PASSENGER SCREENING R&D: RESPONDING TO PRESIDENT OBAMA'S CALL TO DEVELOP AND DEPLOY THE NEXT GENERATION OF SCREENING TECHNOLOGIES

HEARING

BEFORE THE

SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION

COMMITTEE ON SCIENCE AND TECHNOLOGY

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PASSENGER SCREENING R&D: RESPONDING TO PRESIDENT OBAMA'S CALL TO DEVELOP AND DEPLOY THE NEXT GENERATION OF SCREENING TECHNOLOGIES

WEDNESDAY, FEBRUARY 3, 2010

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 2:19 p.m., in Room 2318 of the Rayburn House Office Building, Hon. David Wu [Chairman of the Subcommittee] presiding.

HEARING CHARTER

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION

Passenger Screening R&D: Responding to President Obama's Call to Develop and Deploy the Next Generation of Screening Technologies

WEDNESDAY, FEBRUARY 3, 2010
2:00–4:00 P.M.
2318 RAYBURN HOUSE OFFICE BUILDING

1. Purpose

On Wednesday, February 3, 2010, the Subcommittee on Technology and Innovation will hold a hearing to review the airline passenger screening-related research, development, testing, and deployment activities of the Department of Homeland Security Science and Technology Directorate, the DHS University Centers of Excellence, the National Institute of Standards and Technology, and the Department of Energy National Laboratories.

2. Witnesses

Mr. Brad Buswell is the Deputy Undersecretary of the Science and Technology Directorate at the Department of Homeland Security.

Dr. Penrose Albright is the Principal Associate Director for Global Security at the Lawrence Livermore National Laboratory.

Dr. Bert Coursey is the Program Manager of the Coordinated National Security Standards Program at the National Institute of Standards and Technology.

Dr. Sandra Hyland is a Senior Principal Engineer at BAE Systems.

3. Brief Overview

In remarks made after the December 25th airplane bombing attempt, President Obama called for a review of the current screening systems and an expansion of the development of new technologies, stating:

". . . we need to protect our airports—more baggage screening, more passenger screening and more advanced explosive detec-

> tion capabilities, including those that can improve our ability to detect the kind of explosive used on Christmas.. . . And today, I'm directing that the Department of Homeland Security take additional steps, including:. . . working aggressively, in cooperation with the Department of Energy and our National Labs, to develop and deploy the next generation of screening technologies."

The hearing will focus on the advancement of new passenger screening technologies, testing methods used to evaluate screening machines, and issues encountered during deployment of new screening systems.

4. Background

The Transportation Security Administration (TSA) was created in 2001 to act as a centralized Federal authority to manage transportation security efforts in the United States. Moved to the Department of Homeland Security in 2006, TSA oversees security for highways, railroads, buses, mass transit systems, pipelines, ports and airports. The majority of TSA's work is in airport security, heading up screening efforts for passengers, checked luggage, and commercial cargo.

The Transportation Security Laboratory (TSL) became part of the Department of Homeland Security Science and Technology Directorate (DHS S&T) in 2006 and provides support for TSA's mission through research, technology development, testing and evaluation, and technical support for deployed technologies. The bulk of TSL's work is the validation of explosive detection systems for passengers, luggage, and cargo. TSL tests explosive detection systems submitted by private industry vendors against specifications provided by TSA. Once systems pass the validation phase, they are placed on the Qualified Products List, indicating their efficacy and deployment readiness. In addition to TSL's validation activities, DHS S&T conducts research in imaging, particle physics, chemistry, material science, and advanced algorithms to develop enhanced explosive detection and mitigation capabilities.

The National Explosives Engineering Sciences Security Center (NEXESS) was established by DHS S&T in 2006, combining expertise from three National Labs: Lawrence Livermore National Lab, Los Alamos National Lab, and Sandia National Lab. This center studies the performance characterization of homemade explosives (HME) and understanding vulnerability of aircraft to HME threats.

The National Institute of Standards and Technology (NIST) is a non-regulatory agency of the Department of Commerce. Founded in 1901, NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. MST supports the passenger screening mission of DHS S&T and TSA by developing measurement methods, standards reference materials, and new measurement technologies for passenger screening systems and reference data on explosives. This underlying information is critical to the development of new technologies that can detect and identify the current and future generations of explosives in the most efficient, safe, and reliable manner.

5. Issues and Concerns

Does the current research and development portfolio of DHS S&T, its University Centers of Excellence and the National Labs adequately meet the needs of the TSA and fill existing capability gaps? How are priorities set for future research projects and do these priorities allow a balanced portfolio of basic research, applied research, and technology transition? TSA is responsible for setting research and technology priorities at TSL through the Capstone Integrated Product Team (IPT) process. There are thirteen IPTs in DHS S&T that provide input into the research plans based on their needs in the field. The Transportation Security IPT consists of representatives from agencies such as TSA, U.S. Coast Guard, Customs and Border Patrol and U.S. Secret Service. The IPT process is designed to meet the short-term needs of the customer and can lead to research that is improperly weighted toward flash-in-the-pan areas, such as liquid explosives. DHS S&T, its University Centers of Excellence, and the National Laboratories must coordinate a balanced research agenda that does not overly prescribe reactive research and maintains a proactive view of future passenger screening technologies.

How does TSL develop the testing metrics and methods used to evaluate passenger screening technologies? What are the criteria for success and are technologies that are tested by TSL ready for deployment? If not, what additional efforts are necessary to bring technologies to full readiness? TSL takes technology specifications from TSA and evaluates passenger screening devices submitted by manufacturers. A successful evaluation places the device on the "Qualified Products List" indicating that it is suitable for use by TSA. Although most machines are evaluated successfully, there have been recent examples of missteps, such as the Explosive Trace Portals, or "puffers." These machines use puffs of air to dislodge trace amounts of explosive material from a passenger for detection. Despite passing qualification tests, the extensive pilot study was discontinued due to maintenance issues that arose when the puffers encountered dirt and humidity common in any airport environment. TSL, TSA, and N1ST must work together to ensure that testing metrics and methods not only reflect the minimum requirements for detection, safety, and usability, but can predict performance levels in a realistic environment.

Does DHS S&T adequately consider the social science impact of new technologies (e.g. passenger convenience, safety, and public acceptance due to privacy) when developing new passenger screening devices? What research is being done to develop technologies or techniques that can mitigate concerns over privacy and safety? The newest, most accurate and most efficient passenger screening devices are useless if a passenger refuses to walk through them. TSA and DHS S&T must work to understand how these technologies will affect the people being screened and develop the devices from the start that appropriately minimize these concerns. Congress has recently seen legislation that bans the use of full-body scanners due to privacy concerns. While R&D is currently being done to develop technologies and techniques that minimize privacy concerns, it is reactive in nature to a problem that should have been anticipated.

Chairman WU. This hearing will now come to order. Good afternoon. I would like to welcome everyone to today's hearing on passenger screening research and development.

The attempted bombing on a Christmas Day 2009 flight revealed gaps in our current airport security measures. We are grateful that this attempt was, like several other prior plots, unsuccessful. At the same time, these attacks have exposed vulnerabilities in current passenger screening technologies which must be addressed. Moving forward, we have to make sure that Department of Homeland Security [DHS] research is actively closing the gaps in our capabilities, producing security methods that the public will accept, and increasing our ability to keep Americans safe.

In response to the failed Christmas Day attempt, President Obama called on the DHS to work with the Department of Energy [DOE] to develop and deploy the next generation of airport screening technologies. The purpose of today's hearing is to learn how DHS and other federal agencies will respond to the President's challenge to develop improved screening technologies.

In addition, I am deeply troubled by the lack of attention DHS has paid in the past to important public acceptance issues. In 1997, about 13 years ago, the National Academy of Sciences [NAS] identified the need to pay more attention to public acceptance issues in the deployment of passenger screening technologies. Ten years later, in 2007, and I note that this is on either side of September 11, the NAS concluded again that this is important and also concluded that nothing had changed and these acceptance issues were still being ignored. So it is little wonder the deployment of body-scanning technologies has proven to be such a dramatic public failure. The relevant agencies did not do their homework and follow-up on the NAS recommendations in a serious way. Two reports, ten years apart, both ignored.

Therefore, it concerns me that in the written testimony, other than passing comments on the privacy aspects of deploying airport screening technologies, the agencies before us today still do not have a robust and comprehensive plan for conducting and using effective public acceptance research, nor do they seem to have a plan to allow for input from crucial stakeholders, such as the public, airport officials, or the participating airlines. I want to assure everyone in this room that I am committed to ensuring that legitimate public concerns are adequately addressed in the development of any next-generation airport screening technologies. Of course the screening process must protect the public, but it must be accepted by the public as well in order for it to work.

Finally, I look forward to hearing how NIST [National Institute of Standards and Technology] and DHS will work together to address technical standards, accreditation and certification of these new technologies. Without these pieces in place, new technologies cannot be deployed effectively.

I want to thank our witnesses for being here. We plan to act on your information.

Chairman WU. I now recognize our Ranking Member and colleague, Mr. Smith, for his opening statement.

[The prepared statement of Chair Wu follows:]

PREPARED STATEMENT OF CHAIR DAVID WU

Good afternoon. I'd like to welcome everyone to today's hearing on passenger screening research and development.

The attempted bombing on a Christmas Day 2009 flight revealed gaps in current airport security measures. We are all thankful that this attempt was, like several other previous plots, unsuccessful. At the same time, these attacks have exposed vulnerabilities in current passenger screening technologies that must be addressed. Moving forward, we must make sure that Department of Homeland Security research is actively closing the gaps in our capabilities, producing security methods that the public will accept, and increasing our ability to keep Americans safe.

In response to the failed Christmas Day attempt, President Obama called on the Department of Homeland Security to work with the Department of Energy to develop and deploy the next generation of airport screening technologies. The purpose of today's hearing is to learn how DHS and other Federal agencies will respond to the president's challenge to develop improved screening technologies.

In addition, I am troubled by the lack of attention DHS has paid in the past to public acceptance issues. In 1997, the National Academy of Sciences identified the need to pay more attention to public acceptance issues in the deployment of passenger screening technologies. Ten years later the Academies concluded that nothing had changed and these issues were,still ignored. No wonder the deployment of body-scanning technologies has proven to be such a public failure: the relevant agencies did not do their homework and follow-up on the Academies' recommendation in a serious way.

Therefore, it concerns me that in the written testimony, other than passing comments on the privacy aspects of deploying airport screening technologies, the agencies before us today still do not have a robust and comprehensive plan for conducting and using effective public acceptance research. Nor do they seem to have a plan to allow for input from stakeholders, such as the public, airport officials, or airlines. I want to assure everyone in this room that I am committed to ensuring that legitimate public concerns are adequately addressed in the development of any next-generation airport screening technologies. Of course the screening process must protect the public, but it must be accepted by the public as well.

Finally, I look forward to hearing how NIST and DHS will work together to address technical standards, accreditation, and certification of these new technologies. Without these pieces in place, new technologies cannot be deployed effectively.

I want to thank our witnesses for being here. We plan to act on their guidance.

Mr. SMITH. Thank you, Chairman Wu, and thank you to our witnesses today for taking time for this hearing on developing and deploying the next generation of passenger screening technologies.

The attempted Christmas Day bombing on Northwest Airlines flight 253 was yet another reminder that Al Qaida and its affiliates continue to pursue all means to attack innocent Americans and that we must continue using all means available to us, military, intelligence and technological, to remain ahead of this threat.

I would also like to join the Chairman in welcoming today's distinguished panel. You are all at this forefront of this necessary research, and I look forward to learning more about the ongoing research and expected developments in the field as well as the potential positive and negative implications of this work for all Americans.

While it is vital we continue seeking the most effective technological means to ensure Americans remain safe from attack, we must ensure that new technologies don't needlessly intrude on passengers' privacy. There are more than 700 million airline passenger boardings in the United States every year, and we must find the best possible means to ensure the interdiction of all those who would do us harm, while continuing to protect the privacy of the vast majority who are obviously innocent.

One particular technology which has received widespread coverage in light of the Christmas incident and which I have heard concerns from numerous constituents about is whole-body scanners which allow airport screeners to see concealed contraband beneath passengers' clothes. While the desirability of this technology is understandable from a security standpoint, I look forward to learning how technological advances in other fields such as explosives detection and behavioral sciences will mitigate the need for intrusive scanners.

Thank you again, Mr. Chairman. I yield back the balance of my time.

[The prepared statement of Mr. Smith follows:]

PREPARED STATEMENT OF REPRESENTATIVE ADRIAN SMITH

Thank you, Chairman Wu, for calling today's hearing on developing and deploying the next generation of passenger screening technologies. The attempted Christmas Day bombing of Northwest Airlines Flight 253 was yet another reminder that Al Qaeda and its affiliates continue to pursue all means to attack innocent Americans, and that we must continue using all means available to us—military, intelligence, and technological—to remain ahead of this threat.

I would also like to join the Chairman in welcoming today's distinguished panel. You all are at the forefront of this necessary research, and I look forward to learning more about ongoing research and expected developments in this field, as well as the potential positive and negative implications of this work for all Americans.

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Thank you, again, Mr. Chairman, and I yield back the balance of my time.

Chairman WU. Thank you very much, Mr. Smith. If there are other Members who wish to submit additional opening statements, your statements will be added to the record at this point.

And now it is my pleasure to introduce our distinguished witnesses. First, Mr. Brad Buswell is the Deputy Undersecretary of the Science and Technology Directorate at the Department of Homeland Security [DHS S&T]. Dr. Bert Coursey is the Program Manager of the Coordinated National Security Standards Program at the National Institute of Standards and Technology. Dr. Sandra Hyland is the Senior Principal Engineer at BAE Systems, and Dr. Albright, for right now, we are going to skip your introduction until Governor Garamendi can come by.

For each of the witnesses, you will have five minutes for your spoken testimony. Your written testimony will be included in the record in their entirety. And when you complete your testimony, we will begin with questions, and each Member will have five minutes to question the panel.

Mr. Buswell, please begin.

STATEMENT OF MR. BRADLEY I. BUSWELL, DEPUTY UNDER-SECRETARY, SCIENCE AND TECHNOLOGY DIRECTORATE, DEPARTMENT OF HOMELAND SECURITY

Mr. BUSWELL. Thank you. Good afternoon, Chairman Wu, Congressman Smith, and distinguished Members of the Committee. It is my pleasure to be here. Once again, I commend you on the assembly of this panel, and I am humbled to be among them. I am honored to appear on behalf of the Department today to discuss with you this critical issue of airport passenger screening technology.

I also want to thank the Committee and the staff for your continuing support of DHS S&T and our mission to enable and deliver technology to protect the American people.

S&T is charged with providing technical support and tools to the major DHS operating components and our Nation's first responders, all of whom are on the front lines of homeland security every day. DHS S&T funds basic research and technology development, and supports the Department's major acquisitions through testing, evaluation and the development of standards.

The Transportation Security Administration [TSA] has the lead role in DHS in defining the performance specifications of equipment that are installed at airports as part of their security measures. DHS S&T and TSA coordinate closely on research efforts and equipment test and evaluation to ensure the Department is investing in technologies that meet TSA's operational needs to protect the traveling public.

As you are aware, Mr. Chairman, the Department's research and development priorities are primarily driven through our Capstone IPT [Integrated Product Teams] process. The customers and the stakeholders in this process play a lead role in informing DHS S&T's decision making about research and development investments. The customers chair the Capstone IPTs and establish their desired capability priorities based on their assessment of the risk in their respective mission areas. TSA leads the transportation security Capstone IPT, and based on their desires, our research priorities in aviation security have been, and continue to be, first to improve the capability of currently fielded screening equipment and procedures in the near term, and then in the longer term, develop and deploy new equipment and procedures to improve the security of air travel.

All three of the DHS S&T portfolios, the Product Transition, which is near term, the Innovation portfolio which is led by the Homeland Security Advanced Research Projects Agency, or HSARPA, and the Basic Research portfolio participate in the IPT process. While the IPT members drive the selection of the transition products, the near-term needs, the expressed needs that arise from this process also inform the selection of projects in our Basic Research portfolio and similarly in our higher-risk/higher pay-off HSARPA portfolio.

The Capstone IPT process is effective at identifying high-priority technology needs, but we are constantly looking for better ways to meet those needs. Partnering with the National Laboratories, for example, is not new to us. Since its inception, DHS has worked in close collaboration with the DOE's National Laboratories in the pursuit of technology, supporting the operational needs of the Department.

In response to the President's direction, we have taken a number of actions, one of which is to recently establish the Department of Homeland Security, the Department of Energy Aviation Security Enhancement Partnership as an Under Secretary level governance mechanism for managing the partnership between DHS and the DOE National Laboratories, specifically to advance technical solutions to key aviation security problems. This governance will allow us to extend and leverage this longstanding relationship with a focus on the utilization of the National Laboratories to deliver key advanced aviation security technologies and knowledge.

As you mentioned, Mr. Chairman, development of effective passenger screening technology must meet legal and regulatory requirements and take into account other constraints which could limit our ability to deploy it. These constraints could include physical and performance constraints, such as footprint and throughput, and also more subjective measurements as you mentioned such as public acceptance. To that end, we work closely with TSA and other DHS offices such as the Chief Privacy Office and Office of Civil Rights and Civil Liberties to ensure the research we are doing has a clear path to deployment. To mitigate the risk of excessive travel or resistance to screening technologies, S&T uses the Community Perceptions of Technology panels that include informed experts from industry, public interest and community-oriented organizations to identify potential acceptance issues, and I would be delighted to discuss that more in the question-and-answer period if you want to go into that further.

We also play an important role in the test and evaluation of equipment in advance of major acquisition decisions. For aviation security technologies, this testing is led by the Transportation Security Laboratory [TSL] in Atlantic City. TSL conducts independent verification validation tests, and depending on the maturity and type of detection equipment does either certification, qualification, or laboratory assessments.

Finally, a word about standards. As you said, Dr. Coursey is representing NIST here. He also happens to work on the same floor that I do in DHS S&T as he has been detailed to us to make sure we have a close cooperation with NIST for a number of years, and he has forgotten more about standards that I will ever know. So I will leave the standards discussion to him except to say that we work closely and we guide the NIST standards development for aviation security.

Aviation security is obviously an activity of national importance, and as I mentioned, in response to the President's direction, we have initiated a new governance with the National Laboratories and have done a number of other things as well. Within the government, we are working with the Technology Support Working Group, the Department of Defense, the Department of Justice. We have academia engaged through our university-based Centers of Excellence. We are engaged with industry, have a broad agency announcement out to solicit technological solutions for countering this and other threats across the broad spectrum of Homeland Security. And additionally, we are engaged with our international partners to ensure we are capturing the best technologies possible and also to help improve their security capabilities.

So in closing, thank you for your dedicated efforts to improve the safety of air travel to all Americans. I appreciate the opportunity to meet with you and look forward to your questions.

[The prepared statement of Mr. Buswell follows:]

PREPARED STATEMENT OF BRADLEY I. BUSWELL

INTRODUCTION

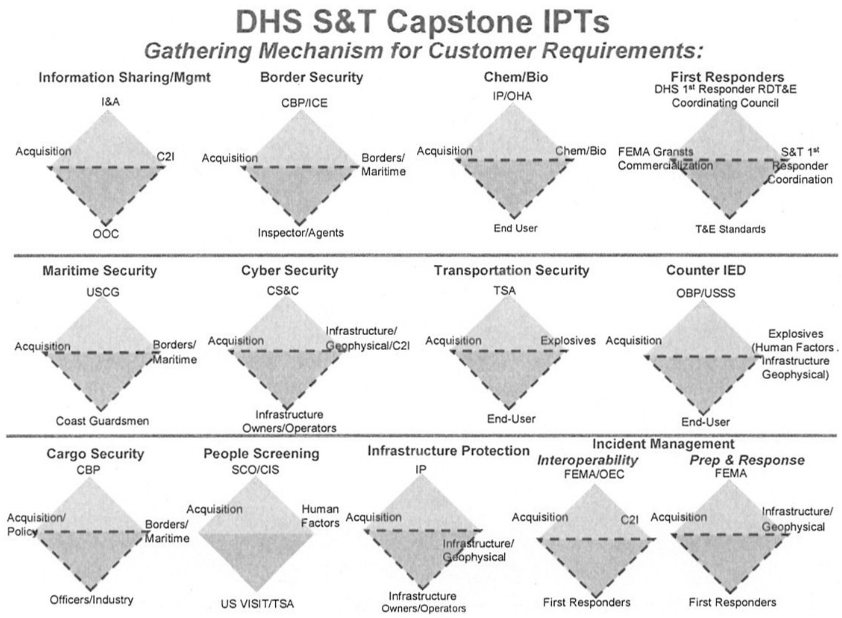
Good afternoon, Chairman Wu, Congressman Smith, and distinguished Members of the Subcommittee. I am honored to appear before you today on behalf of the Department of Homeland Security (DHS) to report on the Science and Technology Directorate's (S&T) research, development, test and evaluation (RDT&E) efforts relating to airport passenger screening technology.

Passenger Screening Capability Development

S&T provides technical support and tools to the major DHS operating components and our nation's first responders who face risk on the front lines of homeland security. S&T funds basic research and technology development, and supports the Department's major acquisitions through testing, evaluation and the development of standards.

The Transportation Security Administration (TSA) protects the nation's transportation systems to ensure freedom of movement for people and commerce. TSA has the lead role at DHS in defining the performance of equipment that airports install as part of their security measures. DHS S&T and TSA coordinate closely on research efforts and equipment test and evaluation to advance capabilities to protect the traveling public. These efforts have yielded numerous technical improvements that enhance the effectiveness of screening techniques and technologies while moving increasing numbers of people more quickly through security.

The Department's research and development priorities are primarily customer-driven through our Capstone Integrated Product Team (IPT) process. DHS customers chair the Capstone IPTs and establish their desired capability priorities based on their assessment of risk in their respective mission areas. Three IPTs—Transportation Security, Counter Improvised Explosive Devices (C–IED), and People Screening—are dedicated to identifying and delivering technological solutions for detecting and countering threats to the safety and security of the traveling public. Our Transportation Security IPT, led by TSA with support from DHS S&T's Explosives Division, strives to identify and deliver technologies to improve our layered approach to aviation security. TSA is also an integral member of the People Screening IPT, providing valuable input as a user of proposed screening technologies. Finally, the Counter-IED IPT works to identify and develop trace detection and standoff imaging technologies that will impact the next generation of checkpoint technologies.



All three DHS S&T portfolios—Product Transition, Innovation/Homeland Security Advanced Research Projects Agency (HSARPA), and Basic Research—participate in the IPT process. While the IPT members drive the selection of Product Transition projects, the expressed needs that arise from this process also inform the selection of projects in our Basic Research portfolio and similarly inform the higher-risk/high pay-off initiatives undertaken by our Innovation/HSARPA portfolio. The more insight we gain regarding current and future threats and the capability gaps of our stakeholders, the better positioned we are to identify promising areas of research and explore innovative solutions that are outside the development timeframe for the nearer term-focused Product Transition portfolio.

In addition to the Capstone IPT process, we have recently established the DHS—Department of Energy (DOE) Aviation Security Enhancement Partnership to advance technical solutions to key aviation security problems in support of priorities announced by the President following the failed Christmas Day bombing attempt While DHS has always worked in close collaboration with the DOE National Laboratories, we have now agreed to create a senior-level (at the Under Secretary level) governance mechanism to manage ways to extend and leverage this relationship with a focus on improving aviation security by:

- Delivering key advanced aviation security technologies and knowledge;
- Conducting analyses to assess possible vulnerabilities and threats and support/inform technology requirements, policy, planning, decision-making activities; and
- Reviewing the use of existing aviation security technologies and screening procedures, and the impact of new or improved technologies using a systems analysis approach to illuminate gaps, opportunities and cost effective investments.

This testimony will primarily address three areas of interest expressed by the Subcommittee: the passenger screening research and development priorities including current and planned research efforts; the physical, social and resource constraints on passenger screening and its impacts on technology; and the testing process that implements passenger screening technology.

Research and Development Priorities

There is no single technological solution to aviation security. A layered security approach to passenger screening features multiple passenger and baggage screening tools and integrates human factors considerations, metal detectors, Advanced Imaging Technology (AIT) with X-rays and millimeter waves, trace explosives detection and canines. S&T's R&D Program is focused on improving the performance of currently deployed screening equipment and procedures in the near-term, and developing and deploying new technologies and procedures in the long-term. Future improvements aim to screen passengers and carry-on baggage for an increasing range of threats and streamline travel by easing certain restrictions, such as the need to remove shoes during screening or limits on carrying liquids onto the plane.

We develop technologies and techniques that maximize our operational flexibility to ensure the privacy, civil rights and civil liberties of our citizens are protected. Our screening research programs are developed and executed in close cooperation with the DHS Chief Privacy Officer as well as the Office of Civil Rights and Civil Liberties to ensure that we consciously consider and address their impacts or risk to the public. S&T conducts in-depth analyses of such efforts through ongoing dialogue with the DHS Privacy Office and the DHS Office of Civil Rights and Civil Liberties and related documentation (i.e. Privacy Impact Assessments or Civil Liberties Impact Assessments).

Through the Checkpoint Program, we continuously evaluate and improve the capabilities of currently deployed technologies against new threats and seek to develop state-of-the-art threat detection technology for TSA passenger checkpoints to screen out evolving threats while improving the passenger experience with higher throughput and minimal restrictions. The highest-priority effort in this area is improving detection software algorithms, including effective automatic target recognition, in our currently deployed imaging systems, particularly AIT and Advanced Technology (AT) X-ray screening devices. AIT is one of the most promising technologies for detecting non-metallic weapons and small quantities of explosives concealed on individuals. AT X-ray provides an enhanced detection capability with multi-dimensional visual screening and improved image resolution of carry-on bags. Both of these technologies would greatly benefit from algorithm improvement and other systems research and engineering approaches that consider human factors to optimize security officer performance in threat detection and identification. The President's Budget Request for this work in Fiscal Year (FY) 2011 is $22.3 million and includes the Checkpoint Program, home-made explosives research and systems research and engineering related to human factors.

Efforts dedicated to suspicious behavior detection could also provide near-term benefit in passenger screening. The Suspicious Behavior Detection Program strives to improve screening by providing a science-based capability to identify unknown threats indicated by deceptive and suspicious behavior. This program addresses operational needs for real-time, non-invasive detection of deception or hostile intent that are applicable across the DHS mission. The President's Budget Request for this work in FY 2011 is $8.9 million and includes the Human Factors Counter-IED Program and its Suspicious Behavior Detection Program.

In the longer term, a continuing, robust RDT&E program across the three S&T portfolios is necessary.

The Explosives Research Program funds multidisciplinary basic research in imaging, particle physics, chemistry, material science and advanced algorithm development to develop enhanced explosive detection and mitigation capabilities. The President's Budget Request for FY 2011 includes $9.1 million for this work.

The transition program, guided by the Capstone IPT process, is comprehensive and encompasses:

- Automated imaging systems to screen for weapons, conventional explosives, and homemade explosives (HME) in carry-on bags;
- Trace explosives detection capabilities for identifying explosives on people and in carry on baggage;
- A next generation fully automated checkpoint for detecting weapons and explosives on people for aviation, mass transit, public gathering venues, or other potentially high-risk buildings;
- Human performance research and technology development for increased security officer efficiency and effectiveness;
- A science-based capability to derive, validate, and automate detection of observable indicators of suicide bombers;
- A science-based capability to identify known threats and facilitate legitimate travel through accurate, timely, and easy-to-use tools for biometric identification and credential validation;
- Technologies and methods for identifying insider threats.

The President's Budget Request for FY 2011 is $31.1 million for Counter-IED efforts applied to checkpoint screening for explosives.

The innovation program, managed by HSARPA, is looking at "leap-ahead" technologies such as:

- Future Attribute Screening Technology (FAST) to determine if it is possible to detect malintent (the mental state of individuals intending to cause harm) by utilizing non-invasive physiological and behavioral sensor technology, deception theory, and observational techniques. Though we have established an initial scientific basis for the technology, this project is still in the early stages as we work on both the science and theory to support the concept.
- MagViz is looking at the possibility of using technology similar to hospital MRI machines to look for and *identify* liquids. The magnetic fields in MagViz are much lower power than its medical counterparts, allowing operation without the restrictions and high costs of traditional MRI. We demonstrated this technology with a small scale prototype at the Sunport Airport in Albuquerque, NM in December 2008. MagViz was successful at identifying a dangerous liquid in a small bottle among many non-hazardous liquids in a standard TSA checkpoint bowl. The project is still in the research phase, and we are now trying to prove the technology using a larger size container and a broader array of both non-hazardous and potentially hazardous liquids.

The President's Budget Request for FY 2011 is $11 million for these projects.

Acknowledging Constraints

Development and the eventual deployment of effective passenger screening technology must meet legal and regulatory requirements. S&T works closely with TSA and other DHS offices to ensure the work we are doing has a clear path to deployment.

In addition to meeting the letter and intent of laws and regulations, public acceptance and perceptions of technology are important factors that cannot be overlooked. S&T uses Community Perceptions of Technology Panels that include informed experts from industry, public interest, and community-oriented organizations to identify potential acceptance issues.

S&T Role at the Transportation Security Laboratory (TSL)

Test and evaluations activities at the TSL encompass two independent functions. First, the Independent Test and Evaluation (IT&E) function is responsible for evaluating mature technology that may meet TSA's security requirements and is suitable for piloting or deployment. Second, the research and development function has responsibilities ranging from applied research, to prototype development, to technology maturation that produces prototypes suitable for evaluation by the Independent Test and Evaluation Team.

The IT&E group works closely with TSA's Office of Security and Technology to determine and discuss testing requirements, priorities and results of evaluations. IT&E activities at TSL include certification, qualification, and assessment testing and generally are performed to determine if detection systems meet customer-defined requirements. Results support decisions of DHS operating elements (such as TSA) for field trials and production or deployment, as well as key program milestones, benchmarking, and investment strategy. RDT&E activities are designed to verify that a prototype or near-commercial off-the-shelf system has met performance metrics established within the R&D program such that it can proceed to the next R&D stage.

The *Certification* Test Program is reserved for detection testing of bulk and trace explosives detection systems (EDS) and equipment under statutory authority 49 U.S.C. § 44913 for checked baggage. Before mature EDS are deployed, it must be certified that salient performance characteristics are met.

Qualification Tests are designed to verify that a security system meets customer-defined requirements as specified in a TSA-initiated Technical Requirements Document. This test, along with piloting (field trials) generally results in a determination of fitness-for-use. This process is modeled after the certification process and is defined within the Qualification Management Plan. Unlike the Certification Test, the requirements of the Qualification Management Plan typically expand beyond detection functions to include operational requirements. The result of Qualification Testing is a recommendation of whether candidate systems should be placed on a Qualified Products List (QPL).

Laboratory Assessment Testing is conducted to determine the general capability of a system. These evaluations of candidate security systems are carried out in accordance with interim performance metrics, and the results drive future development efforts or operational deployment evaluations. While the IT&E group practices best scientific principles in test design, execution, and evaluation of data, assessment criteria are determined by the DHS component's needs.

Developmental Test and Evaluation (DT&E) is performed by the R&D team at the TSL and involves testing in controlled environment to ensure that all system or product components meet technical specifications. These tests are designed to ensure that developmental products have met major milestones identified within the R&D project. DT&E testing at the TSL assesses the strengths, weaknesses, and vulnerabilities of technologies as they mature and gain capability. The primary focus is to ensure that the technology is robust and ready for Certification or Qualification tests.

S&T Role in Standards

The S&T Test & Evaluation and Standards Division guides the National Institute of Standards and Technology's (NIST) standards development efforts for aviation security. These efforts are directed toward development of voluntary consensus standards and associated test methods by the private sectors standards bodies (e.g. Institute of Electrical and Electronic Engineers (IEEE); American Society for Testing and Materials International (ASTM International); the National Electrical Manufacturers Association (NEMA); InterNational Committee for Information Technology Standards (INCITS); and the International Organization for Standardization (ISO).

Chief test engineers from TSL and TSA are actively engaged with NIST on standards development, ensuring that U.S. national standards reflect the need for enhanced aviation security.

Conclusion

Aviation security is critical. As I've described, we will leverage the resources of the National Laboratories to bring needed capabilities to the forefront, and we will continue to collaborate with other Federal partners, academia and industry. We have a Broad Agency Announcement in place to solicit technological solutions for countering the threat across a broad spectrum. Additionally, we are engaging our international partners to ensure we are capturing the best technologies possible and to help them improve their security capabilities.

Thank you for your dedicated efforts to improve the safety of air travel for all Americans. I appreciate the opportunity to meet with you today to discuss research initiatives to strengthen passenger screening and I look forward to answering your questions.

BIOGRAPHY FOR BRADLEY I. BUSWELL

Brad Buswell
Deputy Under Secretary
Department of Homeland Security
Science & Technology Directorate

Brad Buswell is a native of Durango, Colorado and a graduate of the United States Naval Academy. He is a retired submarine officer who served in numerous assignments at sea and in Washington, DC. His Washington assignments included Congressional Liaison for Navy Research and Development Programs in the Navy Office of Legislative Affairs, Assistant to the Chief of Naval Operations for Force Transformation, Executive Assistant to the Chief of Naval Research, and various other positions on the Navy staff.

Following his retirement from the U.S. Navy, Mr. Buswell worked in the private sector for General Electric in its Washington Office as Manager, Government Relations for GE's Global Research division.

He joined the Department of Homeland Security Science & Technology Directorate in October 2006.

Mr. Buswell holds a Bachelors of Science in Systems Engineering from the U.S. Naval Academy and a Masters of Business Administration from The George Washington University.

Chairman WU. Thank you very much, Mr. Buswell. Mr. Garamendi, I want to commend you on an impeccable sense of timing. Would you care to introduce Dr. Albright?

Mr. GARAMENDI. Thank you very much, Mr. Wu. I don't know that I have the sense of timing but good fortune. I finished my work on the Floor and was able to get here to introduce Dr. Albright.

I have never ceased to be amazed at all the things that are done at our National Laboratories, and particularly the most important of all National Laboratories, the one in my district, Lawrence Livermore National Lab. Every time I delve into that lab, I find some fascinating, new things that are going on and things that are very, very important.

Dr. Albright is really into something that is important to all of us. He is the Principal Associate Director for Global Security at the lab. He is responsible for applying the labs' multi-disciplinary science and technology to anticipate, innovate, and deliver responsive solutions to our Nation's complex global, national, homeland and energy security challenges, which is a complex way of saying he is going to make sure we are prepared. And in that context, he comes with extraordinary background, both in the public sector as well as in the private sector, in the private sector with Civitas

Group, an organization that kind of put these pieces together on the private side in matching innovation with needs and the money to make it all happen. And he was also the Assistant Secretary in the Department of Homeland Security where he achieved several remarkable goals, the most important of which was he took the budget from $700 million to $1.6 billion. We are ready to learn from you how we might do it in the context of today's hearing.

In any case, we now move onto his testimony and the work that is being done, and I look forward to hearing that. Dr. Albright, welcome.

Chairman WU. Thank you very much, and I do want to commend the gentleman. We are watching your fine work on the Floor on this little monitor here, and scuttling over here was a good piece of work, and I am sure the amendment was a very fine piece of work also. Thank you.

Mr. GARAMENDI. It was extraordinarily necessary.

Chairman WU. Very good. Dr. Albright, please proceed.

STATEMENT OF DR. PENROSE C. ALBRIGHT, PRINCIPAL ASSOCIATE DIRECTOR FOR GLOBAL SECURITY, LAWRENCE LIVERMORE NATIONAL LABORATORY

Dr. ALBRIGHT. Mr. Chairman, Mr. Smith and I want to particularly thank Mr. Garamendi. Thank you for that wonderful introduction. And thank you for the opportunity to testify at this important hearing today on research and development activities aimed at improving aviation security.

Let me make just one quick comment about Mr. Garamendi. He may not know that I just became a constituent only two months ago, and so I am a native actually of this area for most of my career but got lured out to come to Livermore and am very, very happy to be there and proud for you to be my Representative.

So what I want to do—as you said, I am the Principal Associate Director of Global Security at Lawrence Livermore Labs, one of the National Laboratories that is managed by NNSA [National Nuclear Security Administration] within the Department of Energy. We do an awful lot of work on aviation security at large, but what I want to focus my comments on today specifically are in those efforts associated with passenger screening at the checkpoint.

The NNSA laboratories have long been and continue to be fully committed to contributing their capabilities in systems analysis, explosives, high-performance computing, and other resources to work with the Department of Homeland Security and other partner agencies to protect aviation and combat terrorist threats. In fact, it was in recognition of the particular capabilities of the Department of Energy National Laboratories that specific language was inserted in the enabling legislation for the Department of Homeland Security to permit a special relationship to exist between DHS S&T and the National Laboratories. I know, I actually wrote that language.

On explosives, this is actually a very, very hard problem. Current events show that explosives continue to be the weapon of choice for terrorists worldwide. The threat is evolving. The internet has provided the terrorists with information to manufacture homemade explosives using readily available chemicals. They are also very, very,

very difficult to detect. In some cases, billionths of grams are what is available for sampling, and it must be detected in the presence of other potentially confusing but benign materials. TSA officers only have a short time to detect explosives and assess the situation before they allow the passage of people if they are to maintain the flow of people and goods.

So concentrated research and continuous research and development is fundamental to understanding the threat and creating the tools that will give our Nation the capability to decrease our vulnerability.

The technical capabilities of the National Laboratories, and very importantly their status as federally funded research and development centers, which brings with it unquestioned objectivity and independence and unfettered access to government data and proprietary information, for example, air frame structural data from the air frame manufacturers like Boeing and Airbus, is crucial to improving the security of aviation and providing the necessary and enduring focus to this problem.

So the National Labs have been involved in high explosive research development since the very beginning. Most of you on this Committee don't need to be educated on the role that high explosives plays in the design and testing of nuclear weapons. And so we have now, over time and for a long time, been applying that expertise to the needs of the Department of Energy of course, the Defense Department, the Departments of Justice, the FAA [Federal Aviation Administration], and most recently, the Department of Homeland Security.

The laboratories combine cutting-edge computer simulation codes, state-of-the-art diagnostics, and an environment where both theoretical and experimental chemists, physicists, engineers, materials scientists, can work together to provide a detailed understanding of the science of energetic materials, their effect on aircraft structures, their impact on existing detection systems at the passenger checkpoint, and how systems might be improved to enhance aviation security. As part of that effort, the Department of Homeland Security brought together the three NNSA labs, Sandia, Los Alamos and Livermore, in 2006 to create a program called the National Explosives Engineering Sciences and Security Program which capitalized on the FFRDC [Federally Funded research and Development Center] model, utilizing the expertise of those labs to develop and implement cutting-edge engineering in science-based methods aimed at reducing risk to aviation. That effort has included the evaluation and characterization of explosive formulations, the assessment of catastrophic damage, rapid assessment of technical and performance of emerging detection systems and their applications.

Our future efforts include more focused effort on homemade explosives, on extending the vulnerability analysis to the full panoply of commercial air frames. We are also taking on a substantial effort to perform systems analysis of aviation security to include both the people who would do us harm, their vulnerabilities they are trying to exploit, and the means by which they conducted the attack. And under the President's initiative, near-term improvements to existing deployed systems will be examined and potentially new and revolutionary technologies will be vetted and tested.

I will conclude my remarks by saying there is much work to be done in aviation security. The threat is enduring, smart and adaptive to what we do. The NNSA laboratories have extensive experience in conducting the kind of analysis needed to reduce our vulnerabilities, and we are committed to working closely with the DHS, with NIST and with our partners across the federal government to mitigate that threat.

Thank you for this opportunity to appear before you today. I will be pleased to answer any questions you might have.

[The prepared statement of Dr. Albright follows:]

PREPARED STATEMENT OF DR. PENROSE C. ALBRIGHT

Mr. Chairman, Members of the Committee, thank you for the opportunity to testify at this important hearing to explore research and development activities aimed at improving aviation security. I am Parney Albright, Principal Associate Director for Global Security at the Lawrence Livermore National Laboratory (LLNL), one of the National Laboratories managed by the National Nuclear Security Administration (NNSA) within the Department of Energy (DOE).

My comments today will focus specifically on those efforts associated with passenger screening at the passenger checkpoint. I will begin my comments with an overview of our current efforts and where those efforts are headed in response to President Obama's directive on aviation security R&D with its specific mandate to involve the DOE National Laboratories. I will then discuss how our efforts are currently coordinated with the Department of Homeland Security, Science & Technology Directorate (DHS S&T), the Transportation Security Administration (TSA), and the National Institute of Standards and Technology (NIST). Finally, I will make some brief comments on the social science aspects of passenger screening.

Current Aviation Security Programs & Response to the President's directive

In response to the December 25, 2009 terrorist attempt to destroy Northwest Flight 253, and the President's subsequent directive, the NNSA National Laboratories (LLNL, Los Alamos National Laboratory (LANL) and Sandia National Laboratory (SNL)) continue to be fully committed to contributing their capabilities in systems analysis and engineering, explosives science and technology, high performance computing, modeling and simulation, and other resources to support the President, and work with the Department of Homeland Security (DHS) and other partner agencies to provide aviation security and combat terrorist threats.

This is a hard problem. Explosives have long presented the most prevalent threat to transportation security, to critical facilities, and to individuals. Current events show that explosives continue to be the weapon of choice for terrorists worldwide. The threat is evolving, and the increased access worldwide to the internet has provided the terrorists with information to manufacture homemade explosives (HME) using readily available chemicals. Explosives are very difficult to detect—in some cases, only trace evidence (billionths of grams) are available for sampling, and bulk quantities of explosive mater must be detected in the presence of other potentially confusing, but benign, materials. TSA officers only have a short time to detect explosives and assess the situation if they are to maintain the flow of people and goods.

Continuous and concentrated research and development is fundamental to understanding the threat and creating the tools that will give our nation the capability it needs to decrease our vulnerability. In order to provide that enduring focus on hard problems, the government created a unique type of organization to fill this gap: the Federally Funded Research and Development Center (FFRDC). Objectivity and independence are ensured by the legal structure of the FFRDC, which requires it to refrain from competition with the private sector, be free from organizational conflicts of interest, and provide full disclosure of its affairs to the primary sponsoring agency. In turn, an FFRDC has access beyond that which is common to the normal contractual relationship-to Government and supplier data, including sensitive and proprietary data. They are depended upon to effectively craft solutions to our nation's toughest problems and to anticipate and mitigate future challenges. The technical capabilities, and FFRDC status of the National Laboratories, their objectivity and independence, and the unfettered access to government data and proprietary information such as, for example, airframe structural data, is crucial to improving the security of aviation.

Current Efforts

The National Laboratories have been involved in high explosives research and development since their inception, and apply that expertise to the needs of the Defense Department, the Department of Justice, the Federal Aviation Administration, and more recently, to DHS. Laboratory researchers combine cutting edge computer simulation codes, state-of-the-art experimental diagnostics, and an environment where theory- and experiment-based chemists, physicists, engineers, and material scientists can work together to provide a detailed understanding of the science of energetic materials, their effect on aircraft structures, their impact on extant detection systems at, e.g., the passenger checkpoint, and how systems might be improved to enhance aviation security.

The National Explosives Engineering Sciences Security (NEXESS) Center, established by DHS S&T in 2006, has capitalized on the FFRDC model, utilizing the expertise of the National Laboratories to develop and implement cutting-edge engineering and science-based methods aimed at reducing the risks to aviation. The main focus of NEXESS work has been on performance characterization of homemade explosives (HME) and understanding vulnerability of aircraft to HME threats. The NEXESS Center has provided an important science base for aviation security, including:

- Evaluation and characterization of explosive formulations including, emerging (e.g. homemade) explosive threats, the determination of detonability, methods of initiation, detonation velocity, and impulse energy;
- Assessment of the catastrophic damage threshold for aircraft as a function of explosive amount, location, and flight conditions (initial work has been focused on a specific narrow body airframe) using a combination of highly sophisticated computer modeling in concert with small and large scale experiments;
- Rapid assessment of the technical performance of emerging detection systems and their application to aviation checkpoint security; including one particular example that involved working with L3 to determine the utility of active millimeter wave technology for the detection of concealed liquid explosives on a person.

Due to acquisition priorities, the NEXESS Program has recently been centered on developing system requirements for the procurement of the next generation of checked baggage screening systems. Of particular interest is the LLNL Image Database Development (IDD) Project, which aims to provide a sound basis for standards for next-generation screening equipment. The project, which is sponsored by DHS S&T, is executed in close coordination with DHS S&T, the Technical Support Working Group (TSWG), Explosive Detection System (EDS) system developers, advanced algorithm developers, the Transportation Security Laboratory (TSL), and TSA.

The IDD Project collects raw x-ray data and images for the various EDS and emerging digital radiography (DR) machines to stimulate commercial development of next-generation systems that provide the “best value” combination of performance and affordability for screening checked and carry-on baggage. Performance is measured by a number of criteria, including probability of detection, level of false alarms, signal-to-noise ratio, figure of merit, and throughput.

Compiled from both industry and government-laboratory sources, the data are stored in a common nonproprietary database located at LLNL. This information is used to assist both government and industry in developing a new performance standard for screening checked and carry-on baggage, and for determining needed modifications to future hardware and software to provide higher performance in detecting an increasing portfolio of explosives risks. Working with the NEXESS team, the IDD project is currently supporting DHS/TSA efforts to develop systems specifications and test plans for the $1-billion EDS procurement to be completed in FY 2010.

A similar activity, conducted at Sandia National Laboratory, involves the characterization of threat objects as seen by whole body imaging systems. This effort compiles the variety of images seen by various imaging systems, thus making available a library against which new detection algorithms can be developed and tested.

Los Alamos National Laboratory is investigating the use of ultra low field magnetic resonance imaging (MRI) for detecting harmful materials inside sealed containers. MagViz works by manipulating and detecting hydrogen atoms with small magnetic fields. Pattern-matching software compares the detected signature with a database of dangerous materials.

Future Efforts

Under the President's R&D initiative, the NEXESS effort plans to accelerate the evaluation and characterization of a rather long list of explosive formulations. In addition, the National Laboratories will create a "Threat Matrix" that characterizes these explosives not just in terms of their effects on aircraft, but also in the range of signatures they present to deployed and new detection technologies, thus allowing this effort to more fully inform enhancements to existing systems and the design of future ones.

As part of the vulnerability analysis, we will accelerate the assessment of the susceptibility of the full panoply of commercial aircraft airframes to the variety of explosives represented in the threat matrix, using computer analysis as well as subscale and large scale testing.

In addition, under the President's initiative, substantial efforts will be placed on the systems analysis of aviation security-understanding the various paths that might be exploited by a terrorist to create an aviation catastrophe, the points where government capabilities might be brought to bear to intervene and disrupt an incident, and the alternative architectures of capabilities that serve to mitigate the risk to aviation security. This effort, to be successful, should be focused on addressing all the contributors to risk-the people who would do us harm, the vulnerabilities they try to exploit, and the means by which they conduct the attack. Concepts developed by the National Laboratories for DHS Policy-in support of the development of planning guidance-serve as a very useful model for understanding the most productive approaches to accomplishing our goals for mitigating risk. The systems analysis effort will also consider the implications to the concept of operations of deploying new and improved screening technologies and combinations of technologies.

Furthermore, under the President's initiative, near term improvements to extant deployed systems will be examined. For example, methods for automated anomaly detection in whole body imagers will be explored and tested, perhaps allowing these systems to be deployed at the primary passenger checkpoint-due to the ability of one operator to now supervise multiple machines. Methods for automating secondary inspection-for example, the use of high frequency probes to rapidly ascertain whether or not a threat is posed by detected anomalies-present the possibility for increasing throughput and perhaps even obviating privacy concerns.

Finally, under the President's initiative, new, potentially revolutionary technologies will be vetted and tested. For instance, prospective technologies for determining whether a liquid within carry-on baggage in fact represents a threat will be assessed for use. If successful, it might allow the flying public to again carry duty-free purchases or their accustomed toiletries.

While the NNSA National Laboratories have a long history of combining science and systems analysis with innovation and engineering, they do not create production lines and manufacturing facilities. Hence, over the years, the National Laboratories have worked closely with our government sponsors and with industry to commercialize those innovations, including explosive detection capabilities for aviation security. The currently deployed millimeter wave (mmW) whole body imaging technology uses a licensed technology from Pacific Northwest National Laboratory (PNNL). LLNL has commercialized first generation colorimetric devices, such as the Easy Livermore Inspection Test for Explosives (ELITE), which is sensitive to more than 30 different explosives and provides immediate results. The National Laboratories continue to work on advanced algorithms to simultaneously address false alarms, enhance sensitivity to the expanding panoply of threats, and protect individual privacy.

Coordination with DHS S&T, TSA, and NIST

The primary source of funding for Aviation Security Programs at the National Laboratories is DHS S&T and TSA. In addition to our regular interactions with the DHS and TSA program managers and routine peer reviews conducted at the National Laboratories (by academic and industry experts), the NEXESS program has also established a Blue Ribbon Panel chaired by TSA and includes members from DHS S&T, TSL, the private sector, and academia. This panel provides assistance in evaluating and redefining the explosives detection and certification standards for a range of automated screening systems.

The National Laboratories also support the DHS Explosive Standards Working Group (ESWG), which is chaired by DHS S&T, and includes broad membership across the DHS Components, the NIST and other Federal agencies. LLNL and other National Laboratories are members of the National Electrical Manufacturers Association (NEMA) team, which has been chartered by DHS to write a new standard for airport security called Digital Communication in Security (DICOS). The standard will enable prevention, detection, and response to explosive attacks by standardizing the screening of checked bags as well as other threat risk detection attributes at airports and other security areas. While, the current focus is on x-ray equipment, there are plans for future work in whole body imaging technologies.

Over the last 10 years, the National Laboratories have broadly engaged the scientific community in aviation security. LANL, LLNL, and SNL scientists have participated in numerous National Academy studies and co-authored several reports, including a report entitled, Airline Passenger Screening, New Technologies and Implementation Issues.

Social Science Impact of New Technologies

Commercial deployment of new and improved technologies to meet the threats of today as well as anticipated future threats will require a robust scientific research program to meet the required technical performance and effectiveness. However, we must be mindful that successful deployment of these technologies requires the acceptance of the people required to use it (e.g., airport screeners) and people affected by it (e.g., passengers and crews). Public concern related to passenger screening technologies has been persistent over time and includes health, legal, operational, privacy and convenience issues.

It is my firm belief that the acceptance of a technology-such as whole body screening-will be strongly influenced by the public's perception of the benefits in relation to the loss of privacy. These trades are made all the time by the public, and in the absence of a clearly defined benefit (in terms of enhanced security), the lack of public support should surprise no one. If government regulators mandate such an approach (or an optional full body "pat down" in lieu of the image) without defining in clear terms the benefits to the public in terms of security, or perhaps convenience (e.g. coat removal is no longer required), and in a manner that does not pay due respect to the cultural sensitivities and social concerns of society, then the public will resist. Hence, along with the development of new technical means, it is important to research the social science issues associated with a technology that maybe deemed necessary due to the evolution of the threat or the improvement of capability. Such social science efforts should address the multicultural issues surrounding modern air travel-and address questions like why a socially conservative country like Saudi Arabia accepts full body imaging, while the U.S. public is seemingly less inclined.

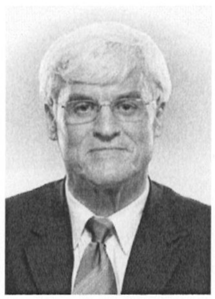
There is much work to do in this area. Understanding the complex interaction between threat and defense requires system-level modeling and analysis across the entirety of the problem. When dealing with the public in such a direct manner on a 24/7/365 basis, the traditional technical performance metrics, cost effectiveness, and the integration issues must stand alongside an appreciation of the human factors associated with deployment. The National Laboratories have extensive experience in conducting this type of analysis for a broad range of national security applications.

Conclusion

As I have demonstrated through a number of examples, the NNSA National Laboratories have long engaged in a wide range of Aviation Security Programs to prevent terrorist use of high explosives. Lawrence Livermore, Sandia, and Los Alamos National Laboratories have worked with DHS since 2006 in aviation security, working closely with DHS S&T and TSA. The President's directive on Aviation Security specifically challenged the Department of Energy, and in particular it's National Laboratories, to respond to the need for innovation in this arena. We look forward to accepting the President's challenge, and applying the full power of these laboratories-multi-disciplinary science and engineering, high performance computing, and (importantly) the core mission to serve the Nation without any real or perceived conflict of interest, as a partner to the government in the context of our special relationship as an FFRDC—to secure our Nation's aviation and our freedoms. In pursuing this effort, we will work closely with DHS, which has been the primary funding source of many of our aviation security projects, and other partner agencies to meet this vitally important challenge to national security.

BIOGRAPHY FOR DR. PENROSE C. ALBRIGHT

Lawrence Livermore National Laboratory



PENROSE (PARNEY) C. ALBRIGHT, PH.D.
Principal Associate Director
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Ph.D., Physics; University of Maryland, 1985
M.S., Physics; University of Maryland, 1982
B.S., Physics/Applied Mathematics, The George Washington University, 1979

Dr. Albright is currently the Principal Associate Director for Global Security at the Lawrence Livermore National Laboratory. Dr. Albright is responsible for applying LLNL's multi-disciplinary science and technology to anticipate, innovate and deliver responsive solutions for our nation's complex, global, national, homeland and energy security challenges.

Before joining Global Security's senior management team in 2009, Dr. Albright served as President of Civitas Group LLC, which has as its core mission matching solutions with the vast security and planning requirements of the homeland and national security sectors. To accomplish this mission, Civitas creates, invests in, and provides strategic advisory services to government and companies with solutions that are critical to protecting our nation.

Prior to his work with Civtas, Dr. Albright served as Assistant Secretary in the Department of Homeland Security. He was confirmed by the Senate as Assistant Secretary on October 3, 2003. His responsibilities included developing the multi-year strategic planning guidance and budget execution for the complete portfolio of programs comprising the Science and Technology Directorate. Beginning in FY03 with a budget allocation of approximately $700M, at the time of Dr. Albright's departure the FY06 budget allocation exceeded $1.4B.

Dr. Albright served as principal scientific advisor to the Secretary of Homeland Security on issues associated with science, technology, and the threat of biological, nuclear, and chemical terrorism. On these issues he served as the Department's primary representative to other US Government agencies, the Homeland Security Council, the National Security Council, the Office of Science and Technology Policy, and foreign governments.

Dr. Albright has authored several policy papers for internal or public consumption, primarily in the areas of homeland and national security. He has also been the author of numerous technical publications and briefings, in both the open and classified literature, primarily in the areas of statistical physics, infrared phenomenology; space-based tactical warning and attack assessment systems; intelligence collection systems; and ballistic and cruise missile defense systems.

Chairman WU. Thank you very much, Dr. Albright. Dr. Coursey, please proceed, five minutes.

STATEMENT OF DR. BERT COURSEY, PROGRAM MANAGER, CO-ORDINATED NATIONAL SECURITY STANDARDS PROGRAM, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Dr. COURSEY. Chairman Wu, Ranking Member Smith and Members of Subcommittee, I am Bert Coursey, the Program Manager, Coordinated National Security Standards Program at NIST. Thank you for the opportunity to appear before you today to discuss NIST's work relevant to passenger screening and our relationship with components of the Department of Homeland Security, including the Transportation Security Administration, the Science & Technology Directorate, and the Transportation Security Laboratory, TSL.

Since 2003 NIST's unique capabilities in measurement science have been leveraged in a coordinated way with DHS to help address critical challenges in multiple areas relevant to homeland security. Today I will focus my remarks on NIST's efforts relevant to passenger screening technologies.

Let me quickly highlight the work that NIST is engaged in relevant to passenger screening in the following areas. Additional information about each of these is contained in my written statement. NIST is involved in measurement standards in the following areas, trace explosive detection, X-ray explosives detection, use of canines for explosives detection, standoff imaging or millimeter wave systems, reference data for explosives, metal detectors, biometrics to enhance screening of travelers, and conformity assessment support for passenger screening technologies.

In each of these areas, NIST is working in collaboration with scientists and engineers from DHS components, with our industry and academic partners, end users and the Nation's voluntary standards organizations to set the baseline for standards and test methods for explosives detection. Several of these projects lead to national voluntary consensus standards, and some of these efforts are leading to international standards. However, in many other projects the test data, test materials and new test methods are being provided directly to DHS, TSA, S&T, U.S.–VISIT [U.S. Visitor and Immigrant Status Indicator Technology] and to our and our other federal partners for their immediate use.

NIST has been involved since 2003 in a multi-year effort with the Transportation Security Laboratory in Atlantic City to engage in research that supports standards and measurement needs for trace explosives screening. The research is designed to improve the reliability and effectiveness of current systems as well as support the development of next generation detection technologies. This work is also providing valuable tools to TSA in the form of test kits and training methods that allow them to optimize the sampling of explosives by the TSA operators. NIST has recently facilitated the development of a suite of national X-ray performance and radiation safety standards that cover the gamut of aviation and transportation venues where explosives are screened. These American national standards are finding increasing use in national and international settings through close cooperation between NIST, DHS agencies and our industrial and foreign partners.

The NIST Standard Reference Data Program is a world-class resource for reference data for thermal, physical and spectroscopic properties of materials for the science and engineering communities. There are serious gaps in the reference data for explosives. NIST has several projects using state-of-the-art systems to acquire new physical and chemical measurement data and also to provide data sets of critically evaluate data from the literature.

NIST scientists have developed a world-class reference facility for measuring the performance of metal detectors, both the hand-held and the walk-through types. Using this facility, NIST developed rigorous and exacting performance standards, one each for the hand-held and for the walk-through metal detectors for the National Institute of Justice as the standards organization. These NIJ standards are used as the basis for procurement for other federal agencies including the Federal Bureau of Prisons and the Transportation Security Administration.

NIST helps lead the development of many biometric standards used to support the screening of travelers. These standards support data sharing and interoperability between points of encounter and centralized biometric services such as the DHS IDENT [Automated Biometric Identification System] and the FBI IAFIS program.

When screening travelers, it is important to deploy technology and processes that provide the highest level of security while keeping the traveling public moving efficiently through checkpoints. To facilitate that, NIST conducts biometric usability studies that help ensure that screening systems are easy, efficient, and intuitive for travelers and inspection agents alike.

Members of the Subcommittee, thank you for your dedicated efforts to improve the safety of air travel for all Americans. I appreciate the opportunity to meet with you today, participate in this panel and to discuss the role of national standards in strengthening passenger screening. I look forward to your questions.

[The prepared statement of Dr. Coursey follows:]

PREPARED STATEMENT OF DR. BERT COURSEY

Chairman Wu, Ranking Member Smith, and Members of the Subcommittee, I am Bert Coursey, the Program Manager, Coordinated National Security Standards Program, at the Department of Commerce's National Institute of Standards and Technology (NIST). Thank you for the opportunity to appear before you today to discuss NIST's work relevant to passenger screening and our relationship with components of the Department of Homeland Security (DHS), including the Transportation Security Administration (TSA), the Science & Technology Directorate (S&T), and the Transportation Security Laboratory (TSL) of S&T.

Since 2003 NIST has had a coordinated relationship with the DHS where NIST's unique capabilities in measurement science have been leveraged to help address critical challenges in multiple areas relevant to homeland security including chemical and biological agent detection, biometrics, first responder communications, and a number of other areas. Today I will focus my remarks on NIST's efforts relevant to passenger screening technologies, but before I get into the specifics of the work I would like to highlight the unique role that the NIST research efforts play in the larger DHS, TSA, and S&T/TSL research, development, testing, and evaluation enterprise.

As a non-regulatory agency of the U.S. Department of Commerce, NIST's mission is to develop and promote measurement, standards, and technology to enhance productivity, facilitate trade, and improve the quality of life. To fulfill this mission, NIST scientists and engineers continually refine the science of measurement, making possible the ultra-precise engineering and manufacturing required for today's most advanced technologies. They also are directly involved in standards development and testing done by the private sector and government agencies.

It is this focus, and the unique capabilities which result, that make NIST an important partner in DHS's science and technology efforts. The measurement methods, standards reference materials, and new measurement technologies produced by NIST are used to both improve the reliability and effectiveness of current passenger screening systems, as well as support the development of next generation detection technologies. The importance of this work to DHS efforts and the recognized need for close collaboration was formalized in a 5-year MOU between NIST and DHS signed in 2003 and renewed with a follow-up MOU in 2008.

In the remainder of my testimony, I would like to highlight the work that NIST is engaged in relevant to passenger screening in the following areas:

- Trace explosive detection
- X-ray explosives detection
- Canine explosives detection

- Standoff imaging systems
- Reference data for explosives
- Metal detector standards
- Biometrics standards to enhance screening of travelers
- Conformity assessment support for passenger screening equipment

In each of these areas, NIST is working in collaboration with scientists and engineers from DHS components, with our industry and academic partners, end users and the nation's voluntary standards organizations to set the baseline for standards and test methods for explosives detection. Several projects lead to national voluntary consensus standards through ASTM International, IEEE, INCITS and others, and some of these efforts are leading to international standards promulgated by ISO and IEC. However, in many other projects the test data, test materials and new test methods are being provided to DHS (TSA and S&T) and our other Federal partners for their immediate use in testing current and future detection systems.

Trace Explosives Detection

Working closely with the Transportation Security Laboratory (TSL), NIST has been involved since 2003 in a multi-year, DHS funded research program that supports standards and measurement needs for trace explosives screening. The research is designed to improve the reliability and effectiveness of current systems as well as support the development of next generation detection technologies. NIST has developed the necessary infrastructure critical to the task by establishing connections with key stakeholders, purchasing an extensive collection of currently deployed trace explosives detection systems, and developing unique measurement capabilities and standard test materials. This infrastructure allows us to understand and test trace detection technology, including the critical front-end sampling process.

Fundamental Measurements and Sampling Studies

Through our ongoing interaction with stakeholders, including the TSA, we identified that a primary limitation in detecting trace explosives in real world scenarios is the inability to efficiently collect the sample. This resulted from a lack of fundamental understanding of the physical and chemical nature of the explosive residue, and the best mechanisms to collect the explosive particles. We have conducted intensive research in this area with the goal of understanding and improving the sampling process. This work encompasses explosive sample collection by physical swiping, aerodynamics (puffer systems) and direct vapor sniffing. We have developed new measurement science tools to understand these processes and test their efficiency. Working with other standards organizations, such as the American Society for Testing and Materials (ASTM), we are developing methods that allow both manufacturers and instrument users to determine the sample collection efficiency of their systems. In addition, we have developed prototype sampling training aids that can be used to test screeners in the field and that provide useful feedback to improve the process. These standard protocols and materials allow for unbiased determination of the effectiveness of the sampling process. Because the standards are developed from a fundamental understanding of the sampling process, they serve as benchmarks for continual improvement in instrument and sampling design.

Some examples of NIST's outputs in this area have been 1) development of a method to determine sampling efficiencies of sample wipes used for trace detectors, 2) development of a prototype training kit to test and improve screener abilities, 3) research articles on the physical nature of explosives residues, identifying specific sample characteristics to target when designing collection strategies.

Optimization of Trace Explosives Detection Equipment Performance

In addition to improvements in the sampling process, further improvements can be made in the trace explosive instruments themselves. Systems can be optimized for detection of current threats, and modifications can begin for detection of emerging threats. NIST has worked to develop a series of unique measurement tools that allow us to study the operational characteristics and fundamental physics that underpin the operation of commercially deployed explosive trace detectors. By understanding each step of the analysis process in detail we are able to make recommendations for improvements in procedures and instrument setup for optimized detection performance.

For several years, NIST has been studying the fundamental science of detecting trace explosives by aerodynamic, non-contact sampling. Typical implementations of this approach include portal-based (puffer) systems. Methods that we have used to study these systems include laser imaging, high-speed videography, and bulk flow tracking, all of which allow real-time visualization of how the air moves around a person's body. These methods, in turn, give NIST researchers insight into how to sample explosive material from a person's shoes, hands, and body. Results typically lead to a better understanding of how these systems work, and may offer valuable information on how to improve the current technology. NIST has also been actively pursuing advanced sampling research with the TSL, developing technologies capable of evaluating sampling systems that may be five to 10 years in the future. Aerodynamic particle sampling is a key concept for these future technologies and likely to be implemented in shoe and cargo sampling which is gaining importance because of the potential for non-contact high-throughput sampling. We have a prototype shoe screening system in our laboratory provided by the TSL.

Standard Test Materials for Tabletop Swipe Based Detectors

Our standards development activities include new types of standard test materials and sampling test methods. The NIST test materials are being developed to test not only the performance of the detection technology but also screener performance. A series of NIST Standard Reference Materials (SRM's) have been produced that allow evaluation of bench-top explosives detectors. We have also developed a novel approach for making explosive test materials using inkjet printing to dispense a known and well-characterized amount of explosives onto special test coupons. This is a cost-effective way of producing a large number of well-characterized and field deployable test materials. We currently produce test materials of the major explosives including RDX, TNT, PETN, and AN. These materials could be used in a variety of scenarios including covert testing, predeployment equipment verification as well as validation and calibration of already deployed systems. Our goal is to make inkjet printing technology readily available to any other Federal agencies that may desire to produce their own test materials. Transferring the technology to end users has been greatly facilitated by the commercialization of all of the inkjet systems currently developed and in use at NIST.

NIST has a long history of working with industry and other government agencies through need-based efforts to develop standard test and reference materials and to work closely in voluntary standards organizations such as ASTM and ISO (International Organization for Standards) where standard methods are written. Standard methods and standard reference materials go hand-in-hand in assuring accuracy and reproducibility across technical communities; in this case verification and calibration of trace detection instrumentation. To document the use of the NIST standard test materials, an ASTM standard method has been developed: ASTM E2520–07 *Standard Practice for Verifying Minimum Acceptable Performance of Trace Explosive Detectors.*

Particle-Based Standard Test Materials

Due to the low vapor pressure of most explosives, the majority of deployed trace explosive detection systems utilize sampling of particle residues. Because sampling of these particles is highly dependent on screener performance, testing of sampling efficiencies and procedures requires the use of standard test particles with known chemical and physical properties. Over the last several years we have also developed a robust protocol for fabricating polymer encapsulated explosive test materials that can be used to test both aerodynamic and swipe based explosives detection systems. These particles are being used in prototype screener testing kits.

Vapor-Based Standard Test Materials

Trace vapor detection is a recent addition to the national strategy and investment in aviation security. Vapor sampling is far easier and less intrusive than particle sampling from surfaces, but suffers from the vanishingly small chemical signals emanating from explosive devices. Trace vapors from explosives are typically mingled with a wide variety of benign compounds in the environment, which can mask or cause false alarms. Reliable vapor-based standard test materials are needed to validate the performance of trace vapor detectors, and to improve the technologies on which they are based.

NIST is developing several systems for performance verification at laboratory and operational sites. We have developed a vapor generator based on inkjet technology, where microdrops containing trace levels of explosives are evaporated and mixed with calibrated air flows. This system, in fact, is capable of reliably generating trace vapors below current detection limits, which provide future validation for next-generation vapor detection technologies.

Field-deployable systems are also being considered and developed. For simple pulsed delivery, there are metered dose inhalers adapted from the health care industry, and encapsulated scents adapted from the fragrance and flavor industry. For simple continuous delivery, there are vapor permeation and saturation devices (similar to smelling salts and room fresheners).

Next-Generation Trace Explosives Sensors

In an effort that highlights the unique capabilities that can be found at NIST, researchers are adapting frequency comb technology—which originated from Nobel Prize winning research at NIST aimed at producing ultra-precise atomic clocks at NIST—into a sensor that can detect the trace gases of explosives. The detection of trace gases that come from explosives is an extremely challenging problem both because the vapor pressure of many common explosives are extremely low, and because many interferents will also be present in any realistic situation. Through a program funded by DHS S&T, NIST is pursuing a detection technique, known as frequency comb spectroscopy (FCS), with the potential to overcome these challenges, providing high sensitivity AND broad spectral coverage. The challenge posed by the interferents can be met through the broad spectral coverage of the combs; this spectral coverage permits FCS to generate a full spectral fingerprint of the trace gases and therefore achieve the required selectivity. The adaptation of this fundamental measurement science research could ultimately lead to a game-changer detection technology that won't require time consuming sampling methods.

National X-Ray Standards for Bulk Explosives Detection

National X-ray standards are necessary to insure that security screening systems for bulk-explosives detection meet the surveillance challenge while properly handling all radiation safely considerations—i.e., they provide the measurement tools to insure that minimum performance and safety requirements are met.

Through funding from DHS S&T Test & Evaluation and Standards Division, NIST has recently facilitated the development of a suite of national x-ray performance and radiation safety standards that cover the gamut of aviation and transportation venues where explosives are screened: checkpoint, checked luggage, cargo, vehicle, and whole-body imaging. These American standards are finding increasing use in national and international settings through close cooperation between NIST, DHS agencies, industrial partners and foreign partners.

In the area of *security systems for screening of humans using X-rays and/or Gamma rays,* DHS and NIST collaborated in the development of an American National Standard for measuring imaging performance—IEEE ANSI N42.47–2010. This National standard provides standard methods for measuring and reporting imaging quality characteristics and establishes minimally acceptable performance requirements for security-screening systems used to inspect people who are not inside vehicles, containers, or enclosures. Specifically, this National standard applies to systems used to detect objects carried on, or within, the body of the individual being inspected. It covers the use of both, backscatter X-ray systems (i.e., detect the X-rays reflected back from the individual being inspected) and transmission x-ray systems (i.e., detect the X-rays passed through the individual being inspected).

As performance is not the only consideration in the use of these security-screening systems, DHS and NIST have also collaborated on the development of National standards for radiation safety for personnel exposed to them. IEEE ANSI/HPS N43.17–2009 applies to security-screening systems in which people are intentionally exposed to primary beam x rays, gamma radiation, or both. The standard provides guidelines specific to the ionizing radiation safety aspects of the design and operation of these systems. This standard was developed under the sponsorship of IEEE ANSI National Committee on Radiation Instrumentation by a 35-member Working Group with the following Federal representation: 4 NIST employees, 7–DHS (including TSA, DNDO, CBP, USSS, S&T), 1–FBP, 2–OSHA, 2–FDA, 1–NRC, and 2–U.S. Army.

IEEE ANSI/HPS N43.17–2009 was influential in the development of a new international standard on this topic, EEC 62463–2010, which is scheduled for publication in August 2010. This international standard is expected to be more comprehensive covering standard requirements, specify general characteristics, general test procedures, radiation characteristics, electrical characteristics, environmental influences, mechanical characteristics, and safety requirements. It will also provide examples of acceptable methods, in terms of dose to the whole or part of the body, for each screening procedure and their required times. In particular, the standard addresses the design requirements as they relate to the ionizing radiation protection of the people being screened, those in the vicinity of the equipment, and the security-screening systems operators.

In the area of *checkpoint cabinet X-ray imaging,* NIST and DHS have collaborated in the development of an American National standard for the performance and evaluation of checkpoint cabinet X-ray imaging security-screening systems—IEEE ANSI N42.44–2008. This standard describes the criteria, test methods, and test objects used to evaluate the performance of cabinet x-ray imaging systems. The standard addresses systems use to screen items with cross sections smaller than 1 m × 1 m, at security checkpoints and other inspection venues (e.g., entrances to Federal buildings). The standard also establishes minimally acceptable imaging performance values for a specified set of image quality metrics and specifies operational characteristics deemed essential for checkpoint x-ray system performance.

In the area of X-ray computed tomography (CT) security screening of checked baggage, DHS and NIST are collaborating on the development of an American National Standard for evaluating the image quality of X-ray CT security-screening systems—IEEE ANSI N42.45–2010. CT security-screening technology is currently been used to screen all checked luggage at U.S. airports and the quality of data for automated analysis is of primary concern. This standard provides standard test-methods and -artifacts for measuring and reporting the image quality of CT security-screening systems. This standard is likely to be considered by TSL as a part of their comprehensive verification and certification of CT security-screening systems.

The above described, and jointly developed, standards and test objects not only guide grants and procurement, but also provide ongoing quality assurance for aging security-screening systems in the field. The uniform application of standard test methods and artifacts allows comparison of the imaging performance of novel systems and prototypes of competing vendors as well as, provides objective quantitative measures of systems claims for a particular technical implementation of explosives detection.

All of these x-ray performance and safety standards continue to be under spiral development as threats and technical countermeasures evolve.

Canine Explosives Detection

NIST is working to develop test materials and documentary protocols for the reliable evaluation of trace explosives and bomb dog detection. SRMs may be used to evaluate performance prior to procurement and during field service. The goal is to provide a suite of materials for evaluation of both the instrumental trace explosives detectors and bomb dogs. For canine performance materials, advanced metrology has been developed that permits the accurate measurement of the primary odors in numerous explosives. Prototype materials have been prepared that mimic the real explosives odor profile and are about to be tested in certified bomb dogs. These canine SRMs will provide substantial monetary savings as well as greater trainer safety by eliminating the current requirement for training aids based on real explosives. NIST also takes a leading role in the development of consensus standards through organizations such as ASTM and SWGDOG that provide best practice protocols for testing detection systems and canines. This work is funded by the S&T Test & Evaluation and Standards Division, and partners in the standards development activities include scientists in S&T and the NPPD Office of Bombing Prevention.

Standoff imaging systems

NIST research has improved the ability to assess claims on the performance of a wide variety of technologies designed to detect explosives, and other weapons, concealed on persons in high-traffic areas such as airports, railway stations, sports arenas, and similar public venues. The work, which is funded by DHS S&T and DOJ National Institute of Justice, includes studies of the reflectance/transmittance of human skin, fabrics, and threat objects when examined from a distance using ultraviolet, visible, infrared, millimeter wave or microwave radiation. A key performance goal for these standoff technologies is the ability to detect hidden IEDs with high probability under various standard scenarios. NIST scientists are also working with DHS to develop a standard to quantify the body coverage of whole-body imagers, such as x-ray backscatter and millimeter wave systems. These recent efforts leveraged longer-term NIST projects in passive and active millimeter-wave and terahertz sensing for security applications. These projects funded by DHS, DARPA, and DOD, made pioneering contributions to active and passive millimeter-wave imaging security applications. The research led to advanced millimeterwave and THz imaging systems, calibration targets that have been distributed to some 20research groups, and a database to guide the development of portal sensors for screening liquids and solids. NIST and DHS, along with other Federal agencies and industry partners, are working with standards development organizations to develop standards, test artifacts, and test methods for imaging systems for the detection of explosives and other threats.

Reference data for explosives

NIST Standards Reference Data program is a world-class resource for reference data for thermophysical and spectroscopic properties of materials for the science and engineering communities. NIST has several projects using state of the art systems to acquire new data from physical and chemical measurements, and to provide data sets of critically evaluated data from the literature. Because of the wide range of new technologies under development for explosives detection, there are serious gaps in the reference data. DHS S&T and NIST funding are directed at filling in some of these gaps. One example was driven by the potential of a technique known as *Dielectric spectroscopy* to detect hazardous liquids in containers. NIST work showed that this technique is capable of clearly differentiating dangerous liquids, such as gasoline and bleach, and innocuous liquids, such as water and milk. The results thus far have been limited to special test holders and work is being undertaken to determine the effect of container typically used to hold these liquids. The results of this effort yielded reference data, which can be use by researchers to develop new airport scanning equipment for liquid containers.

A second data project is directed toward thermophysical properties of explosives. Concealed explosives can be detected through the chemical or physical "signatures" that they leave behind. Timely and reliable physical and chemical property information for explosives is therefore essential for the successful development and implementation of new detection techniques. But, the properties of explosives are widely dispersed in the technical literature and are often discordant with poor characterization of data quality (i.e., poor estimates of the uncertainty of the chemical-physical properties of the explosive compound).

With support from DHS S&T, NIST is developing software tools for on-demand, critically-evaluated physical and chemical properties of existing and conceptual explosive compounds. For this project, primary experimental information on the properties of explosives is collected, critically evaluated, and provided to DHS in the form of expert-system software. The NIST expert system includes state-of-the-art property-prediction tools that allow many evaluations for conventional explosives as well as those that have not yet, or cannot yet, be studied experimentally.

Metal detector standards

NIST scientists have developed a world-class reference facility for measuring the performance of metal detectors, both hand-held and walk-through types. This facility uses a computer-controlled robot to reproducibly position and move specially designed test objects through or by a metal detector. The test objects are fabricated using defined metal parameters to ensure consistency from measurement to measurement and between different test facilities. The methods developed to test the pertinent electromagnetic properties of these test objects have been used to support similar test object development for the S&T TSL facility. The NIST facility also uses a human electromagnetic phantom to emulate the effect of a person on metal detector performance; the materials comprising this phantom were developed in collaboration between NIST and industry scientists. Using this facility, NIST developed rigorous and exacting performance standards, one each for hand-held and walk-through metal detectors, for the National Institute of Justice (NIJ). These NU standards are used as a basis for procurement by other agencies, such as the Federal Bureau of Prisons (BOP) and the Transportation Security Administration (TSA). The methods used in these standards have been emulated by other groups developing other checkpoint security standards and/or test and evaluation methods.

Biometric Standards to Enhance Screening of Travelers

NIST helps lead the development of many biometric standards used to support the screening of travelers. For example, NIST serves as the Standards Developing Organization (SDO) for two documentary standards (ANSI/NIST–ITL 1–2007 and ANSI/NIST–ITL 1–2008), which facilitates the interchange of electronic biometric data including fingerprint, and face and iris images. These standards support data sharing and interoperability between points of encounter (e.g., a port of entry) and centralized biometric services provided by DHS US–VISIT/IDENT and other screening partners such as the FBI IAFIS. NIST also participates in the development and deployment of national and international standards, such as INCITS–M1 and ISO/IEC–SC37, which focus on data formats, performance testing, and image quality. With many biometric standards to choose from, NIST also chairs the group that develops the *Registry of USG Recommended Biometric Standards.*

Ensuring the high quality of collected biometric data is key to improving the use of biometrics. To that aim, NIST pioneered a publicly available and interoperable algorithm known as the NIST Fingerprint Image Quality (NFIQ). Building on its expertise, NIST also works to test algorithms for assessing image quality of iris and faces. For example, NIST created the Image Quality Evaluation and Calibration (IQEC) program to evaluate quality factors and metrics that impact iris-recognition accuracy. IQEC is one of a growing list of NIST evaluations for testing and informing biometric standards. Other notable tests include the Minutiae Exchange Test (MINEX) which tested the interoperability between standard fingerprint template generators and matchers; and the first Iris Exchange Test (IREX 1) which tested the matchability of standard compact iris image formats.

When screening travelers, it is important to deploy technology and processes that provide the highest level of security while keeping the traveling public moving efficiently through checkpoints. To facilitate that, MST conducts biometric usability studies that help ensure that screening systems are easy, efficient, and intuitive for travelers and inspection agents alike. As an example, MST conducted a positioning study to determine the best installation of fingerprint readers on counters at ports of entry. The results of this study were used by TSA in designing checkpoints and placement of the new 10 finger slap readers. In addition, NIST has developed and tested language-independent, international biometric symbols that will help guide travelers efficiently and effectively through the biometric acquisition process. This work was supported by DHS S&T and products were delivered to US VISIT and TSA.

Conformity assessment support for passenger screening equipment

Non-intrusive Inspection Systems

In collaboration with DHS and standards development committees, NIST has enabled the development of performance standards for non-intrusive inspection systems that cover aviation and transportation venues where explosives are screened to include critical characteristics such as electromagnetic compatibility, fire and electrical safety. These standards facilitate the deployment and use of these technologies in environments where passenger/operator safety and performance degradation from electromagnetic interference are key concerns.

NIST has also assisted the TSA Atlantic City Technical Center in enhancing their technical requirements documents for x-ray inspection equipment by identifying appropriate standards references and testing requirements.

Biometrics

NIST assisted TSA in identifying appropriate standards and conformity assessment procedures for a Qualified Products List (QPL) for Airport Access Control biometrics equipment based on the requirements of the *Intelligence Reform and Terrorism Prevention Act of 2004.*

Following a request and funding from DHS, NIST developed a laboratory accreditation program for testing of biometrics products to support the TSA Airport Access Control QPL program; the NIST National Voluntary Laboratory Accreditation Program (NVLAP) will establish an accredited lab network for third party testing to standards for biometrics equipment. This program is available for use by other DHS and other Federal labs—a major step toward providing uniformity of testing for commercial cards, readers and other biometrics equipment purchased by the Federal and jurisdictional agencies.

Summary

Members of the Subcommittee, aviation security is an activity of national importance. The scientific and technological tools that will enhance our security are complex, and major investments are being made by DHS to develop and refine these tools for emerging and evolving threats. Measurements and standards are essential—both to the current generation of security technologies and to next generation S&T approaches. NIST scientists and engineers are proud to accept the challenges and opportunities presented by our colleagues in the other Federal agencies charged with improving our aviation security.

Thank you for your dedicated efforts to improve the safety of air travel for all Americans. 1 appreciate the opportunity to meet with you today to discuss the role of national standards in strengthening passenger screening and I look forward to answering your-questions.

BIOGRAPHY FOR DR. BERT COURSEY

Dr. Bert Coursey, Program Manager, Coordinated National Security Standards Program, at the Department of Commerce's National Institute of Standards and Technology (NIST).

Bert M. Coursey received his B.S. degree in Chemistry in 1965, and the Ph.D. in Physical Chemistry in 1970, from the University of Georgia. He served as an Officer in the U.S. Army in 1969–71 in the Army Engineer Reactors Group at Fort Belvoir, VA. He joined the National Institute of Standards and Technology (NIST) (formerly the National Bureau of Standards) in 1972 and for the following 15 years worked on radioactivity standards for environmental radioactivity and nuclear medicine. More recently he has held management positions in radiation dosimetry and served as Chief of the Ionizing Radiation Division in the NIST Physics Laboratory. He is a member of the Senior Executive Service. He is a recipient of the Bronze (1987) Silver (1997) and Gold (2002) Medals of the Department of Commerce, past president of the International Committee for Radionuclide Metrology, and past president of the NIST chapter of Sigma Xi. He is a Fellow of the American Association of Physicists in Medicine. Dr. Coursey has ninety publications on radioactivity standards and applied radiation dosimetry. Dr. Coursey has served for 30 years as editor of the journal **Applied Radiation and Isotopes.**

Since March 1, 2003, Dr. Coursey has been on assignment to DHS as Director for Standards in the Test & Evaluation and Standards Division in the Science & Technology Directorate, Department of Homeland Security. In 2004 he was appointed the Standards Executive for the Department. His office is responsible for the design and implementation of a national program for standards for homeland security. A partial listing of the DHS standards projects underway includes performance standards and testing and evaluation protocols for personal protective and operational equipment, chemical and biological detectors for emergency responders, explosives detection equipment, and performance standards for information technology (IT) to include credentialing, biometrics and cyber security.

Chairman WU. Thank you very much, Dr. Coursey. Dr. Hyland, please proceed.

STATEMENT OF DR. SANDRA L. HYLAND, SENIOR PRINCIPAL ENGINEER, BAE SYSTEMS

Dr. HYLAND. Good afternoon, Mr. Chairman and members of the Committee. My name is Sandra Hyland and I served as the study director for the 1996 NRC [National Research Council] study "Airline Passenger Security Screening: New Technologies and Implementation Issues" as well as vice chair for the 2007 NRC study "Assessment of Millimeter-Wave and Terahertz Technology for Detection and Identification of Concealed Explosives and Weapons", technology more commonly known as full-body or whole-body scanners. The NRC, National Research Council, is the operating arm of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine of the National Academies, chartered by Congress in 1863 to advise the government on matters of science and technology. I would like to clarify that I am not representing my employer, BAE Systems, but am here to discuss work I have done as an employee and a volunteer with the NRC over the past 16 years.

The FAA and the TSA have sponsored numerous NRC studies on various aspects of aviation security in order to obtain expert, independent guidance on technology priorities and approaches, and we are pleased to continue this positive relationship. My testimony today will center on the earlier reports, in particular, the committee's discussion related to implementation issues associated with new technologies.

The 1996 NRC Report on Airline Passenger Security Screening described not only the technical advances in security screening but also the more practical side of that screening. It is important to understand that no technology, no matter how promising, will work unless it can be successfully implemented within the aviation security infrastructure. To this end, the committee addressed both the legal issues associated with passenger screening as well as the more-difficult-to-quantify issue of public acceptance. And although the report was written prior to 9/11, it is my opinion that the committee's message that it is important to assess the public's reaction to, and acceptance of, the screening technologies remains relevant.

The committee reached its conclusion and developed its recommendations based on briefings from the FAA and other government entities on their security screening approaches and by holding a workshop attended by representative groups, such as airport personnel, that would be affected by changes in passenger screening approaches. My written testimony includes a complete list of workshop attendees.

During the course of the study, the committee held one underlying assumption. The level of inconvenience and invasion of privacy that people are willing to tolerate is associated with their perception both of the severity of the threat and the effectiveness of the screening in averting that threat.

The 1996 committee identified four issues most relevant to the public acceptance of technologies, health, privacy, convenience and comfort. People will differ in terms of the importance they place on these issues and their level of acceptance of passenger screening technologies. Aside from considering the reactions new technologies may elicit, TSA will have to determine an acceptable level of opposition.

I will now briefly discuss the areas of concern identified by the committee. Health. Issues related to health are more related to the perception of health consequences than any actual risks. Specifically, the committee noted that while the technologies were safe, there are public concerns related to, for example, the potential consequences of exposure to the radiation used in scanning technologies. It will be important then to be proactive in education relating to the minimal exposure levels and convey this information so that it is as accessible to a wide audience.

Privacy. Privacy is probably the most significant factor in terms of whether the public will accept a new technology. In the case of the full body imagers described in the 2007 report, there are significant concerns as this technology can display a person's anatomical features. As the committee noted in 2007, at a resolution of one centimeter, the images have enough detail to be embarrassing to many people and can reveal such personal information as the use of an ostomy bag or the presence of breast implants. It will be important then that if this technology is adopted, it is done in such a way that it acknowledges the public's concerns about privacy and carefully balances them against the technology's benefits. In 1996, the committee noted that this technology would most likely only be accepted if the perceived threat level were high and the technology proven to be effective at averting the threat, but that would be difficult to quantify just how high that threat would need to be. In my opinion, given the reaction to the to the attempted bombing of the Northwest Airlines Flight on Christmas, this may be the time to revisit the question of the effectiveness of this technology in airport use, and whether given the threats the flying public would accept it.

The 1996 report also identified steps that may improve public acceptance of body imaging technologies and trace explosive detection, both of which are in my written testimony.

Convenience is largely a matter of time. The 1996 committee noted that screening technologies that impose delays will also have problems with public acceptance.

Issues related to comfort arise when a technology requires that the person being screened to be in close contact with either with the equipment or another person or a technology that requires a person to be in a confined space.

While there are ways to minimize this discomfort, it can lead to a trade-off with technological effectiveness. For example, using airflow to collect samples for explosives detection may ameliorate the concerns of a passenger that does not want to be touched, but may not be as effective as direct contact.

The 1996 committee found that there had been very little study of the public acceptance of screening technologies, and when this topic was revisited relative to the committee's work on the whole-body imagers in 2007, that had not changed. The committee identified a number of intangibles that go into the public's willingness to accept inconvenience, and I have provided a description of those in my written testimony.

However, the committee stated that there is no better way to gauge public acceptance of new technologies screenings than field tests. The committee strongly encouraged that in addition to performance data, information related to the acceptance of this technology be collected. People find it difficult to provide reactions to abstract, hypothetical situations compared to here-and-now machines. So the most accurate reading of the public's reaction to a scenario will be by conducting testing as closely as possible to the proposed implementation.

I would like to conclude my remarks with some personal views based on the input from the participants in the committee's workshops. Several representatives from airport operations and air carrier groups were concerned that the FAA would impose new screening technology without sufficient consideration of passenger acceptance. Air carriers are acutely aware that travelers make trade-offs, and increasing the burden on passenger security screening can potentially push those trade-offs away from air travel. Including the air carriers, airport operators, and other industry representatives in the assessment and deployment of new passenger screening technology will help ensure the successful implementation.

Thank you for the opportunity to testify today, and I would be pleased to address any questions.

[The prepared statement of Dr. Hyland follows:]

PREPARED STATEMENT OF DR. SANDRA L. HYLAND

Good afternoon, Mr. Chairman and members of the Committee. My name is Sandra Hyland and I served as the study director for the 1996 NRC study *Airline Passenger Security Screening: New Technologies and Implementation Issues* as well as vice chair for the 2007 NRC study *Assessment of Millimeter-Wave and Terahertz Technology for Detection and Identification of Concealed Explosives and Weapons* (the form of imaging more commonly known as full-body scanners). The NRC—National Research Council—is the operating arm of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine of the National Academies, chartered by Congress in 1863 to advise the government on matters of science and technology. I would like to clarify that I am not representing my employer, BAE Systems, but am here to discuss work I have done as an employee and a volunteer with the NRC over the past 16 years.

The FAA and, following the events of September 11, 2001, the TSA have sponsored numerous studies with the National Research Council in order to obtain expert, independent guidance on technology priorities and approaches, and we are pleased to continue this positive relationship. My testimony today will center on the earlier reports, and in particular, the committee's discussion related to the implementation issues associated with these technologies.

The 1996 NRC Report, *Airline Passenger Security Screening: New Technologies and Implementation Issues,* described not only the technical advances associated with security screening, but also the more practical side of that screening. It is important to understand that no technology, no matter how promising, will work unless it can be successfully implemented within the current aviation security infrastructure. To this end, in the 1996 report, the panel addressed both the legal issues associated with passenger screening—most of which are related to the concepts of search, the expectation of privacy, and implied consent—as well as the more-difficult-to-quantify issue of public acceptance.

Although this report was written prior to the events of September 11, 2001, and during a time when the internet was in its infancy and "blogosphere" was neither a word nor a concept, it is my opinion that the panel's underlying message—that it is important to assess the public's reaction to, and acceptance of, the screening technologies—is still relevant. Critical differences between the passenger screening approach of today compared to that in 1996 include the federalization of the screening workforce and the assumption by the U.S. government of the security screening operations. Compared to the "arms-length" responsibility the FAA had for passenger screening in 1996, the TSA is now mostly directly responsible for the purchase, deployment, and operation of security screening equipment and for the security screening personnel. This change in the role of the U. S. government in passenger screening does not obviate the need for TSA to assess the public acceptance of a specific security screening approach to strike a balance between security and a robust air travel business.

In their review of some specific potential passenger screening scenarios, the panel relied on this underlying assumption: people relate the level of inconvenience and invasion of privacy that they are willing to tolerate to their perception of the severity of the threat being averted and the effectiveness of the screening efforts at averting that threat. In airline passenger security screening, "people" refers not only to the passengers themselves, but to all the other air carrier and airport personnel exposed to the screening process—including flight crews and air carrier and airport employees who work inside the sterile area of the airport.

The panel developed their recommendations through briefings from the FAA on potential technologies for screening passengers and from other government entities on their security screening approaches, and by holding a workshop attended by representatives of groups that would be affected by changes in passenger screening approaches. These groups included those representing airport management, consumer interests, and air-carrier employees. I have included a complete list of workshop attendees at the end of this document.

In 1996, the panel identified four categories of issues most relevant to the public acceptance of these technologies:

- health
- privacy
- convenience, and
- comfort

People will differ in terms of the importance they place on the various concerns, and will also differ in their level of rejection of passenger screening technologies.

Aside from considering the types of reactions new technologies may elicit, TSA will have to determine an acceptable level of opposition.

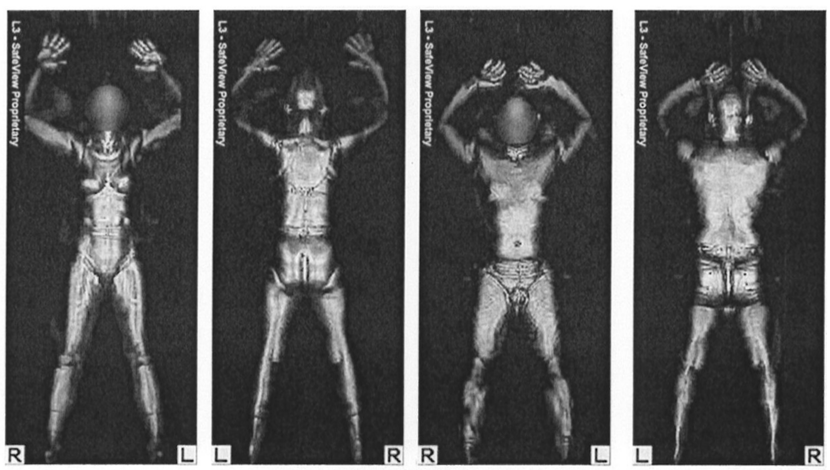
I will now briefly touch on each of the areas of concern identified by the panel.

Health

Issues related to health are more related to the perception of potential health consequences than they are to any actual risks. Specifically, the panel noted that while the technologies themselves were safe, there are public concerns related to, for example, the potential consequences of exposure to the radiation used in active scanning technologies. For this reason, it will be important to be proactive in education related to the minimal exposure levels—and it will be important to convey this information in such a way that it as accessible to the widest audience.

Privacy

Issues related to privacy are probably the most significant in terms of whether or not the public will accept a new technology. For example, in the case of the full body imagers described in the 2007 report on millimeter-wave and terahertz technology, there are significant concerns when it comes to technology that can display a person's anatomical features.



MMW image courtesy of Wikimedia commons: public domain.

As the committee noted in the 2007 report related to this technology, even images with a resolution of 1 cm have significant detail to be embarrassing to many people, as can be seen in the example image shown above. These concerns may be exacerbated when the person being screened is a member of a culture for which modesty is important. Concerns also exist relative to the technology's potential to reveal such personal information as the use of an ostomy bag, or the presence of breast implants. For this reason it will be important that should this technology be adopted, it is done in such a way that the public's concerns about privacy are acknowledged and carefully balanced against the benefits of this technology's use. At the time the report was written, the panel noted that this technology would most likely only be accepted if the perceived threat level were high and the technology effective at averting that threat, but that quantifying just how high the threat would need to be would be difficult. In my opinion, given the reaction to the attempted bombing of the Northwest Airlines Flight on Christmas, this may be the time to revisit the question of the effectiveness of this technology in identifying this kind of threat in actual airport use, and the level of threat at which the flying public would accept this technology as a primary screening approach.

The 1996 report identified five steps that might be taken to improve public acceptance of body imaging technologies:

- masking portions of the displayed image or distorting the image to make it appear less "human"

- using operators of the same gender as the subject to view the images
- ensuring that images are displayed in such a way as to be viewable only to the screener
- providing guarantees that images will not be preserved beyond the brief screening procedure, except when questionable objects are detected, and
- offering alternative screening procedures-such as a "pat down" for those who object to imaging.

The committee noted in its 2007 report that many of these approaches have already been implemented in other countries. In particular, a field trial of one imaging system at Gatwick Airport in the United Kingdom found that the public response was favorable, and that the system was also successful in detecting concealed metal and ceramic weapons.

A second category of technology that has the potential to raise privacy concerns is that of trace explosives detection. As other technical experts have already likely explained, this technology allows for a sample to be taken from a subject (either by walking through a portal or by means of a hand-wand device). This sample is then analyzed for the presence of a chemical signature that would indicate the subject had been in contact with explosive material.

In this case the privacy concerns stem either from the potential for disclosure of information the passenger would rather be kept private (for example, the use of nitroglycerin for a heart condition), or the aversion that some people have to being touched. As with current "pat down" screenings, some of this can be ameliorated by ensuring that the person is screened by someone of the same gender and out of the immediate public view.

Convenience

Convenience is largely related to time. In 1996, the panel noted that screening technologies that impose delays will also have problems with public acceptance.

Speaking from my own perception rather than as a member of the committee, the public has grown to grudgingly accept the need to arrive at the airport well-ahead of their anticipated departure to accommodate not only longer lines at security screening, but also the uncertainty in how long that screening might take. However, there may also have been some backlash as, for example, train ridership has gone up, with Amtrak recording record ridership each year from 2002 through 2008.

Comfort

Issues related to comfort often arise when there is a technology that will require the person being screened to be in close contact either with the equipment or with another person. In some cases, comfort issues can also arise for technology that will require a person to be confined space—such as some trace explosives detection equipment and full body scanners do. In particular, trace detection portals—which also involve directed airflow—have to potential to raise comfort issues.

While there are ways to minimize this discomfort, in some cases this may result in a trade-off with technological effectiveness. For example, the use of airflow to collect samples for explosives detection may ameliorate the concerns of a passenger that does not want to be touched, but may not be as effective as the sampling that comes from direct contact.

In addition to reviewing potential public acceptance of new screening technologies, the panel noted that current screening technology could be made more effective by a better integration of the screening personnel into the system. The inability to maintain a high level of operator performance is a principal weakness of existing passenger screening systems and a potential weakness of future systems. Improving current technologies and developing new technologies both require determining the optimum integration of technological development and human operators into the overall security system.

To ensure an effective screening system, it is imperative to assess the public acceptance of technology and balance that against its benefits before making any decisions about the course to be used. The final part of my statement will review the ways in which the panel discussed how that may be done.

Assessing Public Acceptance

In 1996, the panel found that there had been very little work done to study the public acceptance of screening technologies, and when this topic was revisited relative to the committee's work on the whole-body imagers in 2007, that had not changed. Yet, it's clear that the public perception and acceptance can have a large impact on the behavior of travelers (as I noted with increased use of passenger rail in the northeast corridor).

Additionally, the panel identified a number of intangibles that go into the public's willingness to accept inconvenience, including:

- the nature, extent, and likelihood of the actual threat and the associated risk (Certainly, this changed between 1996 and September 11th)
- the degree of understanding and the perception of the actual threat and the associated risks
- personal beliefs, habits, and cultural mores
- the physical, mental, and emotional state of an individual
- the extent and degree of public understanding of the screening objectives, technology, and procedures
- public perception of the effectiveness of the screening system
- public understanding and perception of the health risks associated with the screening system, and
- the nature and frequency of air travel.

The panel also identified two ways in which the public acceptance of this technology might be measured:

- by surveying the population most likely to be affected by passenger screening, which has the potential to be of limited value due to the self-selective nature of the survey and the likely introduction of sampling error, and
- by identifying similar or analogous circumstances in the past and studying available information related to the public reaction to-or acceptance of-these circumstances. In this case, reaction to metal detectors and baggage scans might provide insight.

However, the panel stated that there is no better way to gauge public acceptance of new screening technologies than by way of field tests. For this reason the panel strongly encouraged that in addition to performance data, information related to the public acceptance of this technology also be collected.

I would like to conclude my remarks with some personal views regarding the input from the participants in the panel's workshops. Many of the representatives from airport operations and air carrier groups expressed the concern that the FAA would impose new screening technology without sufficient consideration of passenger acceptance. Travel by air is a largely voluntary activity—people can choose to take the family to Disney World by air, or they can drive to a nearby attraction. Even business people have a wide variety of tools that can help them minimize air travel, including web-based meetings and other internet-enabled communications. Air carriers are acutely aware that travelers make these types of trade-offs regularly, and increasing the burden of passenger security screening can potentially push those trade-offs in favor of travel by car, train, or bus. Including the air carriers, airport operators, and other industry representatives in the assessment and deployment of new passenger screening technology is likely to be the best way to ensure the successful implementation of new security technologies.

Thank you for the opportunity to testify today. I would be pleased to address any questions the subcommittee may have.

Summary of organizations that participated in the panel's workshop

Organizations attending workshop	Organizations invited but not attending
Air Transport Association of America	
Airport Law Enforcement Agents Network	Air Line Pilots Association, International
American Association of Airport Executives	Allied Pilots Association
Airports Council International North America	American Society of Travel Agents
American Civil Liberties Union	Electronic Privacy Information Center
Association of Flight Attendants	Families of Pan Am 103 Lockerbie
Aviation Consumer Action Project	Victims of Pan Am 103
ITS (provider of airport security services)	
Regional Airline Association	

BIOGRAPHY FOR DR. SANDRA L. HYLAND

Sandra Hyland, Ph.D. has 25 years experience in program management in both for- and nonprofit organizations. She is currently a senior semiconductor engineer at BAE systems. Prior to that, she served in various positions at Tokyo Electron. She has also served as a staff officer at the National Research Council's National Materials Advisory Board and an advisory engineer at IBM. Dr. Hyland has a Ph.D. in materials science and engineering from Cornell University, an M.S. in electrical engineering from Rutgers University, and a B.S. in electrical engineering from Rensselaer Polytechnic Institute. Dr. Hyland is a member of the American Vacuum Society, Electrochemical Society and the Institute of Electrical and Electronic Engineers. She is a fellow of the Society of Women Engineers, and previously served as vice chair of the National Research Council Committee on Technologies for Transportation Security.

Chairman WU. Thank you very much, Dr. Hyland, and thank you for your contributions to the information gathered by this committee.

It is now in order to open for our first round of questions, and the Chair recognizes himself for five minutes. Before we even get to the question of response or lack of response to the 1996 and 2007 reports, I want to ask the panel a threshold question of whether our concern about public acceptance is real or whether it is theoretical. Have you actually determined that the traveling public, that is passengers at airports, are actually concerned about the things we think they are concerned about? The reason why I am saying this is because I spent four hours knocking on doors in Tualatin, Oregon, this past Saturday. I got an earful, but I think that the earful that I got in that neighborhood is very different from the earful that I would get in another neighborhood in my congressional district. Choice of sample and what you ask is absolutely crucial. Are we speculating about passenger concern or do we have direct evidence that these are actual concerns of the flying public? Whoever wants to go first.

Dr. HYLAND. Thank you. That is a question that the 1996 panel struggled with quite a bit. We had experts in how people make decisions to do things they know are risky, like smoking and so——

Chairman WU. Well, did they ask the traveling public what they thought?

Dr. HYLAND. In that case, we recommended that the traveling public be asked, but the question——

Chairman WU. Have they been asked?

Dr. HYLAND. Not as far as I know, but the most important thing——

Chairman WU. This town is filled with pollsters, right? I mean, it is just filled with pollsters. And I am not necessarily recommending that, but it seems like—you know, you don't go and sell cookies in the market without doing a focus group and sampling the public and so on, and we are deploying millions of dollars of equipment, we are betting lives on airplanes.

Dr. HYLAND. Yes, I would like to——

Chairman WU. Have we polled? Have we asked the traveling public? Have we actually asked the question?

Mr. BUSWELL. I don't know.

Chairman WU. Dr. Albright?

Dr. ALBRIGHT. I don't know, either.

Chairman WU. Dr. Coursey?

Dr. COURSEY. I don't know, either.

Chairman WU. So we are sitting in this hearing room engaging in rank speculation about a problem which may not exist? I mean, you read about it in the newspaper, but they are not citing their statistical evidence. I asked this question of staff several days ago, and I was shocked that they didn't have an answer and I am even more shocked that you don't have an answer because you all are in charge of our national research effort. And how do you know that we have a problem without having asked the question?

Mr. BUSWELL. Mr. Chairman, if I may, I think when it comes to public acceptance of these kinds of technologies, aviation securities, passenger screening technologies being one example, we have to assume——

Chairman WU. Why do you have to assume?

Mr. BUSWELL. Because it is prudent to do so——

Chairman WU. Whoa. Look, you can assume that the sky is blue, you can assume the sun rises in the east, but I think that Mr. Smith and I would agree that it is dangerous to make very many assumptions and bet a whole lot on that.

Mr. BUSWELL. I know, but if I may finish, sir, we have to assume that there could be public acceptance issues.

Chairman WU. Well, the question is why? I mean, what makes it safe to make that assumption? And it is a simple thing to ask the question. I mean, all you have to do is throw it in a battery of questions and then also ask the question, have you flown in the last 12 months.

Mr. BUSWELL. Sure. There are certainly scientific——

Chairman WU. And if the answer is yes, the follow-up question is, how many times have you flown. And then you do a simple read of the cross-tabs and you realize, I mean, you have easy data on crossing the number of times flown versus their attitudes about screening technology, right?

Mr. BUSWELL. Sure. Absolutely. And there are scientific—

Chairman WU. So why——

Mr. BUSWELL. —approaches——

Chairman WU. —hasn't that be done?

Mr. BUSWELL. I am not saying that it hasn't, but I don't know that. We haven't done it in S&T that I am aware of.

Chairman WU. You know, as far as I know, I am the only person who has asked that question thus far. The staff was surprised, and they didn't have an answer. You all don't have an answer. This is a really quick thing to do, you know. Like if this were a campaign and this were my campaign, I would ask my pollster to ask that question, and I would have data tomorrow. They run it by telephone tonight.

Mr. BUSWELL. Mr. Chairman——

Chairman WU. So the follow-up question is when are you going to get it done?

Mr. BUSWELL. Well, I will take that for action, sir. And let me go to——

Chairman WU. Give me a date. Give me a date.

Mr. BUSWELL. Let me go to TSA and find out what they have done, and then I will get back to you with a specific date as to how we are going to approach this. They may have data that I am not aware of.

Chairman WU. You know, in what we do, it is kind of a winner-take-all kind of thing, and you know, you live or die by the data that guides you. And I am not necessarily recommending that anybody else live that way. But the thing is, you all are engaged in a very, very important enterprise, the public safety is at stake. A whole economic sector, a whole transportation sector is at stake. And the trust of the public in what their own government does is at stake, and you are telling me that one of the most fundamental questions to our collective knowledge has not been asked. So I am encouraging you in the strongest way possible to either find out that we have the data and get it here or to get that battery of questions asked and get it here. And it shouldn't take very long because Mr. Smith and I and every other elected up here knows that we can get an answer to questions like that by midnight tonight and have a rough analysis by 8:00 a.m. tomorrow and have the thorough analysis within a day after that. That is the threshold question. I will get to the underlying question in the next round.

Mr. Smith, you are recognized for five minutes.

Mr. SMITH. Thank you, Mr. Chairman. Several of you touched on the issue of passenger safety when interacting with the radiation emitted by screening technologies. I was wondering if you could address the radiation levels currently faced by airline passengers and how much increased exposure they can expect in the future. Anyone wishing to respond?

Mr. BUSWELL. Yes, sir. I would be pleased to give you some numbers there. Dr. Coursey can pipe in, too, because I know there are American National Standards Institute [ANSI] standards on the radiation exposure, general radiation exposure from things like screening technology. So to the extent that he wants to comment on that, he can.

So let me put some things in perspective with regard to radiation doses to start with, just so we are all sort of calibrated and we are speaking the same because to me, micro-rem doesn't mean very much unless you understand what you are talking about.

So a low-dose dental X-ray, the dose that you get is about four million micro-rem, or about four rem of exposure. The average annual—I grew up in Colorado, at high altitude. The average annual exposure that you get at high altitude just from the sun, really, is about 4,000 micro-rem. So about 1/10 of what a dental X-ray would be. In one hour on a commercial jet, your dose is about 1,000 micro-rem. In one screening by a back-scatter X-ray body scanner, the dose is about 6 micro-rem. So in other words, if you take a flight from New York to Los Angeles, the dose that you receive would be about 1,000 times what you would get while you are on the airplane compared to what you would get standing in the whole-body imaging passenger screener.

And Dr. Coursey, correct me if I am wrong, but I think the ANSI standard is 25,000 micro-rem per year. So 6 micro-rem is below the threshold that we even have to keep track of how many times you go through the screening process in the airport, if that puts some perspective on the exposure.

Mr. SMITH. Anyone else? Dr. Coursey?

Dr. COURSEY. Yes. I spent most of my career at NIST working in radioactivity and the radiation physics group there. So NIST has been involved for many years in working with the regulatory agencies on dose health effect relationships. But the NIST measurement sciences deal with how accurately can you measure the radiation. The health effects aspects are regulated by the Food and Drug Administration [FDA], and OSHA [Occupational Safety and Health Administration] and the Nuclear Regulatory Commission. So, the federal guidance in this country for health effects comes from the National Council on Radiation Protection and Measurements. And those of us in the Federal agencies follow that guidance. So, this is not guidance coming out of NIST or TSA. There is an American National Standard ANSI N4317 which was developed. And, I think this is a great example of the cooperation here because it had four members from NIST, seven from different parts of DHS, two from FDA who actually participated in writing that standard. And, that is the standard for the safety aspects of the deployment of these X-ray scanners.

I might also point out that a lot of folks are pushing for the millimeter-wave scanners, because there are essentially no radiation affects associated with the millimeter-wave.

Mr. SMITH. Anyone else wishing to comment? If not, that is fine.

Thank you, Mr. Chairman. I will wait for the next round.

Chairman WU. Thank you very much, Mr. Luján, five minutes.

Mr. LUJÁN. Mr. Chairman, thank you very much, and thank you to everyone that is here today.

As we talk about these technologies, I appreciate the fact that I read about MagVis technology that was developed at the Los Alamos National Laboratories discussed in a few of the testimonies. And more than just MagVis, is the ultimate objective for our work with Homeland Security is to get the Department to establish a longstanding running relationship between the NNSA laboratories and the Department of Science and Tech Directorate.

Currently I think that you work with them from time to time when there is an issue specifically to identify such as if there is a terrorist threat that they may use liquid explosives, and what will the damage be to the airplane as opposed to how can we make sure that we are getting that molecular footprint so that we can identify and prevent any liquids that even have a notion of being used to move forward in that way.

So with that being said, Mr. Buswell, although we focused today on passenger screening, I have been impressed with the briefings I have received from the scientists and researchers associated with the MagVis technology, proven technology that has already been demonstrated in a pilot. Your predecessor, Under Secretary Cohen, saw the pilot demo at the Albuquerque Sunport. Can you describe what DHS's plans are for the rapid implementation of this proven technology and what DHS's plans are for further applying the National Labs to this challenge, specifically, the NNSA facilities?

Mr. BUSWELL. Yes, sir. I would be pleased to, and you know, MagVis is one of those emerging success stories I think from our partnership with the National Laboratories. For those who may not be familiar with the technology, MagVis is short for magnetic visibility, and it is looking at the possibility of using technology similar to a hospital MRI machine to look for and not only find but identify liquids. The difference would be the magnetic fields in MagVis are at a much lower power which would allow operation without the restrictions and high costs of traditional MRIs. Getting back to the footprint issue at the screening sites, as Mr. Luján said, we demonstrated this technology in Albuquerque a year ago last December, I guess. In December of '08 was that demonstration. It was very successful in identifying dangerous liquids in a small bottle among non-hazardous liquids in the standard TSA-size screening bowl that you would put your coins or wallet into.

So now the next step in this risk management development is can we do that with an entire tray size application? If that is successful, can we be successful in doing that with the regular baggage, you know, full baggage, carry-on baggage size?

So we are looking at this in a phased increment, and we are confident enough now that the technology has great potential for success that we are looking for commercial partners because at the end of the day, the commercial partners are who we need to get these things deployed en masse. So it is an excellent success story.

And so let me talk a little bit more about your broader question of partnership with the National Labs, and I will go into a little more detail than I did just in my oral comments on this DHS/DOE aviation security partnership.

We have recently established this, it is off and running. It is going to provide a senior-level Under Secretary level governance mechanism to focus the utilization of the National Labs on this very important problem. Right now we are looking at three—you can do all the governance you want, but if you don't get down to the working groups and the people that actually know how to bring solutions to the table, you are never going to get anywhere.

We are looking at three areas to focus on. One, as Dr. Albright mentioned, is this systems analysis of aviation security, both from an aviation security as a system of systems and then from an engineering standpoint. When you get to the passenger checkpoint screening for example, what is the optimal configuration? What are the trade-offs among the technologies? The National Labs, with their modeling capabilities, are uniquely positioned, I think, to help us there. That effort will be co-led by Sandia National Laboratory.

Mr. LUJÁN. Mr. Buswell, if I may, and Mr. Chairman, I want to make sure we get a chance to explore these a little bit going forward with some other questions, but one thing that I just want to point out is, one thing that we learned from the failed attempt on Christmas Day of this last year is that metal detectors didn't do the job. And there has been an investment and commitment going forward with metal detectors. We need to make sure that we are looking at these technologies to be able to identify these materials, that you understand how we take into consideration the complexities associated with chemistry and the value of getting that molecular footprint so that way we can prevent them from getting forward, from moving forward and from identifying people that have them on their body, on their persons, or on materials in a way that is very safe to the individual and the traveling public.

And Mr. Chairman, I will pursue that line of questioning as we go forward as well, but I certainly hope that we can get to that point. Thank you, Mr. Chairman.

Chairman WU. Thank you very much, Mr. Luján, and we will return for further rounds of questions.

Mr. Garamendi, please proceed, five minutes.

Mr. GARAMENDI. Thank you very much. Was it 25,000 microrems a year?

Mr. BUSWELL. Yes, that is the——

Mr. GARAMENDI. And it is 1,000 a flight across the country?

Mr. BUSWELL. That is right.

Mr. GARAMENDI. We better stop going home, Mr. Wu.

Mr. BUSWELL. It is actually 1,000 per hour at altitude.

Mr. GARAMENDI. We have already——

Mr. BUSWELL. I hope you have short flights.

Mr. GARAMENDI. I am not going home this weekend. The question here is what is the status of explosive detection? Dr. Albright, you discussed this in generality, do we really—how long do we have to wait? What is the status or will it ever be possible?

Dr. ALBRIGHT. Okay. So that is a great question. I think it was pointed out by Mr. Luján, to date, most of our technology at passenger checkpoints has revolved around metal detection. The thing that you walk through is looking for metals, and that may have made a lot of sense in the day when we were worried about people bringing guns on board aircraft, but it doesn't check for explosives. That is just a fact of life.

Even with the carry-on baggage systems that we have deployed, without going into classified details, they have utility in detecting explosives, but they are certainly not at the performance point that I think anybody, either any of you or anybody here sitting at the table, would like.

So we have tried to move on to other ideas. Whole-body imaging is certainly one that has been put in play. By the way, as an aside, that was technology that was developed at Pacific Northwest National Laboratory and was then transitioned into the private sector. The difficulty with explosives at the end of the day is that they are—there are two problems. One is that they are not volatile. That means they don't put out a lot of vapor, which is the kind of thing you would detect in a remote environment. You would sniff for the explosive. And they are not very volatile, and frankly for obvious reasons, you would not want to have an explosive that rapidly turns into a vapor and mixes with the atmosphere. That would not be a very stable environment to operate in. So they tend to be very, very hard to detect. You have to actually detect the solid somehow, which is, by the way, the basis of those scanning systems that they use in secondary inspection.

The second difficulty is confusers. You have a lot of—many of you have probably gone through secondary, have been scanned, had your luggage hand-swiped, and it has come back positive. My guess is the first question you were asked was, did you play golf today because if you did, you picked up possibly fertilizer and that will sometimes confuse these systems. And there are lots of confusers. For the checked baggage systems, for example, it is a well-known fact that peanut butter is something that looks very much like an explosive to those systems.

So those kinds of issues, the confusers are a real problem. And then finally, what has changed a lot, particularly over the last few years, is the plethora of explosives that we have to deal with. You know, we originally had a fairly short list of explosives that we were concerned about in aviation security and at the checkpoints. Now there are dozens that show up on the internet that have to be or are in books that people sell. You can get them off of Amazon, that tell people how to make homemade explosives, and the list is fairly long and getting longer, and these have to be evaluated and I think as was pointed out, the signatures then, what they look like to our chemical systems, to the whole-body imagers, to this collection of sensor systems that we are trying to deploy, that all has to be worked through. This is again an enduring, long twilight struggle that we are going to be faced with.

So anyway, the point is that the current status is not what we would like it to be, but it is a very, very hard problem, but nevertheless, there is a lot of ideas for how to improve, you know, a variety of technologies.

Mr. GARAMENDI. If I might, I won't have time to go into all these other questions, but it seems to me that has this whole explosive thing has really gone to the dogs and that is where we are, rely upon dogs?

Dr. ALBRIGHT. Well, you know, but here is the thing. Actually, that came up after the December 25 incident, and there are two issues. The first is there aren't enough dogs. These dogs have to be trained——

Mr. GARAMENDI. Presumably we could deal with that issue.

Dr. ALBRIGHT. Well, you know, it takes a long time to train these dogs. I think there are maybe three sites in the country, maybe four, I have forgotten the exact number, that actually train these dogs. They get tired easily. They are not necessarily as reliable as people think they are. So when you work all that through——

Mr. GARAMENDI. Do OSHA standards apply to dogs?

Dr. ALBRIGHT. Yeah, we will have to get NIST to go evaluate dogs for us. But people have been working very hard on artificial dog noses, for example, and none of these ideas have particularly worked out particularly well.

Mr. GARAMENDI. I am going to just open two other subjects, and my five minutes is up. One is on the social science side of it. We were talking earlier about social science. But it seems to me that the visual screening, that is to look at somebody and say, well, maybe we will take another look at this individual has a role, and there are those in other countries that actually do that to a great extent. And I would be interested in the social science piece of that, does that really work. And the final question that I would like to get to is that the Christmas issue really was more about databases, was it not, and the compatibility and the interaction of databases. And the question arises as to computer science and the ability for computer science to deal with the multiple databases and integrating them.

Mr. Chairman, thank you.

Chairman WU. Thank you very much, Mr. Garamendi. Before I get onto my next set of questions, I want to finish up with some further information on the last question.

After my discussion with Committee staff two days ago, the Cracker Jack staff went into the archives and found two surveys, both done after this Christmas incident and both released January 11, just a few days ago. And one survey by CNN finds that full-body scanners should be used, 79 percent, should not be used, 20 percent, no opinion, 2 percent. But there are no backup numbers on that, so we don't know what the opinion of the traveling public is as opposed to a non-traveling sample. And the Gallup/USA Today organization found—well, there are a variety of findings here. The majority, 67 percent, say they would not personally be uncomfortable with undergoing such a scan. That is the full-body scan that we are talking about. Close to half, 48 percent, saying they would not be uncomfortable at all. Ten percent say they would be very uncomfortable if subjected to such a search, and I have to add that the prior preferences were comparing full-body scan versus a complete pat-down. And there is a difference between men and women, and what they found is also in their sample—let me take a moment here to find the sample information because I think it is very important to our consideration—results based on the total sample of National adults, 95 percent confidence. Results based on a sample of 542 adults who have taken two or more air trips in the past year. Maximum margin of error is plus or minus five percent, but there are no data about how the frequency of flying correlates with the opinions about intrusiveness, and in the CNN survey, the frequency of flying was really quite disparate. About 50 percent flew either frequently or occasionally, and the other 50 percent flew never or rarely. And so you can fit all the frequent passengers into the don't-screen-me category, or you can fit the 50 percent that flies into the I-don't-care category. And I think it is pretty important to determine what it is, whether we are addressing a real problem or not. So Mr. Buswell, I guess before you come back you are going to have that information broken out for us, aren't you?

Mr. BUSWELL. Yes, sir. I will take that for action. Thank you.

Chairman WU. Terrific. Thank you very much. Now, let us assume that this is a problem, that public acceptance is a problem. The 1996 National Academies Study on Airline Passenger Screening discussed the importance of understanding the health, privacy, convenience and comfort impacts of screening technologies, and the report eleven years later, the 2007 report, said very little work had been done in these areas. And I want to ask first our three witnesses from NIST and DHS and the labs, why have these recommendations been in one sense or another ignored by your respective agencies in doing your work?

Mr. BUSWELL. Thank you, Mr. Chairman. I guess I would respectfully disagree that the recommendations have been ignored, and I think there are a number of recommendations that in fact have been adopted. For example, the recommendation that we consider privacy filters to mask portions of the images, whether those be private areas of the body or faces so that those wouldn't be displayed together. The fact that images are not stored. Images of the traveling public are not stored, again a recommendation of that report which was adopted. Putting the screener out of sight of the individual was one of the recommendations, and that was adopted by TSA. The fact that automatic target recognition which is in fact our highest resource priority for TSA would allow images not to be viewed at all unless in response to an alarm is one of those things that we are pursuing. And I think the most important recommendation that we have adopted is the recommendation to assess as early in the development process as possible the potential for community resistance to the implementation of some of these technologies. We have in place a formal process to understand and incorporate community perceptions in the development and deployment of critical technologies. We call it the Technology Acceptance and Integration Program, and they look at things like privacy, civil rights, perceptions, whether that be intrusiveness or invasiveness. They look at convenience and comfort, complexity, usability and the perception of threat risk or safety.

Chairman WU. Mr. Buswell, before my time expires, I am going to give Dr. Hyland an opportunity to comment because you know, I am a generalist. I work here in a legislative body. It is one thing to disagree with me, but Dr. Hyland's written testimony states in 1996 the committee found that there had been very little work done to study the public acceptance of screening technologies, and when this topic was revisited relative to the committee's work on the whole-body imagers in 2007, that had not changed.

Dr. Hyland, would you care to comment about how much work has been done on the public acceptance front?

Dr. HYLAND. Certainly. I would like to say that when we said that in 2007 we found no updates, so as Mr. Buswell says, perhaps there is information being done internally at DHS and TSA that was not in the published realm. So we may have not seen it, but it was of concern to us that there was nothing in the publications that we would see that had addressed these.

Chairman WU. Dr. Coursey?

Dr. COURSEY. Yes, you wouldn't expect NIST to have a large role in this because we are basically in the measurement science, but we do have a very effective group in usability in our information technology.

Chairman WU. I am never surprised at what NIST is involved in. I can't think of a single area that NIST is not involved in.

Dr. COURSEY. This is a very exciting project that is partially supported by DHS S&T, and that is to look at the usability of fingerprint readers as passengers are approaching a checkpoint. So, this is work funded by S&T that is now being used by US-VISIT. But it basically comes to the idea of affordance. When you come up to a piece of equipment, do you instinctively understand what you are being asked to do, or do you have to have some long instruction in doing that?

So I think the public acceptance to some extent will hinge on these usability studies. This one particular one was very helpful for US-VISIT.

Chairman WU. Did you ever compare a Mac with an IBM? Just kidding. Mr. Luján?

Mr. LUJÁN. Mr. Chairman, thank you very much and just to pick up a little bit where we left off, Dr. Albright, modeling simulation, computing capabilities, supercomputers especially within our National Laboratories, can you just speak specifically to how valuable those are as we move forward with talking about how this can be incorporated into looking at deploying these technologies and creating a safer flying environment for passengers?

Dr. ALBRIGHT. Sure. Let me focus on one specific example. One basic concern you have when you are thinking about deploying a next generation of any kind of system, what is the minimum amount of explosive you really need to detect, and clearly we are not very much interested in, you know, very, very small amounts. So the question is, what do these systems really have to be able to do? And the only way to really know that is to ask yourself, what is the vulnerability of the aircraft to various explosive formulations placed at various parts on the aircraft? There are sort of two ways you can do this. One way is you could go out and buy a whole bunch of air frames and just start blowing them up, and we actually do a little bit of that. But that is obviously not a very efficient or cost-effective approach. The other approach is to use some of the exquisite modeling and supercomputing capability that exists at places like Los Alamos and Livermore and Sandia and to do structural modeling of the air frames and then ask questions, like, if I put, you know, so much explosive at this point in the passenger compartment, you know, am I going to get a rupture, a whole rupture, and what would the consequences of that for an airplane under flight conditions.

That is actually pretty hard to do, and it does require validation through some subscale experiments which again, all the laboratories have the ability to do and do in support of this program, and yes, it does every once in a while, if for no other reason than to make people confident that we actually know what we are doing, we actually occasionally go out and blow up an airplane and show that we got the right answer. But nevertheless, that is a fairly broad campaign. Every air frame is different. There are differences between even different embodiments of the—you know, you have 757 stretches, you have 757s. They all have different structural responses, and so you have to have an understanding of that so that you can ultimately set requirements for what that explosive detector has to be able to find when you get to the passenger checkpoint.

Mr. LUJÁN. Thank you, Dr. Albright. Mr. Chairman, I think we have seen the importance of making sure that we are looking at simulation, modeling, supercomputing capabilities to assist us moving in that endeavor as we identify the molecular footprint of some of these chemicals, these very destructive weapons-based materials to do harm. And I also appreciate, Mr. Buswell, that the Department of Homeland Security has moved forward to engage in a more senior level working relationship with our NNSA laboratories. I think it is important that we identify that technologies like MagVis are an important step in identifying where we were weak during this December 25 incident, this horrible failed attempt that we saw come forward. But as we identify the importance about modeling and simulation that we take into consideration the aspects of rendering the whole system. And specifically, Mr. Buswell, if we can get a commitment from DHS that this is one area that we can work with our National Laboratories as well, building into this relationship, to truly understand the importance of evaluating the whole systems-level approach to identify weaknesses so we can have systematic approaches to solve them before we identify a weakness that comes forward from a failed attempt like this.

Mr. BUSWELL. I couldn't have said it better myself. That is exactly the focus of the systems analysis portion of that I started to describe in your last round. And just so you know, Sandia National Lab will be leading that effort. The aircraft vulnerability assessment portion of it will be led by Lawrence Livermore, and then the third area is this idea of emerging technologies. What do we not know is out there? As you said, every time I visit a National Lab, I am amazed at the treasure chest of technologies and science that is going on there. So how do we bring that to bear to this problem and other homeland security problems and national security problems? That work will be co-led by PNNL, Pacific Northwest National Laboratory and Los Alamos. So there is real work to be done there and real profit to be made, I think.

Mr. LUJÁN. Mr. Chairman, just another example of tech transfer and looking to our brightest and best across the country, to identify solutions to problems where given the ability and the necessary environment to support that R&D can solve complex issues when it comes to homeland security, energy, even economic equations so we can understand the complexity of some of the algorithms that were used by financial markets, with the devastation that those have caused us as well.

Again, thank you for bringing this to a hearing, Mr. Chairman.

Chairman WU. Thank you very much, Mr. Luján, and thank you for your contributions to this Subcommittee. I think Sandia has had good fortune in many different respects, and you are one of them.

Mr. LUJÁN. And Mr. Chairman, we hope Los Alamos will as well.

Chairman WU. Yes. Mr. Buswell, I have asked you before and I have also asked your counterpart at the Domestic Nuclear Detection Office about the role of comprehensive risk assessment. At one point or another there was some concern that technologies were being developed and risks were being addressed based on how the Vice President was feeling that day, and I think the prior Vice President and the current Vice President might assess those things very, very differently. And one hopes that in our research endeavor for DHS that we have a steady hand and guided by real risk assessments. So I would like to ask you to address the role of comprehensive risk assessment in creating a multi-tiered detection/prevention approach and how this dovetails into using different approaches, such as using canines as Mr. Garamendi suggested, using personal interviews and behavioral detection as well as this technologic approach.

Mr. BUSWELL. I would be pleased to. The first assessment process—first of all, I think the last time that I was here we discussed the importance of an overall risk assessment, and I am pleased to see in the Quadrennial Homeland Security Review Report that was released earlier this week that the need for a national risk assessment framework was identified as one of those highly important things that we need to go forward with.

So I know the Secretary understands that, and she is engaged in that broader, you know, national risk assessment that we discussed earlier.

Chairman WU. Mr. Buswell, can you send back a report to this Committee on the progress of implementing the systematic risk assessment methods?

Mr. BUSWELL. I would be pleased to. The systematic risk assessment is led by NPPD [National Protection and Programs Directorate], the Office of Risk Management in NPPD. So I will be happy to work with them and get you that information.

Chairman WU. Thank you.

Mr. BUSWELL. When it comes to the aviation security risk assessment, TSA has done a lot of work in this regard. You know, we are not shooting blind here in the screening technologies and the screening approaches that were taken. Likewise, I would be pleased to coordinate with TSA to bring to the Committee that risk assessment that they do regularly and they revisit regularly, based on the threats that are emerging. You know, as Dr. Albright said, at one time there were very few things that we were worried about, people bringing guns and, you know, commercial grade or military grade explosives onto airplanes, now that list is quite long, and prioritizing the list of things that we have to look for and prioritizing the amounts of or establishing the amounts of these various substances that we need to look for is high on the list of things that we need to do and is fundamental to that risk assessment. So I would be pleased to coordinate that engagement with the Committee. TSA has done some work in this area that I think you would be pleased with.

Chairman WU. Thank you very much, Mr. Buswell. I want to return to Mr. Garamendi's point because we have a society that really focuses on technology, and it has served us well in so many different ways. But Dr. Albright mentioned in several different ways why detection technology is very challenged by the very nature of the current threat. Mr. Garamendi asked about dogs, somewhat seriously and somewhat humorously. I remember being at an airport in Canada and having this friendly little dog come along, and I was kind of disappointed that it just went right by me. But I think in retrospect that was a good thing. It sat down and looked expectantly at this nice young man, and the nice young man was promptly taken away by the Mounties, to do what, I don't know. I doubt that it was explosives. I suspect that it was something more fragrant and, you know, the dog was up to the task. But it is not just, you know, our brethren north of the border that do this. Right here, if you drive your car over to the Capitol, they will stop you. First, they run a mirror to look on the underside of your car. And then a dog comes, and my kids and I refer to that as getting your car dogged. I don't know how effective that dog is. What I do know is that that dog works in day time, night time, low temperature, high temperature, when it is dirty, when it is snowing, et cetera.

Now, the puffer machines that were deployed on an experimental basis, I believe 100 of them were deployed around the country on a trial basis, and the figures that we have say that those were $150,000 or more each. And I am told, I mean I haven't seen the puffers in a while, but I am told the reason why the puffers were pulled is because humidity and dust caused puffer breakdown or puffer confusion. I am not sure that a dog would have the same problem, and my impression is that $500 buys you a pretty good dog. Now, granted, you have to feed the dog, you have to train the dog, et cetera. But the puffer machine was difficult to maintain. Why are we building an artificial dog nose when we have pretty good dog noses? Dr. Coursey.

Dr. COURSEY. We actually have chemists at NIST working on both of those problems closely with the DHS S&T, and specifically with dogs the interesting thing I found talking with the DHS office of bombing prevention is the range of different threats that the dogs are being trained to. It can be different in a mass transit environment than it is in the aviation. And as you mentioned, some dogs are trained for narcotics, others are trained for money and others are trained for cadavers. So, there is actually a group called SWGDOG [Scientific Working Group on Dog and Orthogonal detection Guidelines] that has a series of committees that look at the standards for training methods for these dogs. I think there is a lot of basic science still to be done here because we don't know if a dog is reacting whether he is reacting to the particles or to some of the vapors that are associated with solvents that were used.

Chairman WU. You know, a lot of life is kind of empirical, you know? And we need to work out how a dog does this, but I think the rubber hits the road in finding whether dogs can detect explosives, the kind of explosives that we are concerned about on a reliable basis because my arithmetic indicates that if you have a $500 puppy, which is a pretty expensive one, you get 300 of them for a puffer machine. And the question is whether 300 dogs in an airport is more useful than one puffer machine. Dr. Albright, you addressed the technical issues a lot earlier, and perhaps you could try to address this a little bit more.

Dr. ALBRIGHT. Sure. Let me just reiterate the fact that first we don't really understand very well why the dogs are as good as they are.

Chairman WU. Yeah, but the question is are they good?

Dr. ALBRIGHT. That is a good point, and in fact, it sometimes depends a lot on the testing methodology. I won't go into it here, but I could regale you off line about my experiences when I was at the White House reviewing the anthrax-smelling dogs. And it turned out that the test procedure was totally biased. I mean, they couldn't do the job.

Chairman WU. Well, look, if I were a dog, I wouldn't want to be sniffing anthrax, either. Maybe these dogs were just brighter than you were giving them credit for.

Dr. ALBRIGHT. Well, yeah, yeah. No, it wasn't me. I was just the evaluator. I was not the proponent for this. That is a whole other story.

But nevertheless, they do tire very easily. The dog is only good for I think about three or four hours before they start to——

Chairman WU. That is why I said you get 300 dogs for one puffer machine.

Dr. ALBRIGHT. And it is going to cost you—and the training regimen they have to go through——

Chairman WU. I realize that.

Dr. ALBRIGHT. —is months. And then finally, there is a range of explosives that—it is not known how broad a range, including these homemade explosives that we are concerned about, that they can actually—so you are right. There are some science questions that have to be dealt with, but the investment that would have to be made in order to really populate our explosive detection infrastructure or dogs to the numbers that we would need to do it at is——

Chairman WU. Well, you know, we haven't done a very good job of populating airports with usable detection technologies you know, that cost $100,000 or $200,000 each. Now, I realize that there are challenges in acquisition and maintenance and you know, on and on. But you know, sometimes in our society, and you know, I serve on the Science and Technology Committee, but we have an absolute love affair with whiz-bang gadgets, and sometimes it turns out that something simple and inexpensive and deployable is being overlooked because we have made assumptions. I mean, it was in this complex of buildings that a Nobel physicist dumped an O ring into a glass of cold water and said, well, you know, this might be why the Space Shuttle blew up.

So sometimes we need to review our assumptions and our inclination toward complexity. So you know if I should be worried that the dogs guarding the U.S. Capitol or sniffing cars out there, that they are not doing a good job and they are not reliable and that they are going to get tired, I mean, you ought to tell me that that is the case. But it seems to me that those dogs are out there 7/24, and I know that the Capitol is not, you know, several thousand airplanes flying around the U.S.A., but you are not going to tell me that a country that can deploy millions of troops overseas during World War II cannot deploy a few hundred dogs in civilian airports in the continental United States if this is truly the long twilight struggle that some folks would want us to believe that it is.

Dr. ALBRIGHT. No, the only point I wanted to make is that I think a lot of that systems analysis that you were referring to has been done, and it was done in the early days when we were concerned about, you know, right after Lockerbie and that era were really looking for solutions. I have to confess that I haven't looked at it in a while. As to what are the trades between the thousands of dogs you would have to deploy in an airport environment, and the technologies that we are deploying. I would point out, and I think you made the point yourself, that the operating environment out here driving into the Capitol is a very different environment than one at the passenger checkpoint. But nevertheless, the point is a good one, and it is probably a good idea to go back and dust off some of those system studies and ask the question whether or not maybe we are missing something.

Chairman WU. Yeah, you know, I think it is really important to try to review some of these assumptions and test them again and, you know, the operational test is, does it work. And you know, it is really nice to understand the how and the why, but you know, if you have got to understand the how and the why before you deploy something that works, you may not win some struggles that you might otherwise be able to win.

Now, I have never been a conspiracy-type person. I do think that as a society we naturally favor technology, and sometimes it is more expensive than simpler things. I do want to, on this record, make the observation that these technologic means are also, well, they keep the National Laboratories occupied, they keep the producers of the technology occupied, and you know, some of these manufacturers have representatives in Washington, D.C., and I don't think the Kennel Club is very well-represented here. And I don't know if that has anything to do with it, but I sure would like to have some of these easy assumptions revisited or else I would like to have puffer machines at the U.S. Capitol, you know, rather than what they are currently doing.

Let us shift now to one of the challenges here for you all is that we fly a lot. You know, congressmen fly a lot, and so we think we know everything there is to know about flying and being a passenger at least. And we have all had experiences where something that is detected at one airport or on one given day is not detected on another day. You know, you try to take everything out of the bags, but you have a four-ounce bottle of fluid and the limit is 3.5, and on some days it is spotted and you have to remove it and on other days it is not. I don't always travel with a laptop, but sometimes I do. And every once in a great while I forget to take it out of the pocket of my carry-on bag, and as often as not, I don't know if they just wave it through. It seems to me when they catch it, they make you pull it out. But sometimes it seems like they don't catch it. And if I am in a hurry, I am grateful and it is unintentional that that happened but most of the time I also feel a little concerned that what they say is important isn't caught. Can the panel try to account for this disturbing variability in the screening process at our airports?

Mr. BUSWELL. I am the science guy, so I don't have the operational insight to know, you know, the facts about these things. I know anecdotally I have heard the same sorts of things, and what I would tell you is that what we are looking at from the research and development——

Chairman WU. Mr. Buswell, let me jump in right here because this is a really important point. You said, I am the science guy, and I don't know some of the operational things. That is a very important problem that we are trying to address because you are not producing stuff into a vacuum. It is not about the gizmo, it is about the effective service that that gizmo provides. So you really do have to account for all the operational factors. I mean, if you produce a great weapon but the operators don't know how to operate it, or like the Russian tank that is manually loaded but you can only manually load it with a short Russian who is left-handed, you know, that causes a real problem. So you know, what we are trying to hook up here is a technology that is actually implementable in the real world.

Mr. BUSWELL. Sure, and my point with that was that the operational requirements that TSA establishes or what we do our research and development to meet, to field technologies and other operating procedures to meet, you bet there is a variability across a range of things. And one of the things we are working with TSA to do as I mentioned is this idea of automatic target recognition so you are not relying so heavily on the screener who may have been there for some period of time and is fatigued and may miss something. So what we are trying to do is we are trying to develop these kinds of technologies that will help us help the screeners be more effective. We are trying to look at from a behavior detection standpoint, can we identify people who intend to do harm before they ever get into the screening process. We are looking at things like— and you make a very good point with the dogs. I mean, TSA is a system of systems. There is no silver bullet here, which is why TSA employs 700 dog teams. You know, they believe that that capability is real, too, and training occurs at both ends of the leash. And one of the problems as Dr. Albright cited is there is no way to calibrate the device prior to use. So you know, if the dog is having a good day or a bad day, you know, there are limitations and we have to understand those limitations and build them into the system of things that——

Chairman WU. You said there is no way to calibrate. Is that true? I mean——

Mr. BUSWELL. It is absolutely true.

Chairman WU. I mean, can't you walk the dog by experiment and placebo and——

Mr. BUSWELL. Absolutely. Training of the dog is clearly important.

Chairman WU. No, I am saying like you could calibrate the dog on site and determine whether the dog is tired or not and ought to be pulled off line.

Mr. BUSWELL. If you have a training device on site with which to do that. And so one of the things that TSA has asked us to do is develop some low-cost training devices that we can use in the field where we don't have to take the dogs back to the training center so we can more frequently train the dogs to do these sorts of things.

There is research and development going on in all of these areas that try to mitigate or try to minimize the probability that things will slip through, and this is a system of systems. This is a layered approach to security that includes dogs and technology and people and all of those things that make it maximally effective.

Chairman WU. Well, I think the core concern is that based on individual experience and then what is reported in the news media, the American people have a legitimate concern about whether all this inconvenience is producing a result that we all want. And you know, that really is the core inquiry.

Let me go on to one last question. I know that Mr. Smith told me long ago that he had to attend to certain things at a certain time. The transportation security and passenger screening IPTs apparently consider the needs of DHS offices such as TSA but I am told not the concerns of other customers such as the traveling public, airlines and airports. Is this true, and if it is, would considering these other concerns such as customers, the traveling public, air carriers, the ports that operate airports, would this surface some of the problems earlier resulting in different technologies being deployed, different research efforts?

Dr. HYLAND. I would like to say yes, I think that taking into account the public's perception, but the operators of the machine are also involved in the whole aviation security and technology. So designing the machine so that they get as Mr. Buswell says specific information about what they are looking for as opposed to here is a bag, do you see anything different in there. That has been driving the TSA activities. It is only one part, and the traveling public has come to kind of expect that variability, which I think is an unfortunate acceptance of non-standard performance.

Mr. BUSWELL. I would just further elaborate on the Community Acceptance of Technology panels that I mentioned earlier. We run these panels based on technologies that will have to be accepted by the public. So we have done a series of these with some pretty good results, and we intend to do more. So let me give you a couple of examples. We held a panel on microwave vehicle stopping, in other words, law enforcement or others who need to stop vehicles, whether those are cars or boats, can you use a microwave device in order to do that and what would be the concerns that people would have with that. The panels include sociologists, behavior scientists, consumers and public interest representatives, civil liberty sorts of groups and privacy groups, ethicists, and also for each of these technologies, we will include specific subject matter experts. For example, on the vehicle stopping technology, we had a member of the American Automobile Association as part of the panel. And of course, the Coast Guard, CBP [Customs and Border Patrol] and others, law enforcement entities that would be interested in using the technology. So a series of these, we have done several on screening technologies, we have done several on the mobile biometrics, and they allow us to understand and to modify the technology development in a way that makes it more likely that it will be able to be deployed by the operators at the end of the development process. So I think we have got a real success story there with these public acceptance efforts, and this gets to the point that was in the National Academies, engage early in assessing the public acceptance of technology.

Chairman WU. Well, Mr. Buswell, I hope that you are able to come back in a month or two and first of all tell us that you have the data in hand about what problems actually do exist and what people will accept and what they view as overly intrusive. You know, to the extent that you actually involve passengers in your groups, that is commendable. To the extent that you are counting on the opinions of folks who are opining about people, you know, that is a risky thing to do, and apparently there are at least two surveys here where they actually asked people and got answers. And I don't have the granularity in this data to unpack the significance of these preliminary results about the traveling public and the really frequent flyers versus the never flyers versus the sometime flyers, and there really is no substitute for asking. There is no substitute for accurate data, and I think that is true in a whole bunch of fields in science and it is true in your field and it is true of mine also.

I really want to express my deep appreciation to each and every one of the witnesses here today. We are engaged in a very, very important collective endeavor. It is about convenience and public acceptance and economics for airlines that if you sum up all their financial activity over the history of airlines, it is not clear that there is one dollar of profit in there. So you know, they are living on the edge, and if we want to have a privately owned air transit system, then we ought to help them do their job rather than put unreasonable constraints in their way. But the endeavor that we are engaged in is even more important because it is about public safety, and we face all sorts of different risks. But currently, you know, folks are very much focused, and appropriately so, on this terrorism threat and the threat of human-made incidents on airplanes, and we need to address that as aggressively as the American people want us to. But I think most fundamentally, this is about whether this government can do a job, can do any job, can do a job well because what is most corrosive is that experience at the airport that there is incredible variation in the service at that security checkpoint. If any other business entity had that much variability, I mean, you know, McDonald's has a hamburger you so that you don't get a different burger at every McDonald's that you go to and that you don't get a different burger, depending on whether you went in the morning or the afternoon.

We need to, at a more elevated level of conversation, we need to do this task well because it is important for its own sake, but ultimately we need to do it well because it is the only reason ultimately why there is a bond between ourselves and the government. Some believe that it does well. I think John Kennedy said if I wanted to make a difference in the way people perceive the Federal government, I would start by changing the Postal Service, and that is with all respect to my friends in the Postal Service. And I have a riff on that which is, if I were governor of Oregon, the first thing that I would do to change the public perception is work with DMV to brighten up the service there. The American people come into contact with the federal government as much through the TSA and at airports as any other place. Let us do our best to get it right.

Thank you very much, and written questions will be submitted by the staff and by Members. Again, thank you for being here, and we really want to work with you to make sure that you have the legislative support and the fiscal support to get these very, very important tasks right, so we will come back to this in due course. Thank you all very much. This hearing is adjourned.

[Whereupon, at 3:58 p.m., the Subcommittee was adjourned.]

Appendix:

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Bradley I. Buswell, Deputy Under Secretary, Science and Technology Directorate, Department of Homeland Security

Questions submitted by Chairman David Wu

Q1. DHS S&T uses the Capstone IPT process to set the priorities for short and mid-term research programs, but how are priorities set for long-term basic research and research programs at University Centers of Excellence, DOE National Labs, and NIST? How are these priorities coordinated?

A1. The Science and Technology (S&T) Directorate defines research in the context of its portfolios: "Product Transition," "Innovative Capabilities," and "Basic Research." The efforts within the Basic Research portfolio enable future paradigm changes. These efforts emphasize (but are not limited to) university research and governmental lab discovery and invention.

The S&T established Basic Research Focus Areas, generated by the Research Leads in the Directorate's six divisions with input from the research community and vetted through S&T's Research Council. These focus areas represent the technological areas in which S&T seeks to create and/or exploit new scientific breakthroughs and help guide the direction of its Basic Research portfolio, within resource constraints, to provide long-term science and technology advances for the benefit of homeland security.

Each of S&T's divisions sponsors basic research in those areas and coordinates closely with our Office of University Programs (OUP), Office of National Labs (ONL), and International Cooperative Programs Office (ICPO) to ensure effective collaboration of the research efforts.

OUP is responsible for establishing and managing S&T's university research and education efforts. OUP has facilitated the establishment of a network of multidisciplinary universities that support the Department and other members of the homeland security enterprise. OUP develops and manages grants and cooperative agreements, to support targeted research and education projects with the COE lead universities and their partners.

ONL enhances the interaction and coordination between the various S&T research divisions and the DOE National labs, primarily through establishing a research community for homeland security and maximizing opportunities for all DOE assets and capabilities involved in the homeland security mission, including conducting crosscutting workshops that allow the S&T research divisions and the National Labs to present, exchange, and establish research priorities. Additionally, by serving as the primary point of contact on the utilization of National Laboratories, ONL is able to develop, sustain, and expand a coordinated network of DHS and DOE National Laboratories and other Federal labs and centers.

The S&T's Office of Standards funds and coordinates standards development for equipment used and purchased by DHS. Working with scientists, the Standards Thrust Area identifies standards needs and funds initial standards development through a variety of performers—most notably research scientists at the Nation's measurement lab, the National Institute of Standards and Technology (NIST). Once the measurement science is solid, the office works with numerous standards development organizations to finalize homeland security standards in a consensus environment—a forum which includes users, manufacturers and the government.

Q2. At the hearing, the Subcommittee called for DHS S&T to study the issue of public acceptance of full body imagers and to provide data on the public response to these machines. What is the status of this study?

A2. The Science and Technology (S&T) Directorate and the Transportation Security Administration (TSA) have taken into consideration the results of a Gallup poll on full body scanning of passengers, reported by *Gallup.com* on January 11, 2010 in the article "In U.S., Air Travelers Take Body Scans in Stride." According to the Gallup poll, 78 percent of respondents said they approve of the use of full body scanning machines at airports and 84 percent said full body scanning machines would help stop terrorists from carrying explosives onto planes.

Also, in March 2009, TSA conducted passenger acceptance of advanced imaging technology (AIT) testing at six airports. The testing captured statistics on passenger acceptance of AIT during the course of testing millimeter wave AIT in the primary position. During this testing, over 98 percent of passengers chose AIT over other screening options in the primary position, such as a physical pat down.

Q3. Why do the Transportation Security and Passenger Screening IPTs only consider the needs of DHS offices, such as TSA, and not the concerns of other customers such as passengers, airlines, and airports? If DHS had considered these customers' concerns, would development priorities have addressed key privacy concerns earlier in the process?

A3. The Science and Technology (S&T) Directorate's Transportation Security Capstone Integrated Product Team (IPT), other Capstone IPTs, and supporting project level IPTs do consider the concerns of the traveling public, airlines, and airports when prioritizing and developing technology. As an example, inputs from the surface transportation industry, intermodal venues, and trade associations are provided through several means to Transportation Security Administration (TSA) general managers for each of the venues (such as mass transit, freight rail, highway/motor carrier)—including the Government Coordinating Councils and Sector Coordinating Councils. Those inputs are included in the TSA capability gaps submissions provided through the IPT process each year.

If there are privacy issues relative to a new technology, TSA and S&T coordinate with the Department of Homeland Security (DHS) Privacy Office to ensure privacy requirements are met and the technology is properly evaluated for its impact on the privacy of the traveling public. As an operating component, TSA understands the need to balance security and the introduction of new technologies with the need for movement of commerce and the efficient flow of the traveling public.

Many of the priorities set by the Capstone IPT are for screening technology that improves flow and efficiency while maintaining or improving security. Once the Capstone IPT prioritizes a technology development, TSA and S&T work at the project level to ensure the technology and supporting concept of operations take into consideration the traveling public, airlines and airports. This is done through a variety of means, focus groups on the technology, demonstrations and experimentations at airports, and working with the airlines and airports on the more detailed requirements. The considerations and concerns of the traveling public, airlines, and airports are considered from day one within the process.

Q4. In your testimony, you mention the Technology Acceptance and Integration Program and Privacy Impact Assessments. Please describe these programs and provide examples of their input into all stages of the research, development, and deployment of passenger screening technologies, including full body imagers.

A4. The Technology Acceptance and Integration Program researches public perceptions of new technologies and processes to: 1) identify factors that can advance or impede technology deployment and 2) to identify adjustments to technologies and processes that make them more effective in achieving their intended purposes. This research generates knowledge that drives process improvement and guides the development and deployment of technologies to optimize public acceptance.

In particular, the Technology Acceptance and Integration Program sponsors the Community Perceptions of Technology (CPT) Panel Project, which brings together representatives of industry, public interest groups, community organizations, and citizens with subject-matter experts to understand and integrate community perspectives and concerns in the development, deployment, and public acceptance of technology. In FY 2009, the project coordinated three panels. One panel focused on Acoustic Non-Linear Standoff Threat Detection; the second, in conjunction with the Canadian government, examined Radio Frequency Identification (RFID) vehicle registration and LowResolution Imaging for improved Northern Border Security; and the third panel focused on Standoff Imaging technologies. Panel responses work to ensure acceptance of the technologies within affected communities and aid program managers in technical design for deployment to an operational environment. In FY 2010, the program will coordinate two to four panels. In FY 2011, the project plans to conduct another two to four panels, and deliver expert assessments of public perceptions of national security measures in relation to factors such as civil rights and civil liberties, health and safety, convenience, property damage, and privacy issues.

Pursuant to Section 208 of the E–Government Act of 2002 and Section 222 of the Homeland Security Act of 2002, a Privacy Impact Assessment (PIA) is required when: (1) developing or procuring any new technologies or systems that handle or collect personally identifiable information (PII); (2) revising or altering such a technology or system to impact PIT; and (3) issuing a new or updated rulemaking that entails the collection of PIT. S&T conducts PIAs when it funds or conducts research, development, testing, and evaluation activities that collects or impacts PII. Examples of PII include individual names, contact information, biometric information, and images. S&T has conducted PIAs for research projects involving screening technology, such as the Future Attributes Screening Technology Project and the Standoff Technology Integration and Demonstration Program (formerly the Standoff Explosives Detection Technology Demonstration Program).

The PIA demonstrates to the public and stakeholders that program managers and system owners have consciously incorporated privacy protections throughout the research and development life cycle of a system or project. The PIA addresses a wide range of privacy issues, including what information is collected, why the information is collected, how information is going to be used and shared, how information is properly secured and protected, whether individuals are provided with sufficient notice prior to data collection, and how individuals can access or correct their information. The PIA also considers privacy risks associated with the research and data collection, and how program managers propose to mitigate such risks. An example of a privacy risk associated with the collection of individual images during the testing of screening technologies is that individuals are not aware that their images are being captured. To mitigate such privacy risks, program managers ensure that proper notice is provided either by posting signs or getting informed consent from individuals. Individuals may also be given the opportunity to "opt out" of having their images collected. Such analyses are documented in the PIA.

Q5. In your testimony you mentioned the new DHS and DOE Aviation Security Enhancement Partnership. What impediments is this partnership supposed to remove and how will our traveling constituents benefit from this agreement?

A5. The Aviation Security Enhancement Partnership is a senior executive level effort to solve the most immediate aviation security issues by leveraging the power of the national laboratories. The Partnership provides a road map for the national laboratories to use while pursuing solutions to aviation security gaps. This guidance clarifies, coordinates, eliminates duplication, avoids stovepipes and directs work across the national laboratories. Travel sector stakeholders benefit from advanced screening technologies that increase security while improving the effectiveness and efficiency of screening processes.

Q6. President Obama directed DHS and the National Labs to develop and deploy the next generation of passenger screening technologies. How do you plan to coordinate this effort with NIST given their expertise in sensors, biometrics, and technical standards?

A6. The Science and Technology (S&T) Directorate is coordinating directly with the National Institute of Standards and Technology (NIST) in multiple technical areas related to passenger screening. Interactions include close cooperation at the program manager level and several Interagency Agreements (IAAs) in technical areas that include development of standards and measurement methods for biometrics and usability, trace explosives sensors, canine olfactory detectors and advanced imaging technologies. NIST and Department of Energy (DOE) laboratories are partners in the DHS Explosive Standards Working Group.

The S&T's primary contact with NIST is via our Office of Standards in the Test, Evaluation & Standards Division (TSD). We have long-standing programs in explosives detection standards and are capitalizing on those as well as strong relationships with the Transportation Security Administration (TSA) and the Transportation Security Laboratory. Our joint DHS/NIST standards programs in bulk and trace explosives detection have produced documentary standards, standards reference materials, test objects and best practices. Our biometrics standards programs, in partnership with S&T's Human Factors Division, are closely linked with NIST and US VISIT—we have funded standards in face, fingerprint and iris identification, standards for exchange of biometric data, as well as human factors standards to increase passenger throughput with the best possible data collection.

Questions submitted by Representative Ben R. Luján

Q1. Dr. Albright from Lawrence Livermore has done a nice job in his submitted testimony of walking through the broad capabilities of the national labs in the area of passenger screening. Can you describe for us, Mr. Buswell, what DHS's plans are for further applying the national labs to this challenge?

A1. The Science and Technology (S&T) Directorate maintains an established and extensive partnership with the National Laboratories. The S&T's Explosives Division has involved the labs in every aspect of its aviation security technology programs. Examples of established research with Sandia, Los Alamos, and Lawrence Livermore National Laboratories (LLNL) include characterization of homemade explosives and the Manhattan II program. Sandia, Los Alamos and LLNL, as part of the National Explosives Engineering Sciences and Security Center (NEXESS) effort, are working to characterize homemade explosive (HME) threats and determine explosive effects on aircraft structures. Sandia National Laboratory (SNL) has been working on the Manhattan II Program, examining next generation carry-on baggage technologies. Over several years, SNL has been evaluating commercial advanced imaging technology systems to acquire data with which to accomplish automatic target recognition.

As an on-going practice, the National Laboratories share the data accumulated among the national laboratory network and universities through such institutions as the S&T Directorate's Explosives Center of Excellence, co-chaired by the University of Rhode Island and Northeastern University. This has been ongoing in the area of algorithm development where the work requires knowledge of how well current systems can differentiate threats from non-threats and their realistic promise in maturing into true. threat detection capability (as contrasted with anomaly detection).

The S&T has identified prospective research and development with the National Laboratories. For example, how to optimally fuse technologies for passenger screening to obtain the best performance, measured by probability of detection of an ever increasing list of plausible threats and lower false alarm rates.

An additional critically important effort in which the National Laboratories, especially LLNL, have been involved is the industry process to derive a consensus interface standard, DICOS, based upon the medical interface standard, DICOM. This interface standard will permit hardware and software development activities to be independently pursued and then drawn together in a combination of best hardware and best software for the superior performance required in all security applications including passenger screening. While emphasis has been upon application of DICOS to explosives detection systems checked baggage applications, the effort will be extended to passenger screening technologies in the future.

* DICOS: Digital Imaging and Communications for Security

* DICOM: Digital Imaging and Communications in Medicine

Q2. Mr. Buswell, although we are most focused today on passenger screening, I have been particularly impressed with the briefings and demonstration of Los Alamos National Laboratory's MagViz technology, which uses ultra low-field magnetic resonance imaging to identify liquids in carry-on bags. This is a proven technology that has already been demonstrated in a pilot. Your predecessor Under Secretary Cohen saw the pilot demo at Albuquerque's airport. Can you describe what DHS's plans are for the rapid implementation of this proven technology? I ask this in particular in the context of your recent budget submission that called for more than $700M to be spent on new types of metal detectors. It seems to me this is reactive, old thinking. The new challenge today is not metal—it's liquids and other materials that we currently have a hard time detecting.

A2. While the Transportation Security Administration (TSA) is responsible for decisions related to the fielding of technologies in the operational environment, the Science and Technology (S&T) Directorate recognizes the need for new technologies to address emerging challenges. Since 2006, TSA procedures have required passengers to put liquids or gels (e.g., certain toiletries and medicines) in containers that are 3.4 ounces or smaller, and pack the containers into one quart-sized, clear plastic, zip-top bag (3–1–1 rule). The December 2008 demonstration of a prototype at the Albuquerque Sunport Airport showed that MagViz could successfully distinguish between safe and hazardous materials, overcoming challenges that could affect its sensitivity.

MagViz is still a research and development effort. Various technological hurdles need to be overcome before MagViz can be fielded. These hurdles include reducing the footprint, eliminating the use of liquid helium, and improving the scanning speed. Recognizing the potential value of MagViz, and the demanding technical challenges that remain, the Homeland Security Advanced Research Projects Agency (HSARPA) added additional funding to the project in fiscal year 2010. We accelerated our plan to demonstrate the capabilities of a new research prototype to handle a larger TSA tub and a broader array of both non-hazardous and dangerous liquids in July 2010. Responding to a formal requirement by TSA for bottled liquid scanner (BLS) systems to screen 3–1–1 rule exemptions, S&T is also spinning-off MagViz technology to develop a BLS prototype and expect to demonstrate it at Albuquerque Sunport Airport in the fall of 2010. To facilitate the transition of this technology to industry—which must qualify their screening systems through the Transportation Security Laboratory—we are supporting a MagViz Commercialization Workshop being hosted by Los Alamos National Laboratory in March 2010.

Q3. Further, Mr. Buswell, on the point of detectors, all of the briefings I have had from the scientists at Los Alamos indicate that what we need to be focused on is the whole system. We need a systems-level approach to working this threat. I think MagViz is part of that system because we all know that the traveling public would like to go back to taking their bottled water and other liquids onto a plane. So, MagViz is a good start. However, I think DHS and TSA need to go further to really apply the labs to study the whole system of protecting the traveling public. Let's tap into their expertise, their supercomputing capabilities. Can you walk me through what DHS's plans are in this area to pursue with the NNSA labs a systems-level approach?

A3. The Science and Technology (S&T) Directorate is performing systems analysis in conjunction with the Transportation Security Administration (TSA) and Sandia, Los Alamos, Lawrence Livermore, Oak Ridge, Idaho, Argonne, Pacific Northwest, and Lawrence Berkeley National Laboratories in the Aviation Security Enhancement Partnership. While supercomputing capabilities are well suited to modeling complex nuclear physics problems, computational requirements for systems analysis are modest. A systems perspective requires the fusion of complementary technologies that cover the limitations of any single technology and are practical in the real operating circumstances presented where passenger screening occurs. We are determining the optimal combination of technologies to accomplish these ends. The National Laboratories are key partners in this work because they bring both knowledge of the threats, particularly homemade explosive threats through their characterization activities, and detailed knowledge of x-ray, millimeter wave, radar- and terahertz technologies, which are candidates for sensor fusion. The S&T will continue to analyze the aviation checkpoint system in partnership with the National Laboratories and others in order to best apply the capabilities of each.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Penrose C. Albright, Principal Associate Director for Global Security, Lawrence Livermore National Laboratory

Questions submitted by Chairman David Wu

Q1. DHS S&T uses the Capstone 1PT process to set the priorities for short and mid-term research programs, but how are priorities set for long-term basic research and research programs at University Centers of Excellence, DOE National Labs, and NIST? How are these priorities coordinated?

A1. The thrust of this question, as I understand it, is to understand how does the Department of Homeland Security Science & Technology Directorate (DHS/S&T) develop priorities for long term R&D, and the creation of revolutionary new capabilities. As implied by the question, the S&T Capstone IPT process is not well suited for that purpose. IPTs are commonly used for executing projects, such as acquisition programs (e.g., satellites, ships), where it is critical that the various organizations responsible for part of the project's execution (e.g., major subsystems, test & evaluation, requirements, system trades) are working closely together, and where it is critical that a forum exist to allow disciplined vetting of major decisions. The aim of such a traditional IPT approach is to deliver, in a cost effective manner as possible, a defined capability. The needed capability is usually determined through a separate process where either:

- A need articulated by an operational entity is turned over to the technical community for solution, or
- (Importantly) the technical community's vision for the "art of the possible" creates new opportunities for the operators.

The former typically leads to evolutionary R&D and the latter to revolutionary capabilities. IPTs, again, are not generally useful for defining a project, but rather for assisting in its execution.

The DHS/S&T Capstone IPT process is used entirely as a means for defining the content of various portfolios of activity. A particular concern is the IPT process is driven by requirements pull from the operators, rather than technology push informed by the state of the art. This is a noteworthy concern given the general lack of history (and culture) within the DHS operational components for technical innovation. An additional issue is that members of the Capstone IPTs are usually senior leaders within the operational agencies, not obviously attuned to the actual problems as seen in the field, and bound by prior decisions, and ways of doing business. Finally, a portfolio of activities driven by the operational requirements articulated by senior operational managers is almost certainly going to be evolutionary in nature, less reliant on technical innovation, and short term in its deliverables. All of this is exacerbated by DHS/S&T policy (at least as promulgated by the prior leadership) for only funding those efforts that originate from the IPT process. Hence, although the DHS/S&T IPT construct can in fact be useful for defining projects addressing clear gaps in capability generally with short term projects, it is hard to see how, in a consistent manner, revolutionary new ideas, requiring greater innovation and longer duration, can be systematically brought to bear in defense of the public. It is worth noting that "operator pull" R&D has been the model used by the Military Services with their laboratories for many years now, with consequent degradation of that infrastructure; the consequent lack of sustained, high quality technical focus on hard problems; and a heavy reliance on ad hoc private sector initiatives.

An alternative concept, successfully exercised in the early days of DHS/S&T, is to deploy technical staff to the field, working with and observing the operators in their daily missions, and seeing where technology can be deployed in an environment where real operational constraints are taken into account, as opposed to artificial constraints (e.g., "the way we have always done it"). Exposing in a sustained manner technical staff to operations, and to homeland security as a discipline, is far more likely to lead to innovative, game-changing projects than is attempting to educate senior operations managers on science and technology. That sustained focus on issues by technically trained people is a hallmark of the FFRDC concept, and of the DOE National Labs, in particular, Of course, once a portfolio of such projects has been assembled, the senior leadership of the operational agencies would convene with their counterparts in DHS/S&T to adjust and approve the overall effort.

Aside from issues surrounding the suitability of the IPT process for generating innovative projects, analysis and prioritization of the generated needs within the budgetary constraints of the Directorate has been in the past few years lacking.

There is a natural desire to address all needs generated by the users, but there are far more needs than the S&T annual budgets can support and the previous S&T leadership did not provide adequate multi-year strategic planning to prioritize R&D investments. There is no evidence that technology road mapping has been performed to ensure appropriate time and resources are allocated to projects, driven by risk and complexity as opposed to often ill-informed operator desires (regarding, e.g., schedule) expressed within the IPTs. The DOE National Labs have urged the use of technical experts to help with prioritization and road mapping of solutions, and that these roadmaps be used by Congress and the operating units to measure the success and commitment of S&T to the IPT-generated needs.

Finally, there needs to be continued attention given to technology transition from S&T to operational components—even though the IPT construct is dominated by operator "pull", that is no guarantee of an operator-funded procurement. Product maturation mechanisms should be strengthened and concepts akin to advanced technology demonstrations programs used in the DOD might be considered for this purpose.

The new DHS/S&T Undersecretary brings to the table a strong scientific background and an understanding of how science, technology, and engineering can be developed and deployed to address mission issues. Her approach to the President's aviation security directive indicates a thoughtful recognition of the need to address long term foundational issues, the need to deploy the DOE National Labs in a manner that will provide the sustained attention the problem demands, while also addressing near term urgent needs. I look forward very much to working with her to address the Nation's security problems.

Balancing Near-Term and Long-Term S&T

The need for substantial near term, evolutionary research and development applied to the DHS mission is substantial; however the DOE National Labs have become increasingly concerned that DHS has not given adequate attention to long term research. Truly hard problems are not being attacked with sustained focus by the best minds in the Nation. Instead, well-defined, short-term, low-risk projects are being funded-as noted above, that is a natural consequence of the extant IPT process. In this environment, creative breakthroughs will not be realized and hard problems are not likely to get addressed. Examples of the types of challenges that require sustained, high quality focus are real-time detection and assessment of extant, advanced, and emerging biological threats; ability to non-intrusively detect nefarious intent of people; real-time consequence analysis of large-scale natural disasters; and the ability to detect and protect cyber networks at the National scale from attacks.

Even in those areas where the needs are clearly understood by the operators, the balance between near term issues and longer term foundational needs is problematic. For example, in aviation security, the analysis of emerging threats, vulnerability of air frames, and development of improved technical capabilities, while part of the overall program, has been underfunded at the expense of supporting near term operator needs (in this case, an imminent TSA acquisition); while the near term issue is critical, the lack of funding for the foundational science reflects at least a potential concern regarding the relative prioritization of short and long term research. We strongly urge the establishment of a formal process aimed at the development of long term research priorities and roadrnaps, informed by the expertise resident in the relevant research communities, that drive the creation of programs that are of the proper size and length to address long term issues, and to create a foundational base for the homeland security mission.

The Centers of Excellence have historically set their priorities in the context of the research interests of the members, and to a large degree by the priorities expressed in their original proposals. Clearly, a process aimed at the development of long-term research priorities and roadmaps would, as a consequence, allow for the allocation of research to the academic communities, as well as to other government agencies and laboratories, as appropriate. Such a process does not exist to date.

Q2. In your testimony you mentioned the new DHS and DOE Aviation Security Enhancement Partnership—What impediments is this partnership supposed to remove and how will our traveling constituents benefit from this agreement?

A2. The U.S. Government needs an enduring research and development program that systematically addresses current and future threats to the aviation transportation system. DHS/S&T has been working in close collaboration with the TSA and three of the DOE NNSA National Laboratories (Lawrence Livermore (LLNL), Los Alamos (LANL), Sandia (SNL)) in an attempt to render a comprehensive understanding of the range of explosive threats that could be used to compromise an aircraft. The Aviation Security Enhancement Partnership (ASEP) has put in place a governance structure to further enhance the DHS and DOE ability to advance technical solutions to key aviation security problems. Three working groups, co-chaired by DHS and DOE National Laboratory personnel are tasked to recommend a strategy and work plan to:

- Deliver key advanced aviation security technologies and knowledge.
- Conduct analyses to asses possible vulnerabilities and threats and support/inform technology requirements, policy, planning, decision-making activities.
- Review use of existing aviation security technologies and screening procedures and the impact of new or improved technologies using a system analysis approach to illuminate gaps, opportunities, and cost effective investments.

This governance model is intended to be fully consistent and congruent with a broader interagency national security science, technology and engineering strategic governance model.

Q3. President Obama directed DHS and the National Labs to develop and deploy the next generation of passenger screening technologies. How do you plan to coordinate this effort with NIST given their expertise in sensors, biometrics, and technical standards?

A3. As stated in my written testimony, the primary source of funding for Aviation Security Programs at the DOE National Laboratories is DHS/S&T and TSA. In addition to our regular interactions with the DHS and TSA program managers and routine peer reviews conducted at the DOE National Laboratories (by academic and industry experts), the NEXESS program has also established a Blue Ribbon Panel, chaired by TSA that includes members from DHS S&T, TSL, the private sector, and academia. This panel provides assistance in evaluating and redefining the explosives detection and certification standards for a range of automated screening systems.

The DOE National Laboratories support the DHS Explosive Standards Working Group (ESWG), which is chaired by DHS/S&T, and includes broad membership across the DHS Components, the NIST and other Federal agencies. LLNL and other DOE National Laboratories are members of the National Electrical Manufacturers Association (NEMA) team, which has been chartered by DHS to write a new standard for airport security called Digital Communication in Security (DICOS). The standard will enable prevention, detection, and response to explosive attacks by standardizing the screening of checked bags as well as other threat risk detection attributes at airports and other security areas. While, the current focus is on x-ray equipment, there are plans for future work in whole body imaging technologies.

Over the last 10 years, the DOE National Laboratories have broadly engaged the scientific community in aviation security-including NIST. Scientists at LLNL, LANL, and SNL have participated in numerous National Academy studies and co-authored several reports, including a report entitled, *"Airline Passenger Screening, New Technologies and Implementation Issues"*.

Questions submitted by Representative Ben R. Luján

Q1. Dr. Albright, can you describe for the Committee what NEXESS is and what role each of the labs play? I want to be clear for the committee that this exciting initiative, which has been underfunded in the past, provides an already existing framework and strong expertise to address this problem of securing the flying public. And, this is an initiative that involves the close collaboration of all three NNSA labs—Los Alamos, Livermore and Sandia.

A1. The NEXESS Center was established by DHS Science & Technology in 2006 to build new and to support existing engineering and science-based methods for explosives countermeasures. The NEXESS Center is a cooperative tri-lab program, leveraging the explosives, systems analysis, and structural modeling expertise at LLNL, LANL, and Sandia. The NEXESS Center includes 4 elements: Intelligence Assessments, Explosive Engineering Science & Technology, Explosive Detection Science & Technology, and Advanced Concepts.

The goal of NEXESS is to improve our nation's ability to anticipate, and deter/defeat threats from energetic materials. To date, emphasis has been on performance characterization of homemade explosives [HME] and understanding vulnerability of aircraft to HME threats through the application of NNSA structural and blast models. The studies and information produced by the NEXESS Center informs DHS aviation security decisions. NEXESS is currently funded at approximately $10M/year. As you note in your question, up to this point the analysis of emerging threats, vulnerability of air frames, and development of improved technical capabilities, while part of the overall program, has been underfunded at the expense of supporting near term operator needs (most recently, an imminent TSA acquisition of new checked baggage systems); while the near term issue is critical, the lack of funding for the foundational science reflects at least a potential issue regarding the relative prioritization of short and long term research. It is hoped that the recent emphasis placed on aviation security by the President and the senior leadership of DHS and DOE will address the funding issue, and allow the needed foundational research to occur while also accommodating the near term priorities.

The Aviation Security Enhancement Partnership recognizes the contributions of the NNSA Labs. Each of the three working groups are co-chaired by an NNSA Laboratory:

- Systems Analysis—Sandia National Laboratory
- Aircraft Vulnerability Assessment—Lawrence Livermore National Laboratory
- Emerging Technologies—Los Alamos National Laboratory & Pacific Northwest National Laboratory

Q2. Dr. Albright, I have seen the modeling and simulation capabilities at Los Alamos and I was wondering, with the three NNSA Labs being world leaders in supercomputers and visualization how do you see those capabilities applied to aviation security?

A2. The National Explosives Engineering Sciences Security (NEXESS) Center, has capitalized on the FFRDC model, utilizing the expertise of the DOE National Laboratories to develop and implement cutting-edge engineering and science-based methods aimed at reducing the risks to aviation. The NEXESS Center has provided an important science base for aviation security, including:

- Evaluation and characterization of explosive formulations including, emerging (e.g. homemade) explosive threats, the determination of detonability, methods of initiation, detonation velocity, and impulse energy;
- Assessment of the catastrophic damage threshold for aircraft as a function of explosive amount, location, and flight conditions (initial work has been focused on a specific narrow body airframe) using a combination of highly sophisticated computer modeling in concert with small and large scale experiments;
- Rapid assessment of the technical performance of emerging detection systems and their application to aviation checkpoint security; including one particular example that involved working with L3 to determine the utility of active millimeter wave technology for the detection of concealed liquid explosives on a person.

Reducing aircraft vulnerability to explosives will require using the best available advanced computer simulations to model the damage caused to an aircraft by an on-board explosion from a wide range of conventional and homemade explosives. The goal is to provide as parsimonious a set of models as is possible to meet the government's needs for accuracy and error bounds. Model improvement and validation will include conducting physical experiments, as well as computational exercises, to ensure the accuracy, stability, and precision of these computer models; expansion of the types of aircraft for which these models can be applied, including new composite-based structures; and uncertainty quantification. A further goal is to develop fast running models for use in large-scale assessments and rapid turnaround estimates of aircraft vulnerability.

As you point out, the DOE National Laboratories are uniquely positioned to apply the best computing and visualization capabilities on the planet to this problem. It is also important to note that it is not just the computing hardware—the National Laboratories bring world-class multidisciplinary teams of scientists, engineers, computer scientists, operations analysts, and mathematicians together in the same room to bring innovative and creative approaches to these problems, leveraging the hardware and the significant software investments in, e.g., structural analysis and visualization. You can only find this at the DOE National Laboratories.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Bert Coursey, Program Manager, Coordinated National Security Standards Program, National Institute of Standards And Technology

Questions submitted by Chairman David Wu

Q1. DHS S&T uses the Capstone IPT process to set priorities for short and mid-term research programs, but how are priorities set for long term basic research and research programs at University Centers of Excellence, DOE National Labs and NIST? How are these priorities coordinated?

A1. The National Institute of Standards and Technology (NIST) sets priorities for investments in long-term research programs in measurements and standards to support explosives countermeasures in consideration of White House level planning, investments from other Federal agencies and synergy of the programs with other NIST laboratory directions. White House level planning includes the National Science & Technology Council (NSTC) report *Research Challenges in Combating Terrorist Use of Explosives in the United States* (December 2008), as well as Homeland Security Presidential Directive 19 (HSPD–19), February 2007. NIST also has long-term research projects funded by the DHS S&T in the areas of trace particle behavior and transport, and frequency comb spectroscopy. This science will inform the next generation of trace explosives detectors. Finally, NIST looks at the synergy of other agency investments in understanding particle behavior and in limits of explosives detection with related NIST investments in fundamental measurements and standards for diagnostic health care, pharmaceuticals and environmental measurements. NIST priorities for long-term research are coordinated with DHS S&T and the interagency Technical Support Working Group (TSWG).

NOTE: This response is for NIST only, not DOE, DHS or Universities.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Sandra L. Hyland, Senior Principal Engineer, BAE Systems

Questions submitted by Chairman David Wu

Q1. DHS S&T uses the Capstone IPT process to set the priorities for short and mid-term research programs, but how are priorities set for long-term basic research and research programs at University Centers of Excellence, DOE National Labs, and NIST? How are these priorities coordinated?

Answer to question about funding priorities

A1. I have no expertise in the area of determining basic research priorities and coordination and prefer not to speculate in this area. There are some groups within the National Academies, such as the Laboratory Assessment Board or the Standing Committee for Technology Insight-Gauge, Evaluate & Review (which is specifically focused on the intelligence community's needs), that could be a good resource for comparing the various approaches to research and development funding.

Follow up to discussion during the hearing

In the 1996 report, the NRC committee specifically recommended against polling the travelling public about potential screening technologies without being very specific about the potential implementation within the security system. For example, asking travelers if they object to the invasion of privacy posed by the full-body scanners is unlikely to produce information that would be useful to predict the actual response to these systems being implemented in the airport. Gathering information about future travelling behavior is more likely to be productive if very specific scenarios are posed, and if those being polled are chosen to represent a wide variety of users including passengers, operators, airport managers, airport security personnel, etc. Sociologists and others whose expertise is predicting how people will behave in given situations should be involved in how to present the information, what questions are likely to produce actual predictive responses, and how much detail is needed to describe a specific implementation scenario. Test beds inserted into actual stream-of-commerce passenger flow, such as the one set up at Gatwick Airport, will be invaluable in getting accurate and predictive feedback on specific implementation of new screening technology.

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