolavirus neutralization by a human survivor antibody. <i>Nature Structural &amp; Molecular Biology</i> . 26(3):204–12.  |
| <i>Neuron</i>                                    | 14.403 | Cain MD, Salimi H, Diamond MS, et al. 2019. Mechanisms of pathogen invasion into the central nervous system. <i>Neuron</i> . 103(5):771–83.   |
| <i>Science</i>                                   | 41.063 | Mullin E. 2019. Nanoscavengers could protect people from sarin gas, other nerve agents. <i>Science</i> . <a href="https://www.sciencemag.org/news/2019/01/nanoscavengers-could-protect-people-sarin-gas-other-nerve-agents#">https://www.sciencemag.org/news/2019/01/nanoscavengers-could-protect-people-sarin-gas-other-nerve-agents#</a> . Accessed April 13, 2020. |
| <i>Science Advances</i>                          | 12.804 | Yen TJ, Lolicato M, Thomas-Tran R, et al. 2019. Structure of the saxiphilin: saxitoxin (STX) complex reveals a convergent molecular recognition strategy for paralytic toxins. <i>Science Advances</i> . 5(6):eaax2650.   |

|                                       |        |   |
|---------------------------------------|--------|---|
| <b>Science Advances</b>               | 12.804 | O’Kane PT, Dudley QM, McMillan AK, et al. 2019. High-throughput mapping of CoA metabolites by SAMDI-MS to optimize the cell-free biosynthesis of HMG-CoA. <i>Science Advances</i> . 5(6):eaaw9180.                |
| <b>Science Advances</b>               | 12.804 | Robotjazi H, Weinberg D, Swearer DF, et al. 2019. Metal-organic frameworks tailor the properties of aluminum nanocrystals. <i>Science Advances</i> . 5(2):eaav5340.   |
| <b>Science Translational Medicine</b> | 17.2   | Ko SY, Akahata W, Yang ES, et al. 2019. A virus-like particle vaccine prevents equine encephalitis virus infection in nonhuman primates. <i>Science Translational Medicine</i> . 11(492):eaav3113.                |
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