U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HEARING CHARTER

Keeping America Secure: The Science Supporting the Development of Threat Detection Technologies

Thursday, July 19, 2012
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

I. Purpose

On Thursday, July 19, 2012, the Committee on Science, Space, and Technology will hold a hearing to examine the federally-funded research and development (R&D) of threat detection technologies. Witnesses will describe how threat detection R&D has evolved, including how future threats are anticipated. Witnesses will discuss the "state of the art" of successfully deployed technologies, the boundaries and current challenges to improved physical threat detection, and the ways in which stakeholders conduct and apply research to protect the public and to mitigate threats. Further, witnesses will explore how relevant federal agencies and laboratories coordinate and work with the private sector to ensure that research supports marketable and economical products.

II. Witnesses

Dr. Richard Cavanagh, Director, Office of Special Programs, National Institute of Standards and Technology.

Dr. Huban Gowadia, Acting Director, Domestic Nuclear Detection Office, Department of Homeland Security.

Dr. Anthony Peurrung, Associate Laboratory Director, National Security Directorate, Pacific Northwest National Laboratory.

Dr. Thomas Peterson, Assistant Director, Directorate for Engineering, National Science Foundation.

III. Background

Prior to the September 11th terrorist attacks, the threat of terrorism from both the international and domestic environment was not as ubiquitous as it is today. Screening for threats was limited

in scope, and strategic policies to protect the public were nascent or non-existent. In response to the increasing awareness of domestic threats to the public, the Department of Homeland Security was formed in late 2002 from components of 22 disparate agencies. The importance of early detection through screening and monitoring for explosives, incendiary devices, firearms, chemical, biological, radiological, nuclear, and other dangerous materials was magnified by the September 11th attacks.

To counter the growing list of threats and to prevent a variety of attacks on the country, the U.S. government and the private sector expanded R&D into technologies that could detect dangerous materials in public places where large groups of people gather, and to ensure that we had the capability to respond quickly when a potential threat is identified. The consequent development of technologies such as large scale x-ray and gamma ray machines, radiation portal monitors, and non-intrusive imaging systems have enabled detection and interdiction of nuclear and radiological materials before entering the U.S.

With high-profile events scheduled for the upcoming months including the Summer Olympic Games and the Democratic and Republican National Conventions, there is continued interest in improving existing detection technologies and advancing new ones. The U.S. federal science agencies research, develop, test, and evaluate threat detection technologies. The hearing will examine how R&D informs a layered, risk based system-approach to detecting threats, including advanced intelligence, screening technologies, and securing the environment. The following research and development programs undertaken by the federal government support the advancement and development of threat detection technologies.

National Institute of Standards and Technology

The National Institute of Standards and Technology (NIST) acts as a technical adviser and partner to public safety agencies, the criminal justice community, and industry. NIST's public safety and security activities center around four areas: consumer safety, first responders, homeland security, and law enforcement. NIST has been specifically involved with threat detection and reduction through research conducted on radiological/nuclear detectors; chemical, biological, radiological, nuclear, and explosive (CBRNE) protective equipment; emergency response equipment; and concealed weapon detection. NIST's expertise is leveraged to test existing detection methods, and to develop new standards and technologies for the prevention of and response to terror attacks.

Under NIST's Physical Measurements Laboratory, (PML) the Radiation Interactions and Dosimetry Group develops performance standards for x-ray security-screening systems used in the detection of bulk explosives and other items. The group, which is supported by the Department of Homeland Security, maintains a test bed for assessing the image quality of portable x-ray and imaging systems used by bomb squads for explosives and ordnance detection

and for disarmament. These test results from the group's test bed form the basis for minimum image-quality standards utilized by both public and private sector stakeholders.

In addition to image quality standards, the NIST Counterterrorism and Response Technologies (CART) program is tasked with improving the safety and effectiveness of responders working with CBRNE and physical security equipment through science and technology, as well as the development of standards.

NIST also supports work to evaluate the explosive detection systems commonly seen at airport security checkpoints, marine terminals, loading docks, and border crossings. Such explosive detection systems are currently in use by all levels of government with the purpose of protecting the public from explosive materials; however, there is limited information available to evaluate the performance of these detectors. NIST's work in this area is designed to reduce the use of ineffective equipment and ensure quality detection takes place.

Department of Homeland Security Science and Technology Directorate

The Department of Homeland Security (DHS) Science and Technology Directorate's (S&T) mission is to strengthen America's security and resiliency by providing products and innovative technology solutions for the homeland security enterprise. The R&D supporting this mission takes place primarily through the Homeland Security Advanced Research Projects Agency (HSARPA), which focuses on identifying, developing, and transitioning technologies and capabilities to counter chemical, biological, and explosive terrorist threats, as well as protecting our nation's borders and infrastructure.

DHS S&T's Explosives Division conducts research to advance state of the art science related to explosives countermeasures and prevention, including the development of new capabilities to detect, respond to, and mitigate improvised explosive devices. The division has developed technologies to screen passengers, carry-on and checked luggage, and cargo for the commercial airlines industry; it is also involved in projects that identify and detect conventional and enhanced explosives threats and mitigate their potential damage; and it is working to improve screening systems processing time, capacity, reliability, and effectiveness while minimizing false alarm rates, cost, and labor.

The Chemical and Biological Defense Division analyzes chemical and biological threats, develops pre-event assessment, discovery, and interdiction capabilities as well as capabilities for warning, notification, and analysis of incidents.

DHS S&T also fosters technology partnerships and research collaborations through the Research and Development Partnerships (RDP) group. The RDP group manages cooperation across all DHS University Programs and Centers of Excellence, DHS S&T Laboratories (the Chemical Security Analysis Center, the National Biodefense Analysis and Countermeasures Center, the

National Urban Security Technology Laboratory, Plum Island Animal Disease Center, and the Transportation Security Laboratory) as well as research funded in partnership with the Department of Energy National Laboratories.

Domestic Nuclear Detection Office

Within DHS, the Domestic Nuclear Detection Office (DNDO) is the primary entity in the U.S. government for coordination of response to radiological and nuclear threats. DNDO manages interagency efforts to develop technical nuclear detection capabilities, measure detector system performance, ensure effective response to detection alarms, advance and integrate nuclear forensics efforts, and conduct transformational research and development for advanced detection technologies. DNDO works with federal, state, local, international, and private sector partners to fulfill this mission.

DNDO works to determine gaps and vulnerabilities in the existing global nuclear detection architecture, and formulates recommendations and plans to develop an enhanced architecture. DNDO also conducts and coordinates a long-term research and development program to address significant architectural and technical challenges unresolved by near-term R&D efforts. Further, through the DNDO Product Acquisition and Deployment Directorate, DNDO is able to address detection needs through a focus on commercially developed devices. Industry has advanced detection technologies, and DNDO has flexibility and adaptability in enhancing existing products and developing new devices.

DNDO also supports the development, publication and adoption of national consensus standards for radiation detection equipment. DNDO collaborated with NIST in conducting a review of all national and international consensus standards for preventive radiological and nuclear detection systems. This survey information was used to support the formation of an interagency working group to draft government-unique technical capability standards. Also, the DNDO Graduated Radiological/Nuclear Detector Evaluation and Reporting (GRaDER) Program uses available standards to test and evaluate commercially developed systems. The program has created the infrastructure for voluntary, vendor testing of commercial off-the-shelf radiological/nuclear detection equipment by independent, accredited laboratories against national consensus standards.

Department of Energy

Pacific Northwest National Laboratory (PNNL) is one of ten Department of Energy (DOE) national laboratories managed by the Department of Energy's Office of Science. PNNL researches and develops technology solutions for the DOE, DHS, the National Nuclear Security Administration (NNSA), the Department of Defense (DoD), the Intelligence Community, and universities and industry. At PNNL, the National Security Directorate works to develop science-

based solutions to help prevent and counter acts of terrorism and the proliferation of weapons of mass destruction.

PNNL's National Security Directorate conducts research into "signature discovery." In the world of threat detection, a signature is a unique or distinguishing measurement, pattern, or collection of data that identifies a phenomenon, or threat, of interest. PNNL develops new algorithms, methods, tools and techniques to anticipate future threats by detecting their precursor signatures. Detecting these signatures enables sampling and analysis for remote detection, on-site inspection, and testing of biological, chemical & nuclear threats. PNNL also works to develop operational and strategic information analysis tools in order to provide deeper analytical insights at faster speeds for counterterrorism missions.

The National Security Directorate conducts research through PNNL's Computational and Statistical Analytics Division; the Technology, Policy, Analysis and Operations Division; the Systems Engineering & Integration Division; and the Physical and Chemical Sciences Division.

National Science Foundation

The National Science Foundation supports two main areas of non-classified scientific research to develop technology in order to secure the national defense: the Division of Mathematical Sciences (DMS), and the Academic Research Initiative (ARI), which cuts across different divisions of the Foundation.

Since 2009, the NSF's DMS has worked collaboratively with the Defense Threat Reduction Agency (DTRA) and more recently, the National Geospatial Intelligence Agency (NGA), to develop the next generation of mathematical and statistical algorithms and methodologies in sensor systems for the detection of chemical and biological materials and for information inferred from geospatial information. Mathematical research areas examined by NSF include areas such as mathematical modeling, signal processing, statistics, harmonic and geometric analysis, topology, numerical analysis, and optimal control.

The focus of NSF in this area recognizes one of the challenges of threat detection and reduction today: the sheer amount of information that can now be collected must be processed and analyzed in order to be useful. Developing new approaches to the analysis of this information is one of the most important recent challenges for the mathematical sciences. New and improved mathematical and statistical methods and high performance algorithms are needed to clear the bottleneck.

In addition to the DMS funding, NSF also supports the ARI, a collaborative effort with DNDO and other agencies to fund research on detection systems, individual sensors, or other research that is potentially relevant to the detection of nuclear weapons, special nuclear material, radiation dispersal devices and related threats. Many different divisions of NSF come together to support

the ARI multidisciplinary solicitations, which require at least two distinct academic departments work together on any research grant. The goals of the ARI are to advance fundamental knowledge in new technologies for the detection of nuclear threats and to develop intellectual capacity in fields relevant to long-term advances in nuclear detection and response capabilities.

Office of Science and Technology Policy

The National Science and Technology Council (NSTC) is the principal means within the executive branch to coordinate science and technology policy across the diverse entities that make up the federal research and development enterprise. The NSTC Committee on Homeland and National Security (CHNS) provides guidance and direction to the NSTC to increase the overall effectiveness and productivity of federal R&D efforts in the area of science and technology related to homeland and national security. The purpose of the committee is to address policy matters that cut across agency boundaries and to provide a formal mechanism for collaboration on technology activities.

The CHNS identifies priorities and plans for homeland and national security R&D, advises on technical, programmatic, and operational issues that affect federal agencies, and recommends action on major R&D issues to the director for approval. Membership of the NSTC CHNS includes representation from many classified and non-classified federal agencies, including DHS, NSF, DOE, and DOC.

IV. Issues for Examination

- What federally-funded R&D is designed to detect threats to the public? How is this research guided and prioritized across the federal government?
- What are the barriers to improved threat detection? What R&D breakthroughs are necessary to advance new types of detection?
- Who conducts the risk analysis that the federal government uses to determine how to rank threats? How does data collection and analysis inform the government's response to known threats?
- How do the threat detection technologies developed by the federal government work within the wider systems-approach to protecting the public from dangerous materials? How are the technology end-users and screeners involved in the development process?
- How is threat detection R&D coordinated across the federal government? How could it be improved?