THE DISPATCH

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From the Program Manager

Welcome to the latest issue of *The Dispatch.* This month, we have articles from Test Support personnel describing their missions and contributions in fulfilling DTRA's mission. Many areas of test support are located on Kirtland AFB, New Mexico.

The Counter-WMD Technology Department (J9CX) researches, develops, demonstrates, and transitions innovative technologies and capabilities to actively counter the full spectrum of CBRNE threats, while test support personnel provide end-to-end test event planning, management, safe execution, and results analysis supporting the DOD, Federal Agencies, and friendly nations' programs to counter proliferation of WMD.

The Test Support personnel have a long history of safe, effective, and efficient testing, and they are very proud of their accomplishments. I am sure you will enjoy learning about their capabilities.

Please contact us directly if you ever have any questions or comments related to the DTRIAC at dtriac@dtra.mil.

Thanks,

Joyce Rowell

DTRIAC Interim Program Manager

Contact Us

dtriac@dtra.mil
or visit us at
www.dtriac.dtra.mil

Ask the IAC

How does DTRIAC incorporate private holdings into the collection?

Any collection that pertains to DTRA's mission can be submitted for inclusion into the DTRIAC collection. Send an email containing a description of the collection to DTRIAC@dtra.mil, and the appropriate collections area will respond, according to the description.

Appropriate arrangements for receiving the collection will be made, either via mail or truck. If the collection contains classified material, it must be inventoried before being received by DTRIAC to follow proper transmission and handling procedures. If the collection is unclassified, an inventory is not required but is still helpful.

After DTRIAC has received the collection, subject matter experts will review the collection and prioritize which documents, films, and photographs are the most appropriate to include in the collection. These items will be cataloged and scanned using the same process as other submissions. The collection name will be noted in the catalog metadata, so researchers can easily find all media belonging to that collection.

Measurement Techniques for High-Temperature Data Acquisition

DTRA performs a wide variety of high-explosive blast events. An important component in the agency's mission data set is the measurement of fast response high-temperature phenomenon data associated with these events. Test Diagnostics has developed an accurate method through which to acquire this difficult-to-obtain temperature data.

Test Diagnostics has internally developed and continues to improve two fast response high-temperature measurement systems that can sustain a harsh blast environment of up to 500 psi and accurately obtain data in excess of 3,000 °C with a response time of 300 µs. The first system is a completely self-contained near-infrared (NIR) ratio pyrometry four-color system (700–2,400 µm range). The second system is also an NIR ratio pyrometry system that uses an expendable front-end mounting configuration which secures four fiber optic cables to the specific measurement location. Each of the four cables is assigned a specific narrowband IR center wavelength. The fiber optic design provides a low-cost configuration that physically separates the measurement point subject to the severe blast environment from the vulnerable instrumentation components (e.g., photodiodes, conditioning electronics). These cables convey the infrared energy data produced by the fireball to the physically protected NIR indium gallium arsenide (InGaAs) photo detectors whose voltage output signals are then processed to provide the fireball temperatures.

Fireball at the fully instrumented GAGAMP event, Alberta, Canada. The intensity of the fireball in these types of tests can make it difficult to obtain data.

Test Diagnostics ensures that these temperature measurement systems have the capability to measure under extremely severe environments (i.e., fragmentation, caustic chemicals, hot blast particulates). The custom design must include extensive protection including fragmentation resistant coverage to the sensor heads, thermal mitigation to minimize any high-temperature effects to the front end conditioning electronics, and fragmentation protection to the conditioning electronics. DTRA has deployed these fiber optic ratio pyrometry systems to support a variety of events including Agent Defeat (HUMBLE YUCCA, DISTINCT RAPTOR), high-temperature charge diagnostic measurements (HUMBLE GINGKO), and internal fireball temperature measurements (GAGAMP event).

Test Science and Technology Support

Test Science and Technology Support is involved in the test process from start to finish, working to ensure an accurate test management process. It directly supports the warfighter on numerous programs by evaluating the effectiveness and performance of a weapon system against an operationally representative target. DTRA is responsible for the following mission objectives:

- Supporting cutting-edge testing by providing scientific data on weapons effects and effectiveness
- Providing innovative research and development through the use of predictive models, including those for targeting and weaponeering as well as for physics and phenomenology

Test Science and Technology Support *(continued)*

Test Science and Technology Support provides testing and research support for the following:

- Chemical and biological simulants field testing
- Structural response testing
- Geotechnical characterization
- Seismic and geotechnical field measurements on tests
- Structural and rock damage testing and model development
- Weapons, tactics, and effects testing against realistic targets
- Anti-terrorism structural testing
- Blast mitigation model development
- Phenomenology tests and model development
- Advanced energetic testing and model development
- Crater measurements
- Far-field air blast and ground shock measurements
- High performance computational analysis

Customers

DTRA program managers
National Nuclear Security Administration
U.S. Armed Forces
National Aeronautics and Space Administration
Geological Society of America
Centers of Disease Control
Department of Homeland Security
United Kingdom Atomic Weapons Establishment
United Kingdom Ministry of Defence
Federal Bureau of Investigation
Bureau of Alcohol, Tobacco, Firearms, and Explosives
Singapore Ministry of Defence
Special Operations Command
Air Force MOP Quick Reaction Team
Air Force Research Laboratory
Sandia National Laboratories
Air Armament Center
Air Force Technical Applications Center
warfighters
modelers

Facilities and Infrastructure

Facilities at Kirtland AFB include:

- Advanced Energetic Test Facility
- Component Test Structure-3 (CTS-3)
- Column Test Reaction Structure (CTRS)
- Scaled Tunnels
- Thermal Radiation Test Facility (TRTF)
- Technical Evaluation Assessment and Monitoring Site (TEAMS)

TRTF supports DOD, NASA, and other industry agencies involved in evaluating the responses of materials, components, and subsystems exposed to intense thermal radiation of up to 2,200–3,000 K blackbody temperature. The primary use of TEAMS has been for training exercises for detecting and identifying radiological sources, testing various types of detectors to identify different sources, and first responder and decontamination training. It also supports DHS and Customs Border Patrol efforts on securing and screening cargo, seaports (domestic and international), and U.S. border crossings and weigh stations. The LBTS was used to simulate air blast and

Test Science and Technology Support *(continued)*

Air Blast

- Improved modeling
- Explosive yield to tunnel size
- Roughness
- Dust
- Advanced energetics

Structures

- Progressive collapse
- Concrete columns
- Wood structures
- Building facades
- Steel jackets

Damage

- Structural response
- Tunnel response
- Localized, complete failure
- Best database collected
- Archival

Geology–RPSS

- Rock mass characterization
- Correlation to penetrability
- Zones of damage
- Real time seismic information and robust modeling
- Simple geology and siting

Nuclear Weapons Effects and Radiation Detection and Assessment

- Thermal screening tests
- Thermal property evaluation
- Thermal ablation
- Nuclear airblast and thermal effects and survivability
- Radiation detection and detector validation
- Radiation first responder and decontamination training
- Securing and screening cargo, seaports, and US border crossings

thermal environments for a nuclear detonation of up to 600 kT as a means to test military test articles for nuclear weapons effects and survivability.

Testing and Modeling Activities

Test Science and Technology Support is comprised of program managers, test scientists, and test coordinators. Each team member is instrumental to the robust milestone review process that ensures programmatic, fiscal, and technical soundness of all assigned tests. This gold standard is achieved by using computational methods pre- and posttest to evaluate the weapon environment and resolve issues. For instance, findings regarding Massive Ordnance Penetrator (MOP) late-time aft-end oscillations were used to improve the aft end and fusing for a successful MOP follow-on test. Simulating penetration mechanics involves the ability to handle kinematics of material failure and the flow of completely failed material. Additional research and computational methods are being pursued to increase the accuracy of modeling to more robustly predict the time and depth of weapon position.

Test Science and Technology Support brings the science to the fight with a unique capability to scientifically measure and interpret diagnostic data and provide that data to users and modelers. The branch provides specialized, in-house capabilities through its seismic and digital photogrammetry laboratories. Its pre- and posttest computational support helps customers to better understand the weapon environment. Test results are independently verified with TTP validation that covers all USAF, USN, USMC, and air-to-ground bombing platforms.

Test Science and Technology Support is the technical link to the entire testing process with its critical role in combating weapons of mass destruction by evaluating weapon system effectiveness and performance. It takes great pride in its mission and the great people that make it happen.

Test Fielding

When a warfighter or program manager wants to evaluate the effectiveness and performance of a weapon system against an operationally representative target, they come to DTRA's Research and Development Directorate (J9). Within this directorate, Test Fielding plays a major role in assisting the customer with constructing test articles and overseeing the test management process for the developmental test program. Test Fielding is responsible for the following mission objectives:

- Ensuring all tests meet customer's test objectives and are conducted on time and within budget
- Providing a systematic process and approach for managing the planning and execution of the customer's test program
- Providing design and construction engineering support to counter and defeat the proliferation of weapons of mass destruction (WMD)
- Developing small or large-scale operationally-representative targets or test articles
- Providing technical assistance for engineering and construction support

Test Fielding is comprised of four areas:

- Test Fielding
- Engineering and Construction
- Permanent High-Explosive Test Site
- Technical Evaluation Assessment Monitor Site

Test Fielding

Test fielding is responsible for managing the test planning and execution process. To accomplish this task, each test is assigned a test team consisting of military members, DOD civilians, and support contractors. Each test team member provides a level of technical expertise used to develop the test concept, test design, test methodology, and execution plan. The test team ensures the test article is properly constructed and the instrumentation and optics are designed and fielded to meet the test scientist's test objectives. The test group director (TGD) is responsible for developing the test execution plan and leading the test team in test planning and design, test article construction, test scheduling, budget compliance, and the safe execution of the test event. The TGD follows a well-defined test milestone process, closely monitoring the progress of a given test program from test concept to posttest activities. The results of the milestone test process are briefed to senior leadership staff at the Senior Review Panel.

Engineering and Construction

This area is responsible for designing and constructing the small and large-scale test articles used to support each test.

Engineering and construction has a certified professional construction engineer that assists the customer in defining the test requirements for a given test article. When the test requirements are fully defined, the construction engineer translates these requirements into functional construction designs which are then used by the construction support contractors to build the test article. Test Fielding maintains in-house staff that provides design expertise, survey support, quality assurance, material testing, and concrete production.

Test Fielding *(continued)*

Permanent High-Explosive Test Site

The Permanent High-Explosive Test Site (PHETS) is located at the northern test range at White Sands Missile Range (WSMR).

PHETS provides the test infrastructure support at WSMR. To save the customer money, PHETS maintains a warehouse of government furnished equipment (vehicles, large and small equipment) that is used to support the construction support contractors in building the test articles at WSMR. PHETS also coordinates with WSMR to ensure logistical support is provided for test bed preparation, range support, and test execution.

Technical Evaluation Assessment Monitor Site

The Technical Evaluation Assessment Monitor Site (TEAMS) is located at Kirtland Air Force Base, New Mexico. TEAMS provides the warfighter and non-DOD agencies low-cost, multi-use test bed facilities to conduct preliminary evaluation, assessment, demonstration, and training to detect, combat, and defeat WMD for both domestic or international threats.

TEAMS has become an important national asset to both military and civilian agencies working to advance the development and fielding of improved radiological and nuclear detection systems. TEAMS serves as a DTRA-based training resource for DOD and National Nuclear Security Administration (NNSA) radiation survey teams, joint explosive ordnance disposal teams, and DOD/NNSA first responders and National Guard civil support teams.

TEAMS provides adaptability infrastructure to support two national laboratories and civilian companies doing research in radiological and nuclear detection. TEAMS is staffed by two full-time personnel who coordinate and schedule tests and training activities at the site.

Test Fielding plays an important role in combating WMD by evaluating weapon system effectiveness and performance. It provides the customer with expertise in test management, test article construction, test support, and test infrastructure and facilities. Test Fielding is a great place to work with a great mission on the cutting edge of weapon developmental technologies—plus they get to blow things up for a living!

Radiation/Nuclear Program

The J9 Radiation/Nuclear (Rad/Nuc) Program is housed at the DTRA Technical Evaluation Assessment Monitor Site (TEAMS) and provides on-site as well as mobile off-site support. The Rad/Nuc Program includes a precision static test laboratory, a dynamic test laboratory, and a calibration standard portal detection system. The precision test laboratory supports static testing of handheld, portable, or other detection devices or systems. The laboratory utilizes low-Z tables with a precise coordinate location system to perform accurate and repeatable detection sensitivity and identification testing. The dynamic test laboratory also supports precision dynamic (motion) testing of small, handheld, portable, or other detection devices or systems and utilizes the same low-Z tables and coordinate location system as the precision test laboratory but has a computer-controlled automated source motion system to enable repeatable dynamic accuracy and sensitivity testing of a moving source. The calibration standard portal detection system consists of a calibrated standard detector row and provides support for testing and verifying portal detection systems under test.

Radiation/Nuclear Program *(continued)*

The Rad/Nuc Program assets include a cohesive, integrated instrumentation control network and support the integration of wired, fiber optic, and wireless systems for combined display, camera control, device under test (DUT) control, and DUT data collection. Tests and training exercises are conducted from the Data Control Center (DCC), which supports test configuration, monitor and control, and data archive (test database). For data analysis, the DCC is equipped with modern analysis applications including Gamma Detector Response and Analysis Software (GADRAS), PeakEasy, and Monte Carlo N-Particle eXtended (MCNPX).

Additionally, a site-wide pan/tilt/zoom high resolution digital camera network with online video data storage is available to support test and training documentation. J9 has also developed a universal input/output (I/O) unit. This unit supports all current physical I/O standards (USB, RS-232, Ethernet, RS-485, etc.) for DUT connection to the instrumentation control test network. The hardware capability is expandable. The universal I/O unit also supports software plug-in capability for current and future software or driver compatibility. This allows any device with proprietary software to be integrated into the control network.

The J9 Rad/Nuc Program utilizes portable detection systems as calibration standards. These devices, which include He3, Nal, and Labr technologies, are well characterized and are used for comparative analysis and detection performance evaluation.

In addition to on-site program support, the J9 Rad/Nuc Program also provides a Mobile Command and Control System (MCCS) to support off-site testing. The MCCS contains a Mobile Command Center (MCC) that functions as DCC. Mobile assets also include wireless network and remote pan–tilt–zoom camera systems.

Diagnostics Support

The mission of Diagnostics Support is to research, develop, and demonstrate innovative technologies and capabilities to actively counter the full spectrum of chemical, biological, radiological, nuclear, and explosives (CBRNE) threats. DTRA maintains the high level of responsiveness and expertise in the areas of CBRNE testing required to support current and upcoming programs directly related to DTRA's counter-weapons of mass destruction (WMD) mission. A main testing objective is to provide the most accurate data utilizing the most advanced, fully calibrated National Institute of Standards and Technology (NIST) technology for data acquisition systems, sensors, and ancillary instrumentation to support the warfighter in potential CBRNE warfare environments. This data is then used to support and validate modeling and simulation capabilities (reach-back and test concept refinement). It also provides a tool that assists in establishing a standard that will serve to validate future CBRNE analysis developments for both warfighter and civil defenses. Additionally, Diagnostics Support maintains the DOD's finest team of instrumentation engineers, scientists, photo technologists, and supporting contractors to meet any testing requirement. Diagnostics Support maintains world-class testing capability in all areas of instrumentation technical support including the emerging areas of chemical and biological counter-WMD testing, radiation and nuclear detection and attribution, seismic and acoustic monitoring, as well as the traditional explosive environmental measurement and testing.

Diagnostics Support maintains three main areas of diagnostic support including instrumentation development, fielding operations, and optical instrumentation support. Instrumentation development involves the research and development of new state-of-the-art sensors and data acquisition systems to support testing based on modern and emerging technologies and process improvements including developing long range (5-year) upgrade and replacement plans. Diagnostics Support delivers end-to-end instrumentation fielding operations support by providing instrumentation engineers, optics engineers, and electronics technicians to manage all diagnostic activities. Additionally, fielding also includes sensor support for all J9 test team testing events. Test instrumentation requirements are acquired and evaluated, and instrumentation systems are designed to support these requirements. Instrumentation system performance is monitored and evaluated, post event status reports are prepared, and posttest data (environmental and optical data) analysis is supported.

Integrated Support

In an era of austere budgets, DTRA Research and Development Directorate has teamed with White Sands Missile Range (WSMR) Test Center Range Operations Directorate (WSR) and Materiel Test Directorate (WSM); WSMR Garrison Directorate of Public Works (DPW); and USAF 586th Flight Test Squadron, Detachment 1, to hold quarterly test scheduling and infrastructure meetings. Mr. Jeff Thomas has routinely highlighted the value of these meetings as a forum to continuously improve the partnership between DTRA and WSMR in the effective and efficient utilization of resources. The goals of these meetings are to address any major or minor issues, and evaluate schedules and requirements to continue outstanding execution of a shared developmental testing mission.

At the kickoff meeting held 25 May 2012, Mr. Thomas shared J9's anticipated long-term use of WSMR, including Capitol Peak Tunnel Complex in fiscal years 2014–2017 and construction of a replacement test article for Large Test Structure-2 (LTS-2). Mr. Michael Garcia provided a briefing of how WSR's test scheduling function was evolving into a less flexible, yet more reliable, predictable, and stable capability in order to support DTRA and other WSMR customers. This initial meeting set the stage for a forum that continues to provide for improved communication and collaboration between the aforementioned stakeholders.

In addition to discussions on evolving test schedules in support of current test programs, stakeholders have addressed the following: electrical power reliability at J9's Permanent High-Explosive Test Site (PHETS) and Stallion Control Center (SCC), the transition to a common WSMR recycling program, WSR's 60-day range scheduling process, and the service catalog estimation tool used to assist test planners in the development of early, rough WSMR cost estimates. Coordination between Diagnostics Support and TRAX, WSMR's optics contractor, has resulted in the use of J9 optics assets to support DTRA test requirements when TRAX equipment inventory is inadequate. Coordination between other DTRA branches and WSMR Garrison Environmental has resulted in the WSMR simulant license renewal (mutually beneficial to DTRA and WSMR future customers with Agent Defeat-like objectives), initial planning of new granite and sandstone test bed areas for future J9 test objectives, and final disposition and turnover of the Large Blast Thermal Simulator (LBTS) to WSMR.

While much has been accomplished, these meetings will continue to provide an opportunity to coordinate change and plan for a future that is mutually beneficial to both DTRA and WSMR in maintaining focus on meeting their shared testing mission. The next meeting is scheduled for 17 October 2013.

LBTS at WSMR

Phishing, Pharming, and Whaling

You are using a MacBook Pro®, so there is no need to worry about viruses, worms, Trojans, or malware—right? Actually, while every mail system has issues and benefits, for the most part it is the attack vector of choice for malicious actors on the Internet today; used to insert code on your computer and gain access to your personal data—credit card information, health information, bank information, and passwords. This does not just impact your personal computer—if you are connected to a network, malicious code can soon populate and move throughout the network and attach itself to any computer. The malware installed is called Advanced Persistent Threat (APT). The goal of APT is to remain resident on your computer surreptitiously and not be discovered. The most advanced APTs have been found to be resident on computer systems and networks for years.

In a 2012 article entitled "Spear-Phishing Email: Most Favored APT Attack Bait," Trend Micro Inc. stated that the goal of APT is "to gain entry to a target organization's network and obtain confidential information." In addition

Phishing, Pharming, and Whaling *(continued)*

to obtaining your passwords, credit card numbers, and personal information, APT's goal is to remain resident without being recognized while collecting data from everything attached to the affected computer.

Phishing is the practice of sending a message to a large group of unrelated people, i.e., the spam you get each day. Online training provided by the Defense Information Systems Agency (DISA) states that "phishers try to trick you by using an email or popup message as bait or [a] lure." The message usually claims to be from a company or other entity that you normally do business with; however, when you click on the associated link, you are redirected to a malicious site.

Spear phishing involves sending a similar message to a smaller, more targeted group of people, such as friends you communicate with each day. It is important to verify that a message you receive from a friend was actually sent by that friend. It may be that their account has been compromised and everyone in their contact list got the same message, personalized to appear authentic.

Whaling is the practice of sending very individualized messages to high-level executives, and particularly persons employed in the DOD. They are just targets waiting to be plucked in the eyes of hackers. This is why it is very important to use caution when posting information on social networking sites—especially regarding where you work, where you live, and what you do for a living.

Pharming is another way that advisories can gain access to computers and networks. Compromised Domain Name Service (DNS) can be "poisoned" by changing the Internet Protocol (IP) address for intended web traffic to a falsified web server, but this threat can also affect a user's computer by changing the host's file on the target computer. This latest attack vector is harder to implement, but much more effective. Once the host's file is changed, the user may not know if the site they are surfing to is actually the correct one. Clicking on a malicious email or link or surfing to an affected website can also expose a user to this attack.

Most phishing, spear phishing, and whaling messages intend for the person being targeted to open an attachment or click on a link on a malicious website. It is important that users understand that when they click on an attachment, or a web link in an email, potential danger exists. Phishing may not only result in identity theft and financial loss, "phishing may also jeopardize the security of your organization's information and information systems," according to DISA's web-based training.

Social Networking and You

Social engineering is used to obtain a user's access credentials, such as a user name and a password, in order to commit online identity theft. Social engineering is carried out using social networking sites such as Facebook, Twitter, LinkedIn, Instagram, and new programs that are being introduced each day such as Vine—a program linked to Twitter (and soon to be added to Facebook) that allows a user to upload six-second videos. DOD employees, contractors, or vendors are more likely to be targeted for malicious code; as a result, they need to understand what they should, and should not, post to their accounts. DISA's social networking training site is a great resource for this information: http://iase.disa.mil/eta/sns_v1/sn/launchPage.htm.

It is important that end users follow simple user name and password policies to protect their identity and to protect computers from attacks. DISA produces an unclassified version of computer security training that will help users stay abreast of the latest threats and how to take protective measures. The DISA website (http://iase.disa.mil/eta/phishing_v2/phishing_v2/launchPage.htm) contains information on phishing that addresses protection as well as steps to follow in the event that a computer or personal credentials have been compromised.

Do This; Not That

When you click on that attachment or link in an email from your bank, you may end up at a malicious website that looks and feels just like the one you are used to using. If you enter your user name and password, you are now compromised. Instead, go directly to the website and check to see if there is an actual message waiting for you (this is particularly important for LinkedIn requests). If no message is found on the website, you probably received a malicious message. Protect yourself; delete the message; do not forward or respond to it.

DTRIAC Collection Additions

DTRA Technical Reports

DTRA-TR-09-18, Addendum to IGVN Volume 2, Extensions to the Report Detailing Improvements to the Calculation of the Ground Shock Vulnerability Number

The addendum to DTRA-TR-09-18 modifies the Global Damage Model by replacing an approximation for the direction of the principle free field strain vector with the true direction. Additionally, improvements and corrections are made to the Local Damage Model by means of insertions in DTRA-TR-09-18.

DTRA-TR-12-003, Upper-Bound Radiation Dose Assessment for Military Personnel at McMurdo Station, Antarctica, between 1962 and 1979

U.S. veterans who were assigned at McMurdo Station, Antarctica, from 1962 to 1979, have expressed concern that their health may have been affected by radiological releases from an onsite nuclear power plant. This report presents the results of the Department of Defense's radiation dose assessment for McMurdo Station veterans who were not monitored for occupational radiation exposure. This assessment determined that the radiation doses were low and the associated probability that disease could have arisen from these doses is also low. Finally, recommendations are provided for McMurdo Station veterans, their dependents, the Department of Veterans Affairs (VA), and the Naval Dosimetry Center regarding the VA radiogenic disease claims process.

DTRA-TR-13-2, Radiation Protection in the Application of Active Detection Technologies

Commentary from the National Council on Hadiation Protection and Measurements (NCRP) Scientific Committee 1-18. NCRP was asked to provide a general review of Active Detection Technology (ADT) and their anticipated uses, to analyze their potential for exposure to humans, and to provide guidelines to ensure that doses to operating personnel and bystanders are within recommended limits. NCRP was further asked to provide recommendations on how to best achieve the recommended guidelines for dose limits.

DTRA-TR-13-3, Radiological Health Protection Issues Associated with Use of Active Detection Technology Systems for Detection of Radioactive Threat Materials

Commentary from the National Council on Radiation Protection and Measurements (NCRP) Scientific Committee 1-19. NCRP was asked to provide a review of health protection and safety issues specifically for the use of active detection technology security systems. It addresses important factors in the design and testing of ADT systems that must be given attention prior to their deployment.

DTRA-TR-13-37, A Scalable Technology for Monitoring Health Status and Surveying Infections

There were two goals. One was to determine if the peptide chip technology could migrate from slides (CIM10K) to chips (HT330K). The second was to determine the feasibility of making peptide arrays of pathogen proteomes to multiplex for diagnosing infections.

DTRA-TR-13-38, State-of-the Art Electromechanically Cooled (EMC) High Purity Germanium (HPGe) Detector and Spectrometer

High Purity Germanium (HPGe) high resolution radiation detectors require cooling to cryogenic temperatures, typically 75-100 K, during operation. In most instances, this cooling is provided by liquid nitrogen, which cools the detector by evaporation. There are a few commercial designs in which mechanical refrigerators are used in place of the liquid nitrogen. Generally these mechanical refrigerators are large and require hundreds of watts of power to operate. Mechanical coolers have been limited to fixed-base laboratory.

DTRA-TR-13-39, Microfluidics-Based Long Pathlength Optical Spectrometer System (LPOSS)

The Mini-Long Pathlength Optical Spectrometer System (LPOSS) was developed to be an automated sequential flow injection analysis device. Past attempts to develop a viable LPOSS instrument proved difficult. Both method of development and hardware development took longer than expected and the prototype LPOSS units proved unreliable. This task was proposed with expectation that a functioning LPOSS unit and methods would be available. Initially, it was believed that this was the case, and after only a minor increase to the amount of memory upgrade was implemented, it became apparent that the LPOSS has other problems. To prepare the LPOSS, as currently designed, would not perform as intended in a field test and the effort was ended.

DTRA-TR-13-41, Pixilated Detector

This project focused on the development of mercuric iodide (HgI_2) pixilated detectors utilizing the "Single-Polarity charge sensing technique." This technique can improve the energy resolution and reduce the noise of gamma-ray room-temperature HgI_2 detectors. The efforts were focused not only on detector development, but also on the improvement of existing elements and the development of new elements of HgI_2 detector technology.

DTRIAC Collection Additions *(continued)*

DTRA-TR-13-42, Long Path length Optical Spectrometer System (LPOSS)

Significant effort has been devoted to the development of technologies for monitoring the nonproliferation of chemical weapons under the Chemical Weapon Convention (CWC). The need for rapid screening for CW materials during on-site inspections has been identified. A variety of analytical methods have been identified and developed to monitor the presence of CW compounds including the degradation products that remain as a result of the exposure of chemical agents to the environment Since the chemical agents themselves are usually unstable when exposed to environmental conditions, they tend to undergo hydrolysis, which lead to more stable, and less hazardous degradation compounds. These degradation compounds may serve to indicate past deployment of chemical agents or their production and/or stockpiling.

DTRA-TR-13-43, High-Resolution Structural Monitoring of Ionospheric Absorption Events

Under this task, we have augmented the hardware of the Long Wavelength Array (LWA) to provide a significant riometric capability, in order to search for anomalous absorption events that are associated with radiation belt precipitation events. Although limitations arising from initial data quality and radio frequency interference (RFI) have slowed implementation, the DTRA-supported augmentations are being incorporated into the standard data flow of the Prototype All-Sky Imager (PASI), in order to give real-time, 24/7 riometry. Incorporation of an outrigger site, to enable treatment of the unknown structure of the celestial background and the effects of confusion noise, was completed. However, RFI issues have prevented combination of outrigger data with LWA1.

DTRA-TR-13-44, Operation Tomodachi Registry: Radiation Data Compendium

Department of Defense affiliated individuals were potentially exposed to radiation as a result of the Fukushima Daiichi Nuclear Power Station radiological releases that followed the earthquake and tsunami on March 11, 2011. This compendium provides an open source document of the measured and derived input values used to calculate radiation doses of the DoD-affiliated individuals reported in DTRA-TR-12-001 "Radiation Dose Assessments for Shore-Based Individuals in Operation Tomodachi" (Cassata et al., 2012); DTRA-TR-12-004 "Radiation Internal Monitoring by In Vivo Scanning in Operation Tomodachi" (Cassata et al., 2013); DTRA-TR 12-017 "Radiation Dose Assessments for the Embryo, Fetus, and Nursing Infant during Operation Tomodachi" (Falo et al., 2013); and DTRA-TR-12-041 "Radiation Doses for Fleet Based Individuals in Operation Tomodachi" (Marro et al., 2013).

DTRA-TR-13-46, Bulk Composite Materials for Detection of Gamma Radiation: Phase II

Nanocomposites were developed under SBIR Phase II funding for the purpose of demonstrating an enabling technology for the manufacture of bulk scintillating composite materials that have gamma detection properties comparable to single crystal NaI but with increased manufacturability. Efforts focused on producing bulk nanocomposites of known scintillating materials with loadings of 50 wt% nanoparticles. A special effort was placed on the development of CeBr3 nanoparticles.

DTRA-TR-13-48, Low Power, Room Temperature Systems for the Detection and Identification of Radionuclides from Atmospheric Nuclear Tests

For half a century, CdZnTe/CdTe has been investigated for producing radiation detectors. Albeit some success, detector performance and production yield issues remain. Most importantly, the basic science about the factors limiting the detector property and production yield is not understood. The goal of this program is to experimentally and theoretically understand these limiting factors. In addition, techniques will be developed to remove these factors. In this program, 160 CZT crystals have been grown to achieve the program goal. It is discovered that Cd vacancies and Te antisites (Te at Cd sites) are the two major defects that limit the performance of the CZT/CdTe detectors. The introduction of Zn in to the crystals is one way to reduce the density of Te antisites. A process to reduce Cd vacancies has been developed for the growth of CTZ crystals. Zn has been introduced into the crystals to reduce the densities of the Te antisites. Using these approaches, CTZ with Zn contents of 0%, 4%, 10%, 15%, and 20% have been produced and detectors have been fabricated. The best detectors are produced in CZT grown with 10% Zn and 1.5% excess Te. The resolution of 57Co 122 keV peak is less than 5%.

DTRA-TR-13-49, Advanced Discrete-Continuum Methods for Dynamic Loading of Tunnels by Ground Shocks

It has been long recognized that ignoring discrete nature of rock masses and engineering structures such as tunnel walls in numerical analysis may lead to wrong results [1,2,3]. On the other hand, accounting for every single joint in these structures is not computationally feasible. Therefore, for many practical applications using derived homogenized mechanical properties for such systems may be highly desirable. In the case of shock wave loading, the structure may experience strong deformations causing blocks to split and slide along the joints. In these situations the homogenized model cannot replace detailed numerical analysis which accounts for the discrete properties of the structure.

DTRIAC Collection Additions *(continued)*

DTRA-TR-13-53, Thermal Neutron Beam Concentrator (TNBC)

The purpose of this Phase I program was to conduct a feasibility analytical study/design of a combined neutron generator and moderator/concentrator that could meet the following objectives:

(1) Design a neutron generator that can provide a flux greater then 10^9 n/s at an energy of 2.4 MeV

(2) Adapt the neutron generator using moderator and beam-forming concentrator for use in detecting strategic nuclear material (SNM)

(3) Develop an analytical model of the TNBC and provide predictions for detecting SNM at 3 m from the neutron source

DTRA-TR-13-54, Pre-incident Analysis using Multigraphs and Faceted Ontologies

Situational awareness requires acquisition of meaningful and reliable information. In any number of operating environments, large streams of raw information must be analyzed and processed by agencies that range from law enforcement to emergency services during a crisis. This research focuses on information related to strategic intelligence collection and analysis. Reports obtained by such processes reveal only pieces of the situational picture—it is the combination of many reports (from different analysts and sources) that potentially reveal the underlying picture. Decision makers will benefit greatly from methods that organize information into new semantic perspectives different from that in which it was collected. This research investigates the organization of context specific information into semantic graphs and the merging of the semantic graphs into a multigraph to create a faceted ontology. This organizes the viewpoint-specific semantic graph structures into a more readily interpretable, robust, perspective neutral representation. The simpler semantic structures are collected from various sources focusing on, for example, socio-cultural networks, geo-spatial distributions, or threat scenario trees.

DTRA-TR-13-55, Cascading Failures in Coupled Distributed Power Grids and Communication Networks

The University of New Mexico, through its University Strategic Partnership (USP) program, has supported the DTRA initiative aimed at advancing the state of the science and body of knowledge for "Network Adaptability from WMD Disruption and Cascading Failures." Using a combination of graph-theoretic dynamical modeling of cascading failures, optimal distributed control-algorithm design, and distributed estimation techniques, the team has studied how various communication network-based power measurement and control approaches impact the robustness and efficiency of power networks in the face of WMD-induced cascading failures.

DTRA-TR-13-56, Task 22.2 Benchtop Neutron Detector System

The objective of this task was to design, fabricate, test, and evaluate a prototype benchtop neutron detection system. A high-pressure Helium-3 (He-3) scintillator was considered for detecting thermal and fast neutrons in the presence of intensive gamma radiation. The properties of a high-pressure 3He scintillator were investigated. The decay time of scintillations in in 3He +0.5% Xenon (Xe) gas mixture was found to be 200 ns.The purity of the gas has shown to be of crucial importance to light-output of the scintillator. A specially designed purification system based on molecular ps cooled with liquid was constructed and used for purification of 3He gas.

This Quarter in History

July 1, 1971	The Defense Atomic Support Agency (DASA) is reorganized as the Defense Nuclear Agency (DNA) and becomes solely responsible for sponsoring future weapon effects tests.
July 4, 1934	Leo Szilard filed a patent application for the atomic bomb, describing the concepts of using neutron-induced chain reactions and critical mass. The patent was awarded. Szilard immediately attempted to turn the idea over to the British government so it could be classified and protected under British secrecy laws. Szilard campaigned against the use of atomic weapons for the rest of his life.
August 5, 1963	The United States, Great Britain, and the USSR signed a treaty in Moscow banning nuclear tests in the atmosphere, space, and underwater.
September 23, 1992	The last U.S. nuclear test, JULIN DIVIDER, occurs at the Nevada Test Site.