Statement of Jill M. Hruby
Vice President,
International, Homeland, and Nuclear Security
Strategic Management Unit
Sandia National Laboratories

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Introduction

Chairman Lungren, Ranking Member Clarke, and distinguished members of the House Committee on Homeland Security Subcommittee on Cybersecurity, Infrastructure Protection, and Security Technologies, thank you for the opportunity to testify. I am Jill Hruby, Vice President of Sandia National Laboratories' International, Homeland and Nuclear Security organization. Sandia is a multiprogram national security laboratory owned by the United States government and operated by Sandia Corporation for the National Nuclear Security Administration (NNSA).

I appreciate the opportunity to comment on a topic that is so important to the long-term security of our nation. I hope my statement today, along with those of my colleagues in the Department of Homeland Security (DHS) and from the national security science and technology provider community, will result in concrete actions to ensure that DHS can provide science and technology (S&T) solutions that allow our Nation to get, and stay, ahead of threats to our homeland. In order to do this, I believe DHS needs to create and foster an enduring environment where dedicated, outstanding scientists and engineers can as providers of solutions that will deter acts of terrorism, enable resilience to natural disasters and other incidents, and facilitate trade and travel while enhancing security.

One example of how dedicated scientists made a difference in urgent circumstances was the decontamination foam that was used to clean up nearly all the contaminated buildings in Washington DC after the anthrax attacks. Our scientists had been watching the biological threat for years – concerned that pathogens would someday be used against our population – and that we would need to rapidly respond. When the attack came, we had already developed a novel, effective technology to quickly mitigate the consequences. That kind of threat awareness, and the ability to do something concrete about it, comes from a special

type of person in a special type of institution. The DOE national security laboratories cultivate those committed people and establish and maintain those capabilities. My hope is that, with a shift in the way DHS and these labs engage with each other, we will realize a robust and enduring approach to ensure our nation is always prepared.

Major Points of This Testimony

- *The only way DHS can get ahead of the threat is with a dedicated and flexible science and engineering enterprise focused on solutions for the long term and the unique nature and capabilities of the DOE national security laboratories makes us natural partners in this dedicated enterprise.*
- *DHS has benefitted from many technical solutions that the DOE national security laboratories contributed as a result of long-term research and development performed for other agencies long before its creation, but that pipeline is not being sustained.*
- *DHS as a whole is not taking advantage of the systems analysis and long-term innovation that the DOE national security laboratories are best suited to provide; however, there are some ongoing efforts that begin to model what the partnership could look like – and lead to enduring solutions to hard homeland security mission challenges.*

Need for Dedicated Homeland Security Research and Development

In the aftermath of 9/11 and the Amerithrax attacks, the National Academy of Sciences completed a rigorous assessment of major Homeland Security challenges. "Making the Nation Safer[1]" described in detail how important technical approaches were to effectively managing the risks in the homeland security mission space – especially since many of the most consequential threats are posed by technology. The report pointed out what we now accept as a basic truth – that our society and infrastructures are very complex and completely interconnected. Understanding threats and potential consequences to these systems, as well as understanding how to optimally balance the components of the systems – technologies, people, and concepts of operations – is the fundamental first step in changing the risk equation in our favor. And although the National Academies proposed a suite of near-term, high priority research and development activities, they also stated it was critical to establish a flexible supporting science and technology enterprise that could change and adapt as circumstances change. Getting in front of the threat – and staying there - is what the DOE national security labs were created to do – and what we have been doing well for over 60 years.

[1] *Making the Nation Safer: The Role of Science and Technology in Countering Terrorism*, Committee on Science and Technology for Countering Terrorism, National Research Council, http://www.nap.edu/openbook.php?record_id=10415, 2002, The National Academies Press, 440p.

Congress recognized the capabilities the DOE labs could apply and explicitly created pathways that would facilitate the new Department's access to and use of these labs in the 2002 enabling legislation – PL107-296, Sec 309. This legislation was remarkably forward-looking, and explicitly gave DHS direct access to the DOE labs' unique expertise, knowledge base, and experimental and computational facilities - developed over years of taxpayer investments - to help with needed science and technology for homeland security on an equal basis with other missions. As a result, it provided a direct path to establishing a cadre of experts with an enduring focus on the hard problems in homeland security within the DOE national laboratories.

Today, the DHS and laboratory community recognize the unique nature of homeland security work relative to other national security challenges. When supplying technical solutions for homeland security, consideration must be given to the operator and his or her environment and training, to individual freedoms and US public acceptance, to interagency coordination, and to other practical and policy considerations. In addition, the homeland security missions are broad including everything from natural disaster preparation to protection from, response to, and recovery from the use of a weapon of mass destruction against the US civilian population. This is not a mission space that will be covered simply by adapting solutions being developed for other reasons – it is a unique mission space requiring solution providers with considerable domain knowledge and expertise.

DOE National Laboratories Construct

Let me start with a brief summary of the DOE laboratories for those of you who are unfamiliar with us. DOE manages 17 national laboratories, 3 being managed under the National Nuclear Security Administration (NNSA). Sandia and our two sister NNSA labs - Lawrence Livermore and Los Alamos - are large, multidisciplinary research and development (R&D) institutions **wholly** dedicated to the national security. Most of the DOE laboratories have missions devoted to science and energy, although two of those – Pacific Northwest National Laboratory and Oak Ridge National Laboratory - have significant footprints in national security. All of the national laboratories have operated as Federally Funded Research and Development Centers (FFRDCs) since our creation about 65 years ago during the Manhattan project. Today, Sandia's prime sponsor is the NNSA and we work with support from multiple government agencies to provide science and engineering solutions for complex and high-risk systems, endangered by often existential, threats.

The FFRDC construct has served the nation exceptionally well for 70 years. The core tenets of FFRDCs (from FAR Title 48CRF35.017) govern the practices and culture of the national laboratories:

- An FFRDC meets a special long-term research or development need,
- An FFRDC is required to conduct its business in a manner befitting its special relationship with the government, to operate in the public interest with objectivity and independence, and

- A long-term relationship between the government and FFRDCs should provide the continuity that helps the FFRDC both attract and retain high-quality personnel. This relationship should also be of a type to encourage the FFRDC to maintain currency in its field(s) of expertise, retain its objectivity and independence, preserve its familiarity with the needs of its sponsor(s), and provide a quick response capability.

The fact that we are FFRDCs, coupled with the nature of our work over decades, has created a truly valuable and unique resource for the US government to meet its special long-term needs for science, technology and engineering. Efforts at the DOE national security labs span the complete technology lifecycle from basic research and development to testing and evaluation, modeling and simulation, technology system deployment, operator and decision-maker support and training, and policy advice. Our special relationship with the government provides for independence and objectivity – and our bottom line commitment is to the mission rather than the shareholder. This creates a different mindset among our staff, one of total commitment to sponsors' needs and to the security of the nation. The labs do not compete with industry; rather we partner with them to pave the way for commercialization of technology once it is sufficiently mature to become operationally viable. We do not fulfill all of the needs for homeland security technology solutions – but we fill a crucial niche as a brain trust of homeland security domain expertise and deep and broad science and engineering in addressing both urgent and long-term needs for science, technology, and systems advice.

Each of the DOE National Security Laboratories has unique strengths and capabilities. At Sandia, our culture of both scientific excellence and large-scale systems engineering drives us to think about the totality of a problem and to understand what will really make a difference; not to simply reach for "low hanging fruit" but to really explore how to change the game. Nothing is more likely to inspire lab staff to innovation than stating an important problem is too complex to solve. All of the DOE National Security Labs have the ability to bring together interdisciplinary teams to tackle problems that are beyond the scope of academic institutions – although we frequently partner with academia to feed the innovation pipeline, to keep our skills sharp, and to develop future generations of laboratory staff. Sandia creates and maintains large facilities for the US government such as environmental test ranges, including those for testing novel explosives; nano- and micro-fabrication facilities capable of producing both research prototypes and unique, radiation-hardened microelectronics; and high-performance computing. These facilities can be used for high-risk, classified experiments and push the envelope beyond the scale of those existing at purely academic or commercial entities.

A Brief Summary of Sandia's Homeland Security Contributions

All of the DOE National Security Laboratories have applied their unique expertise individually and in collaborative partnerships over the years to create solutions to high-impact homeland security problems. The examples below are a subset of the areas in which Sandia has contributed. Each of the labs could share a similar list of contributions.

Looking over the Horizon – Biological Risk

The long-term relationship codified by the FFRDC construct provides for an enduring focus on significant national security issues that creates the deep and broad knowledge base that not only enables the labs to understand the immediate threats, but also to look over the horizon and anticipate future risks. Before the creation of DHS, the labs anticipated the potential for a biological threat to be used on civilian populations in the US, and invested in solutions to use if needed – such as the specialized foam (mentioned earlier) used to decontaminate 53 of the 56 Washington DC area buildings that were contaminated by the 2001 anthrax attacks. Our microanalytical methods that allowed characterization of the Amerithrax material were incorporated into specialized equipment and transferred to DHS' National Bioforensics and Analysis Center (NBAAC) for routine use in the investigation of biocrime and bioterror events. We were engaged in developing the first generation of the BioWatch program, which placed detectors in locations around numerous US cities to rapidly detect the release of pathogens into the air. As DHS is now enhancing the system, the labs are performing tradeoff studies to inform the requirements for the next generation system to ensure performance metrics for response time and detection sensitivity are understood and incorporated. Today, rapid advances in biology have opened the door to the possibility that terrorists might engineer existing or develop novel organisms to enhance their efficacy and evade current detectors and countermeasures. Sandia is investing in methods to rapidly identify new threat organisms to allow response to these new potential threats.

Leveraging and Coordinating Efforts – Nuclear and Cyber Risk

Another key strength of our national security laboratories is the ability to leverage across the breadth of related national security missions – helping to create a more consistent and robust system across multiple US government agencies and international partners. As expected, the labs have contributed to the current goals of nuclear and radiological risk reduction beginning with aggressively accelerating research to modify radiological detection technologies originally developed for DOD and NNSA for use in homeland security applications. DHS operations required that equipment originally capable only of identifying specific radionuclides in controlled lab conditions rapidly evolve for effective deployment in the noisy, environmentally variable real world and for use by non-technical operators. The DOE National Security Labs were key to this technology transition.

The labs continue to work with the Domestic Nuclear Detection Office (DNDO) to build the Global Nuclear Detection Architecture (GNDA) and develop international guidelines documents on core concepts related to nuclear detection. DNDO's "Model Guidelines Document" is currently being adapted by the International Atomic Energy Agency (IAEA) to be part of its Nuclear Security Series. DHS has been able to leverage capabilities and past experiences at Sandia including those gained from supporting the NNSA's nuclear nonproliferation efforts such as Second Line of Defense (SLD), the Department of State's Export Control and Related Border Security Assistance (EXBS), the Department of Defense CENTCOM workshops on weapons of mass destruction (WMD) interdiction and border security, IAEA initiatives, and others. The benefit to DHS includes not only specific technologies but also technical bench strength that have been built by the DOE national

security laboratories for other agencies to apply to the unique problems in homeland environments. Those agencies, in turn, benefit from the contributions sponsored by DHS – resulting in an overall uplift of the nation's nuclear security capabilities.

Because of our long history in cybersecurity for a variety of sponsors and beginning with our responsibility for the security of the command and control of the US nuclear weapons, DHS' National Protection and Programs and Science and Technology Directorates are now leveraging Sandia's knowledge of the most sophisticated cyberthreats to perform adversarial analyses on potential new cybersecurity approaches before they are deployed for use by government and industry. We also use our deep knowledge base and ties to other government entities to develop and extend tools for analysis of risk factors, to perform threat assessments, and conduct vulnerability assessments on systems of interest to the DHS.

The Nation's Technical First Responders – Urgent Response to Natural and Man-Made Incidents

Our enduring focus provides an ability to quickly respond to urgent needs – and this is particularly true for WMD and other high-consequence threats. The labs are the nation's technical first responders. In the aftermath of Hurricane Katrina, the Christmas Day bombing attempt, and the Deepwater Horizon and Fukushima disasters, our deep technical expertise was used as an immediate and integral part of the overall response to guide executive leadership in characterizing the situation, predicting the evolution of the incident, and advising on appropriate response and consequence management approaches.

Applying System Solutions and Developing Requirements Informed by Domain Knowledge – Border and Aviation Security

No homeland security solution exists in a vacuum. These solutions are all part of complex, interdependent systems that include technology, human operators and decision makers, environmental and operational constraints, policy drivers, and many other competing and reinforcing requirements. Sandia systems analysts work with both DHS S&T and DHS operational components to refine the understanding and definition of problem space, create and apply an analytic framework that utilizes "measures of effectiveness" germane to stakeholders objectives, analyze options within that framework, and then explain options, insights, and tradeoffs to enable action.

The highly complex and enduring challenge of enhanced border security requires developing a detailed and accurate understanding of the global systems architecture and all of its important components: ports of entry and unattended borders at the ground level and below, in the air and on the water, across all modes of transportation and conveyances, moving legitimate and illegitimate people and goods. The border is a complex interdependent system that can only be addressed through a multidisciplinary, sustained and long-term effort. For over 60 years, Sandia has been providing trusted national service in the form of end-to-end analysis and full life-cycle support solutions for safeguarding critical national assets.

In the early 1990s, Sandia performed a mile-by-mile analysis of the southwestern U.S. border for the Immigration and Naturalization Service. The study assessed the impact of potential technological and operational changes, and made specific recommendations such as the very successful multilayer San Diego fence. The 1993 report continues to be frequently requested and referenced by DHS and others interested in understanding the border system.

More recently, Sandia led a team to contribute to aviation security by performing system modeling and analysis of the TSA airport checkpoint system in order to understand the effect of deployment of new systems on the checkpoint operations. As a result, a decision framework and prototype tool was provided to TSA to apply a structured approach for evaluating system impacts and tradeoffs among key aviation security objectives. And when TSA starts its next system acquisition, it will know in advance how effective it will be for the dollars expended and how best to deploy the systems so the technologies and its human operators work smoothly together.

DHS Relationship with the DOE National Security Laboratories

As discussed above, Sandia worked on many homeland security challenges long before the September 11th attacks and we have been committed to DHS since its inception. Our lab, along with other DOE national security labs, provided scientists who established the framework for the S&T Directorate (and later DNDO) and who also filled key roles in the initial senior leadership team. The labs played a foundational role in creating the systems configuration and enabling the technical basis for major homeland security capabilities in use today, including the BioWatch System, radiation detection technologies used at major points of entry, and the technical basis for assessing aircraft vulnerability. Sandia remains firmly committed to the homeland security mission, even though DHS work is a very small and decreasing percentage of our work.

While the 2002 legislation creating DHS authorized utilization of the DOE national laboratories as R&D FFRDCs for DHS that is not the role that we have today. Now our laboratories are used predominantly as contractors on competitively bid research projects. We perform discrete research and technology development in response to specific technical requirements. While the labs have been relatively successful in competing for projects on a transactional basis, this model fails to utilize the unbiased technical advice and analysis for systems based solutions based on a thorough understanding of the mission and the operational needs of the sponsor, deep scientific understanding, and multidisciplinary national security expertise unique to these laboratories. In fact, working on projects rather than mission is precisely the wrong use of these labs.

Part of the issue with appropriate use of the DOE national security labs is it requires coordination between S&T and the operational components in a way that doesn't exist today. The S&T Directorate is responsible for R&D efforts and priorities in support of DHS' mission, and performing associated demonstration, testing, and evaluation and assessing

threats and vulnerabilities. But the responsibility for understanding the systems-level mission challenges lays with the operational components – e.g., CBP, TSA, and FEMA.

Mission relevant R&D must have an integral connection to the needs of the operational components and the environments in which they work. Solving major homeland security challenges requires systems-level solutions enabled by a combination of thorough understanding of operational missions, subject matter expertise, and R&D focused on core challenges. The most fruitful collaborations begin with scientists and engineers working directly with the operators. The depth of insight gained during these collaborations is invaluable in characterizing the entire system, determining the most crucial needs, and creating a vision of what is possible. If the operational components directly access the DOE national security labs as FFRDCs to support them in developing their systems requirements – the result could be avoiding the monetary and security costs incurred with suboptimal systems.

Another issue has occurred because of the shift in the S&T Directorate an almost exclusive focus on foraging for existing technologies that can be rapidly adapted and integrated into existing systems. It is not surprising that in today's operationally dominated homeland security environment, the operational components and the S&T Directorate are driven by immediate needs and have neither the time nor an ingrained cultural inclination, to focus on systems-level solutions for the rapidly evolving global environment. While this approach can be a useful part of overall solutions, it is equally also important to find the right balance between harvesting available technologies and driving innovation for the long term.

Many of the most impactful technical solutions to the homeland security problem arose from investments made by the government before DHS stood up. That pipeline that benefitted from long term R&D has dwindled or, in some cases, perhaps even been lost. If technology foraging is the sole focus of DHS, then it will fall farther and farther from achieving the levels of risk reduction required to protect the nation now and in the future. The lack of interest in the type of creativity the labs bring to bear on the homeland security problem coupled with the lack of DHS commitment reflected in intermittent and unpredictable funding has resulted in lab staff, who had previously dedicated themselves to this mission, walking away to work on other important national security problems. The longer this absence of enduring mission partnership continues, the less likely will we be able to recapture the most talented scientists and engineers to attack problems unique to the homeland security mission and operational environments – and drive the innovation required to stay ahead of the rapidly adapting adversaries and effects that propagate through our highly interdependent systems.

For all of these reasons, if DHS can institutionalize the FFRDC partnership relationship with the DOE national security laboratories that was envisioned and authorized in the 2002 Homeland Security Act, we can provide a very important capability for meeting homeland security challenges and fill the keystone niche that bridges the gap between what we have and what we need in terms of effective security technology systems.

Presently there are some activities that show promise to result in mission-level work that takes advantage of the character of a FFRDC relationship and that would provide substantial benefit to the homeland security mission.

- In biosecurity, DHS S&T has recently engaged a few DOE national security laboratories in the ongoing development of an integrated biosecurity strategy.
- A group of DOE labs together with the Homeland Security Systems Engineering and Development Institute and the Homeland Security Studies and Analysis Institute has been working with TSA to develop systems analysis resources for the development and implementation of risk-based screening.
- S&T and FEMA have engaged Sandia, not just as a technology provider for technologies used by emergency preparedness professionals to enhance their training, but also as a long-term strategic partner to help create a roadmap for development and utilization of technology to enhance the nation's emergency preparedness. This partnership has also allowed S&T and FEMA to demonstrate several near-term wins, while continuing to pursue a longer-term R&D agenda to address tomorrow's technology needs.
- Recently, Undersecretary Tara O'Toole has asked a group of DOE national security laboratories to articulate major emerging homeland security challenges, along with the capabilities and R&D that will be required to address those challenges.

A Future with Dedicated Homeland Security Research and Development

The pace of technology change and the increasing complexity and interdependence of the systems homeland security manages and employs demands that DHS moves to the forefront of innovation to keep in front of the threat – and even more importantly, to shape the environment which the threat operates and affects. As stated by the National Academy of Sciences back in 2002, it is critical to establish a supporting science and technology enterprise that could change and adapt as circumstances change.

The only way to move from a reactive to an anticipatory posture in the homeland security mission space is to establish and sustain a dedicated R&D enterprise that is a full partner in creating the future. This partnership can help ensure that not only the urgent – but also the most important and enduring problems are addressed. This partnership can ensure that dedicated scientists and engineers develop and preserve familiarity with the needs of its DHS sponsors, establish a long-term enduring relationship that keeps high quality personnel engaged in addressing mission challenges, maintain currency in fields of expertise important to the mission, can provide a quick yet deeply knowledgeable response capability, and can provide the advice and systems understanding needed to implement solutions that truly address the most important risks.

With a full partnership with the DOE national security labs, we can imagine a future where:

… we no longer simply reacted to novel explosive threats in the months and years after they have been used – but rather developed in advance synthesized information from intelligence assessments, detection R&D, explosive performance R&D, and advanced detection concepts. This information could drive development and prioritization of mitigation methods for various adversary threat pathways, concealments and threat materials. The labs already created the structure to accomplish this task and have many of the component parts, which could be resourced and sustained as an integrated capability.

…. we could enhance security without disrupting the flow of people or commerce. We have already begun working with TSA and industry to develop risk-based, threat-informed screening architectures and enabling technologies that enable graded passenger screening, with maximum screening of only the highest risk passengers. A systems approach would consider the entire system and not just the checkpoints. Protective measures throughout the airport and aircraft could eventually lead to the point that you won't have to take off your belt and shoes – and perhaps you can even carry a bottle of shampoo on board the plane with little or no risk that a terrorist could smuggle in enough liquid explosives to bring down an airplane.

… the labs have applied their expertise to push the envelope on data to decisions – enabling the analysis of enormous and diverse data sets and quickly providing the most important elements of the information to decision makers in order to react to events in near-real time. For instance, it were possible to pull together the vast array of data on nuclear materials that is currently collected and stored in hundreds of different locations in different formats; synthesize and analyze it and then push actionable information out to front line operators in near-real time.

…. a biosurveillance system and key enabling technologies provide a cost effective risk-based mix of environmental monitoring and medical diagnostics and surveillance to give early warning of attacks to major population centers – saving countless lives by allowing timely medical intervention for those people who have actually been exposed and require medication.

…. a national level analysis capability for understanding the impacts of cyber attacks across interdependent US infrastructure elements allows us to defend our civilian infrastructure against asymmetric and ubiquitous cyber threats,

…. analysis tools and subject matter experts decipher the complex interdependencies of our critical infrastructure, assess vulnerabilities and potential cascading effects, thus enabling the government, private sector, and citizens to dramatically increase resilience saving lives, property, and services.

We are committed to the homeland security mission; we can make a difference. It is what we strive to do – provide exceptional service in the national interest.