ESTABLISHMENT OF THE DEPARTMENT OF HOMELAND SECURITY

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OPENING REMARKS

Mr. Chairman and members of the committee, thank you for the opportunity to appear before you today. I am the Director of the Lawrence Livermore National Laboratory (LLNL), a position I assumed on July 1, 2002. It is an honor and immense responsibility to lead one of the nation's national security laboratories, particularly in the wake of September 11. The events of that day tragically make clear that the United States is not immune to the scourge of terrorism, and they call for the nation's leaders and technical community to take dramatic steps to improve homeland security.

Enactment of legislation to form a Department of Homeland Security—an idea supported by the President and the Congress—will fundamentally change for the better the nation's approach to preventing terrorist attacks on the United States, reducing the nation's vulnerability to terrorism, and managing the aftermath of any attack. The mission is complex and daunting in scope. One major challenge for the new department will be effective integration of relevant activities, which are currently dispersed among many government organizations. Another challenge will be focusing the unsurpassed scientific and technical talent of this nation to improve capabilities to deal effectively with threats, those most critical today and as well as those emerging in the future.

I support formation of a Department of Homeland Security and I am here to comment from a technical perspective on both the needs of the new department to pursue a sustained research, development, testing, and evaluation (RDT&E) program and the capabilities available to it to do so. Currently, RDT&E capabilities are dispersed, but there is an important concentration of them—particularly related to chemical, biological, radiological and nuclear threats—in the Department of Energy's National Nuclear Security Administration (NNSA) and its laboratories and other sites. I will discuss relevant capabilities at LLNL and some of the important programs and partnerships we have in place. They illustrate LLNL's approach to developing and deploying technologies and systems to strengthen homeland security and the success we are having in placing the right tools in the hands of the right people.

Effective partnerships among the various sources of expertise and with the users of new capabilities are required to make necessary improvements in homeland defense to cope with today's dangers and prepare for the threats of tomorrow. Focus on the most effective approaches to the highest priority issues is also required. To that end, the

Administration's proposal prudently includes the formation of a "center" to ensure that all needed science and technology elements are being addressed to deal in particular with the weapons of mass destruction threats, without unnecessary duplication of effort, and that the best use is made of the nation's technical and fiscal resources. As Governor Ridge has testified (June 25, 2002), there needs to be "one unit …that deals with research and development, science and technology" and provides "strategic direction for homeland security research and development."

The Administration has made clear that they would like to locate a center of excellence at the Lawrence Livermore National Laboratory and use as well other national labs and other research facilities around the country. General John Gordon, testifying before Congress as NNSA administrator, voiced support for the concept of locating the Department of Homeland Security's main research facility at LLNL with satellite centers of excellence elsewhere. A center at Livermore would not only benefit from the Laboratory's multidisciplinary capabilities and those at Sandia National Laboratories (California), it would be advantageous for the homeland security mission and facilitate partnerships because of the Laboratory's location in the San Francisco Bay/West Coast area, which has many intellectual resources and homeland defense challenges. At LLNL, we are honored by the Administration's proposal, we are anxious to contribute to homeland security to the best of our abilities, and we are confident that we can help make the Department of Homeland Security a success.

LLNL'S CONTRIBUTIONS TO HOMELAND SECURITY

Lawrence Livermore National Laboratory was established 50 years ago to pursue innovative solutions to the nation's pressing needs to advance nuclear weapons science and technology. Since then, the Laboratory has continually adapted to address the evolving challenges of the day and anticipate future needs, keeping a central focus on national security. As one of NNSA's three national laboratories, LLNL is a principal participant in the Stockpile Stewardship Program to maintain and enhance the safety, security, and reliability of the nation's nuclear weapons stockpile. The Laboratory is also engaged in vital national programs to reduce the threat posed by the proliferation of weapons of mass destruction (WMD) and to provide for homeland security. These complementary missions—stockpile stewardship and countering WMD threats—are integrally connected in terms of their overarching goal of enhancing security, and the research activities largely draw on the same base of scientific and technical capabilities and expertise.

Because Livermore and our sister NNSA laboratories (Los Alamos and Sandia) have long been working to develop technical capabilities to detect, counter, and mitigate WMD proliferation and terrorism, we were able to respond rapidly and effectively to the events of September 11 and its aftermath. Although those investments are paying great dividends in the newly declared war on terrorism, substantial sustained investment is

needed to develop vastly improved warning and response capabilities to protect the U.S. against these threats, now and in the future. We are fully committed to this long-term national security endeavor and are well positioned to provide RDT&E support to the Department of Homeland Security.

Lawrence Livermore is contributing widely and effectively to the war against terrorism with capabilities and partnerships and through RDT&E programs directly relevant to the Department of Homeland Security's mission. The provided examples illustrate three major points about the Laboratory:

- **LLNL has demonstrated the capability to work problems from end-to-end** — starting with an understanding of the threat and the users' needs, devising a systems solution, developing the enabling technology advances, testing both the component technologies and systems solution in cooperation with users, moving the new technologies to U.S. industry, and working with the user community to ensure effective deployment and training.

- **LLNL has strong capabilities and active programs in each of the WMD areas** — chemical, biological, radiological, and nuclear. In addition, the Laboratory has major programmatic activities in threat assessment and intelligence support as well superb supercomputing capabilities. Accordingly, we have a "critical mass" of programs and capabilities that provides the Laboratory an excellent overall perspective of threats, technical opportunities, and user needs.

- **LLNL has many strong ties to research partners and the user community** — including sister laboratories, the Nevada Test Site for remote testing, a wide range of universities, and many ties at the local- and state-government level.

The Capability to Work Problems from End-To-End—BASIS as an Example

A research and development program particularly focused on the area of WMD terrorist threats is an integral part the legislative proposal for a Department of Homeland Security for good reason—the nation faces a dire immediate threat that unquestionably will grow more sophisticated over time. The nation's vulnerabilities vary widely in their significance and their potential for being ameliorated by new capabilities and/or changes in operations. What is needed is a comprehensive perspective of the issues, a vision where one wants to go, and a pragmatic approach to problem solving to put products in the field expeditiously.

At LLNL, we take a systems approach to the overall problem and determine what priority items can be dealt with expeditiously with existing equipment or modest improvements in technology and where investments in longer-term research and development will be necessary. In those areas where a new system based on existing or emerging technologies can make a substantial difference, it is important to work the problem comprehensively with the end user in mind.

The development of the Biological Aerosol Sentry and Information System (BASIS) by Livermore and Los Alamos exemplifies this approach and serves as model of how the Department of Homeland Security could most rapidly and effectively take technology from the conceptual stage through to actual deployment. The process is more than R&D, it is RDT&E—research, development, testing, and evaluation.

In late 1999 we were challenged by the Secretary of Energy to develop and field a biological detection system in time for the 2002 Salt Lake City Olympics. At the time, there was no system suitable for civilian use for broad-scale biological environmental detection and monitoring. Early detection and rapid response are the keys to reducing the human health consequences of a biological agent attack. Over the next three years, we and our colleagues at Los Alamos developed and demonstrated a successful system to meet this challenge. BASIS was fielded at Salt Lake City in February 2002 as part of the overall security strategy for the Olympic Games where it performed exactly as designed. The goal-oriented approach used in this program greatly contributed to its outstanding achievement. In particular, BASIS benefited from:

- *A Clear Objective at the Outset.* For BASIS, clear, top-level objective was established at the beginning of the project with respect to the desired cost and performance attributes of the system. The objective was based on an understanding of the threat, technical possibilities, and user needs. After this, the management of the program and the technical details were left to the technical team.
- *Close Interactions between Users and Technology Developers.* There were extensive direct interactions with the Salt Lake Olympic Committee, local, state, and federal response agencies, the public health system, and the technology developers from conception through implementation and operation.
- *Problem-Solving Systems Approach.* The sponsors, users, and technologists recognized the need for a system-level solution, not a single technological widget, and for the system to work in conjunction with other equipment (e.g., medical surveillance systems). LLNL and LANL brought together a team of engineers, biologists, computer scientists, and operations specialists to execute the program.
- *Advanced Technology Developed by Labs, Transferred to and then Procured from Industry.* The system used the most advanced biological detection technologies available (i.e., PCR). The best biological detection instrument for this application was from a commercial entity (Cepheid) that had earlier licensed the technology from LLNL.
- *Testing and Evaluation against Standards by Recognized Authority.* The biological assays were co-developed by LLNL and the Center for Disease Control's (CDC) Bioterrorism Laboratory. The testing regimen was established with law enforcement and public health, assuring a high level of confidence in the system.
- *Transfer of Operations to Contractors.* Local contractors provided the bulk of the staff for all aspects of the system operations at the Olympics. LLNL/LANL staff were used in supervisory roles and for technical support.

Strong Capabilities and Active Programs—Nuclear and Radiological Threats

As one of NNSA's three national laboratories, LLNL is fully engaged in the Stockpile Stewardship Program and has a very large science and technology base supportive of work on nuclear weapons, nuclear materials, and nonproliferation that can be leveraged to support homeland security. The Laboratory is home to one of the nation's two research facilities for special nuclear materials. It operates a remote test site and has a close working relationship with the Nevada Test Site where work that requires even greater isolation is carried out. Several activities that contribute to homeland security merit special mention:

Nuclear Threat Assessment Program. The NNSA's Nuclear Assessment Program was established in 1977 to provide a national capability for correctly and expeditiously assessing the credibility of communicated nuclear threats. Shortly after its inception, the Nuclear Assessment Program became the central point of contact and action office within the NNSA for assessing and monitoring illicit nuclear material trafficking incidents worldwide. Selected elements of the program are routinely used to provide NNSA technical support to the law enforcement, diplomatic and intelligence communities. The major support activities include real-time assessments of nuclear threats and black market transactions, participation in FBI designated Special Events, and providing NNSA courses on nuclear crime at various national and international training venues. Since the terrorist attack on September 11, there has been dramatic increase in requests for our services; we have assessed 25 nuclear threats, 90 illicit trafficking cases, and 51 other nuclear related incidents.

The operational capability consists of a small group of professionals who are collectively knowledgeable in nuclear explosives design and fabrication, nuclear reactor operations and safeguards, radioactive materials and hazards, linguistics analysis, behavioral analysis and profiling, as well as terrorist tactics and operations. The assessor teams are organized into specialty teams and operate in secure facilities at the three participating NNSA contractor sites. An Assessment Coordinating Center at LLNL directs credibility assessment operations for the NNSA and provides a single point of contact for federal crisis managers during emergency operations.

Nuclear Incident Response. The Laboratory is a key participant in the national nuclear incident response groups, including the Joint Technical Operations Team (which deals with nuclear terrorism or extortion threats), the Accident Response Group (which responds in the event of an accident involving U.S. nuclear weapons) and the Radiological Assessment Program (which assists state and local agencies). Livermore maintains a deployable response capability, called HOTSPOT, which can be transported to any location by military aircraft to provide local radiological field support.

Specifically, the Radiological Assessment Program (RAP) provides technical and operational expertise to state and local agencies to mitigate the consequences of a

radiological incident or emergency. It uses DOE and national laboratory experts with skills in assessing radiological and toxic contamination and the attendant risks to human health. The Livermore RAP teams have primary responsibility for California, Nevada, Hawaii, and the U.S. Pacific Rim territories. They are called upon, on average, three to five times per year. In 2001, they responded to three requests for assistance along with normal exercises and training. Typically, RAP investigates containers suspected of housing radioactive materials, seeks the location of lost industrial or medical radioactive sources, and advises federal, state, and local authorities on the consequences of a radioactive release or personnel contamination. RAP regularly drills with similar teams from other federal agencies, state, local, and tribal governments as well as private companies and organizations.

To deal with the latest emerging threats, LLNL now maintains a home team capability to assist response workers at all levels. The home team is trained to recognize and respond to nuclear terrorism. Included within this umbrella is the ability to supply timely interpretation of signals from field instruments (the so-called "nuclear triage" program being developed at NNSA headquarters).

Search and Inspection Technologies. There is a pressing need for technologies to improve the screening of passengers, baggage, and cargo. Candidate technologies, in various stages of development at Livermore, include computed tomography (CT), x-ray scanning, gamma-ray imaging, neutron interrogation, and ultrasonic and thermal imaging. These efforts build on projects and expertise in the Stockpile Stewardship Program to develop improved sensors for non-destructive evaluation of the condition of weapons and weapon components in the stockpile. NNSA has assigned LLNL the responsibility to establish a national test bed for the inspection of cargo containers (discussed further below).

Two Laboratory-developed search technologies demonstrated their applicability to counterterrorism response when they were deployed to the World Trade Center. The first, a micropower radar, can "see" many feet into concrete rubble and could be a valuable tool for search and rescue operations. The other, a remote monitoring instrument that uses hyperspectral data to detect and identify trace gas emissions, was flown over Ground Zero to characterize hazardous gases emanating from the rubble.

Sensor Networks. Livermore has developed a concept for correlated sensor networks for detecting and tracking ground-delivered nuclear devices or nuclear materials, the Detection and Tracking System (DTS). A novel algorithm integrates data from the various sensors, together with information from other sources (e.g., an intelligent traffic system) to identify sources of concern, track their movement through the road network, and guide responders in intercepting the suspect vehicle. Since September 11, DTS development was accelerated and a prototype system was demonstrated in an urban environment. We are preparing for further, larger scaled demonstrations of this system with added capabilities.

Strong Capabilities and Active Programs—Biological and Chemical Threats

Bioscience research at the Laboratory traces its root to 1963, when a program was established to study how radiation and chemicals interact to produce adverse consequences to humans. Research activities at LLNL and LANL led to a focus on DNA and technology development that led to DOE's decision to launch its Human Genome Initiative in 1987. Both laboratories are part of DOE's Joint Genome Institute, which includes Lawrence Berkeley National Laboratory and is located in nearby Walnut Creek, California, and have contributed to deciphering the human genetic code. We are applying our expertise in genomics to counter the threat of bioterrorism. In addition, in support of Livermore's national security and other programs, the Laboratory also has outstanding capabilities in chemistry and materials science.

Biological Agent Detectors. The biodefense capabilities that have been deployed in the wake of September 11 have, at their core, advances in biological detection instrumentation developed at Livermore. We have made technology breakthroughs in biodetection instrumentation, pioneering the miniaturization and ruggedization of both flow cytometry and DNA identification devices. Our miniature thermal cycler unit makes possible DNA amplification via polymerase chain reaction (PCR) and identification in minutes rather than the hours and days previously required. Livermore's miniaturized PCR technology has been licensed to private industry and forms the basis of today's most advanced commercial biodetection instruments (e.g., Cepheid's Smart Cycler, Environmental Technology Group's handheld biodetector).

Cepheid Smart Cyclers are the heart of the field laboratory of the Biological Aerosol Sentry and Information System (BASIS), developed jointly by Livermore and Los Alamos and previously discussed. In developing BASIS, the two laboratories worked closely with the many law enforcement, emergency response, and public health agencies that would be involved in dealing with a bioterrorism event to develop appropriate sample handling (chain of custody), communications, and response protocols.

DNA Signatures. Biodetectors depend on unique antibodies or DNA sequences to identify and characterize biological pathogens. Livermore is developing gold-standard DNA signatures of top-priority threat pathogens (anthrax, plague, etc.) and are working with the Centers for Disease Control and Prevention (CDC) to validate these signatures and distribute them to public health agencies nationwide. We are also working with the Federal Bureau of Investigation, CDC, Department of Defense, and U.S. intelligence agencies to develop detailed biological "fingerprints" and data to support forensic analysis of any act of biological terrorism.

Chemical Analysis for Forensic Attribution. Timely and complete analysis of suspect chemicals can answer important questions related to nonproliferation, counterterrorism, and law enforcement. Our Forensic Science Center has assembled a unique capability for detecting and characterizing ultratrace levels of virtually any compound in any sample matrix. Expertise and instrumentation are available for complete chemical and isotopic analysis of nuclear materials, inorganic materials, organic materials (e.g., chemical

warfare agents, illegal drugs), and biological materials (e.g., toxins, DNA). The Forensic Science Center also develops advanced laboratory and field capabilities for ultratrace analysis, including a portable (55-pound) gas chromatograph/mass spectrometer, field kits for thin-layer chromatography, and novel sample collectors using solid-phase microextraction.

The Forensic Science Center has begun the rigorous testing required to become the second U.S. laboratory certified by the Organization for the Prohibition of Chemical Weapons (OPCW), which is responsible for implementing the Chemical Weapons Convention (CWC). Under the terms of the CWC, all samples collected from inspected facilities must be analyzed at two OPCW-designated laboratories. The U.S. Congress mandates that all U.S. samples be tested in the U.S. Currently, the U.S. has only one designated laboratory, the Edgewood Chemical and Biological Forensic Analytical Center. Livermore will provide the second required facility.

Strong Capabilities and Active Programs—Underpinning Capabilities and Facilities

Several special capabilities at Livermore merit special mention because they provide broad yet critical support to homeland security: our International Assessments Program, the National Atmospheric Release Advisory Center (NARAC), the Counterproliferation Analysis and Planning System (CAPS), high-performance computations, and the Computer Incident Advisory Capability.

Intelligence Analysis and Threat Assessment. One of the most critical, yet difficult, elements of homeland security and counterterrorism is gaining insight into the capabilities, intentions, and plans of persons, groups, or states hostile to the U.S. Our International Assessments Program (Z Division) is one of the strongest capabilities in the country for analysis and research related to foreign nuclear weapons and other weapons of mass destruction, including early-stage foreign technology development and acquisition, patterns of cooperation, and foreign cyber threats. Such intelligence analyses serve as the foundation for homeland defense against WMD threats. Intelligence provides an essential input to threat analyses that, in turn, provide the basis for defining functional requirements for technical homeland security systems. Furthermore, intelligence can provide “indications and warning” of an imminent attack, thus guiding further deployment of defensive assets. Thus there is a critical need for both long-term, in-depth intelligence analysis and timely, responsive indications and warning.

Z Division regularly provides analysis products to our intelligence, defense and policy-making customers. Our assessments of foreign weapons programs and activities provide important input to policy makers and diplomats as they develop strategies for U.S. responses to events affecting national security. The capabilities in Z Division also support our Nuclear Threat Assessment Program (previously discussed), which analyzes nuclear terrorist threats and smuggling incidents.

In addition to filling a critical niche by providing all-source intelligence analyses of foreign nation-state programs to acquire WMD, we develop data analysis tools and data integration methods to aid intelligence collection and assessment and avoid the pitfalls of information stovepiping. Some of these tools are currently being evaluated by our analysts as well as end-users across the Intelligence Community, while many others are under intense development and will be applied to the counter-terrorism problem. In the aftermath of September 11, we provided intelligence analysts and assessments as well as information-operations tools and expert personnel to the U.S. Intelligence Community.

There is tremendous potential for the knowledge and capabilities of Z Division to support Department of Homeland Security needs for threat analyses, and for new analysis tools. However, I want to emphasize that this expansion of scope needs to be accomplished in a way that preserves Z Division's access to raw intelligence, and its ability to use nuclear weapons design tools in its analyses, both of which have historically been enabled by our designation as a Field Intelligence Element of DOE.

Atmospheric Modeling for Consequence Management. The National Atmospheric Release Advisory Center (NARAC), located and operated at the Laboratory, is a national emergency response service for real-time assessment of incidents involving nuclear, chemical, biological, or natural hazardous material. NARAC can map the probable atmospheric spread of contamination in time for an emergency manager to decide whether protective actions are necessary. NARAC is on call to respond to real incidents and can also be used to evaluate specific scenarios for emergency response planning, such as optimizing the siting of bioaerosol samplers or determining evacuation routes.

Since it was established in 1979, NARAC has responded to more than 70 alerts, accidents, and disasters and has supported more than 800 exercises. In addition to accidental radiological releases (e.g., Chernobyl, 1986; Three Mile Island, 1979), NARAC has assessed natural and manmade disasters (Mt. Pinatubo volcanic ash cloud, 1991; Kuwaiti oil fires, 1991). NARAC has also provided assessments to state and local responders to toxic chemical accidents (e.g., Richmond sulfuric acid cloud, 1993; Sacramento River Spill, 1991). State and local agencies can request NARAC support for actual releases or planning by contacting DOE's Office of Emergency Response or the NARAC program office at Livermore.

The Counterproliferation Analysis and Planning System (CAPS). Developed continually updated by LLNL, Counterproliferation Analysis and Planning System (CAPS) is a versatile and powerful modeling system for analyzing, end-to-end, a proliferator's WMD production processes and for assessing interdiction options and their corresponding consequences. CAPS is as easy to use as a Web browser, with its powerful and complex science (spectral analysis, toxic release modeling, etc.) invisible to the user. CAPS is widely accepted by the military's mission planners and is the Department of Defense's preferred counterproliferation planning tool.

High-Performance Computing. With supercomputers acquired as part of NNSA's Advanced Simulation and Computing (ASCI) program and additional institutional

investments in massively parallel computers, Livermore is an international leader in high-performance computing. Many groundbreaking applications are being developed. An example directly relevant to homeland security is our computational biology work directed at genomics—the development and use of bioinformatics tools and databases.

We have developed computational tools to automatically identify regions of bacterial and viral pathogen genomes that have a high probability of being unique to that genome. We can now process any draft or finished pathogen genome in a few hours and confidently detect all regions that are not "matched" in any other known sequenced genome. This capability has been tested on numerous bacterial and viral pathogens both at LLNL and with collaborators such as the Centers for Disease Control, the U.S. Army Medical Research Institute of Infectious Diseases, and the Department of Agriculture. We are currently using this unique computational capability to satisfy pathogen detection needs of these and other federal and state agencies.

Building on the approach we are taking, we will attempt to tackle more complex problems such as automatically determining all protein signature targets in a genome and determining the "pathomics" of virulence across all pathogens (i.e., the molecular mechanisms of virulence itself). The computational needs to address these problems will require use of cutting-edge supercomputer resources such as those at LLNL.

Computer Incident Response. LLNL is home to DOE's Computer Incident Advisory Capability (CIAC), which was formed in 1989. We assist any DOE facility that experiences a computer security incident with analysis, response, and restoration of operations. CIAC serves as DOE's watch and warning center, notifying the complex of vulnerabilities that are being exploited, specifying countermeasures to apply, and providing a picture of the attack profile. The center also develops science and technology solutions in support of computer network defense and products such as SafePatch, which earned its developers a Government Technology Leadership Award. CIAC's list of clients has grown to encompass other government agencies, and there have been several incidents where the team worked with the Federal Bureau of Investigation.

Strong Ties to Research Partners and the User Community

Many of our various research partners are cited throughout my testimony, and I discuss the vital need for partnerships later. An often overlooked—yet important—aspect of a successful research and development program is understanding the users' needs. Additional examples of our connections and work with the user community follow.

Expert Personnel Assisting in Homeland Security. Livermore scientists serve on various task forces, committees, and advisory groups dealing with aspects of homeland security and counterterrorism. For example, a Livermore expert on x-ray imaging is a member of the National Academy of Science Committee on Assessment of Technology Deployed to Improve Commercial Aviation Security. Other Laboratory scientists serve as technical advisors to the U.S. Customs Service, the National Guard, and the Los Angeles

Emergency Operations Center, and as members or advisors to various Defense Science Board task forces addressing homeland defense. Still others are assisting the California Highway Patrol and the California State Office of Emergency Services (OES) with training related to weapons of mass destruction and serving as members of the California Council on Science and Technology, which is providing technical advice to the OES's State Strategic Committee on Terrorism.

Forensic Science Support to Law Enforcement. Over the years, Livermore's Forensic Science Center (previously discussed) has responded to many requests from law enforcement for assistance in forensic analysis of unique samples. Since September 11 and the subsequent anthrax scare, hundreds of samples of concern have been analyzed for local and federal law enforcement and government officials. Previously, the Center has been brought in to analyze Supernote counterfeit bills, methamphetamine samples, biotoxins, suspect chemical-warfare specimens, and nuclear contraband. It has characterized explosive traces from the 1993 World Trade Center bombing, the Unabomber case, and the Fremont serial bomber; performed forensic sleuthing related to the Riverside "mystery fumes" case; analyzed samples for the Glendale "Angel of Death" case; and analyzed Capitol Hill offices as requested following anthrax decontamination. Locally, the Center assisted Livermore police by rapidly identifying a vapor that sickened response personnel at the scene of a suicide; once the chemical was identified (malathion), law enforcement agencies were able to take appropriate personnel-protection measures and complete their investigation.

LINC for Improved Emergency Preparedness. Through the LINC program (Local Integration of the National Atmospheric Release Advisory Center with Cities), we are currently working with local agencies in the Seattle area. A LINC pilot project is testing and evaluating the effectiveness of an approach to emergency preparedness that offers the potential for dramatic improvements. Sponsored by NNSA's Chemical and Biological National Security Program, LINC integrates capabilities at LLNL's NARAC (previously discussed) with local emergency management and response centers. Ultimately, LINC's goal is to provide continuous operation of an integrated, nationalwide system that aids emergency preparedness and response at all levels of government.

A National Test Bed for Standards, Test, and Evaluation. One key function of the Department of Homeland Security will be the setting of standards for technical homeland security systems. To set such standards will require practical, technical judgment, with consideration of the threats that the technology is intended to address, a concept of operations for its use, and the infrastructure necessary to use it effectively. This process must involve the Intelligence Community, end users in federal, state and local government, and technical experts. Candidate technologies must undergo objective testing and evaluation to determine how well they satisfy the standards, as input to acquisition decisions by those with operational responsibilities.

NNSA has assigned LLNL the responsibility to establish a national test bed for the inspection of cargo containers for chemical, biological, radiological, and nuclear weapons and materials. To meet this responsibility, we have initiated threat analyses to establish

the range of threat scenarios that such inspection systems should address. We have also begun a research program, based on calculations and experiments, to characterize the relevant "observables" for successful detection. We have engaged federal, state and local organizations with operational responsibilities in this area to factor in their practical, operational constraints. We have set up a test facility where exemplar containers are loaded with surrogate materials, as well as typical cargo, so that commercial equipment and research prototypes can be tested in meaningful scenarios. We believe that this methodology should be extended to other terrorist scenarios of concern.

Risk and Vulnerability Assessments of Critical Facilities. Through our participation in DOE's Vulnerability and Risk Assessment Program, we have made systematic assessments of the threat environment, cyber architecture, physical and operational security, policies and procedures, interdependencies, impact analysis, risk characterization, and possible mitigation measures for the 2002 Winter Olympic Games in Salt Lake City, eleven electric and gas infrastructures, and several independent service operators (ISOs), including the California ISO during the electrical energy crisis. We have also analyzed the vulnerability of buildings, dams, and other structures to catastrophic damage from earthquakes and explosive events. Projects have included evaluation of the earthquake vulnerability of major bridge structures (including the Golden Gate and San Francisco-Oakland Bay bridges), the structural integrity of nuclear material shipping containers for a variety of impact scenarios, and the likely damage resulting from the explosion of natural gas storage tanks in a suburban environment.

More generally, LLNL has applied risk and decision theoretic methodologies to a wide range of hazardous endeavors, both internal to the Laboratory and for the public sector, and we can be considered a major scientific contributor to the discipline of risk assessment and risk management. We have developed methodologies for and conducted risk assessments of nuclear power generation, nuclear explosive operations, information systems, transportation systems and hazardous material protection (called vulnerability analyses) to identify and enhance safety, safeguards and security. In addition, LLNL has assisted other federal agencies in the application of risk management.

Engineering a Novel Truck-Stopping Device. In October 2001, the Governor of California contacted Livermore requesting assistance to develop a means of stopping tanker trucks, to keep hijacked trucks from becoming motorized missiles. The objective was to make it possible to stop these large trucks using equipment readily available to peace officers, namely their vehicles and their weapons. A retired Livermore engineer and consultant teamed with Laboratory engineers, technicians, and heavy equipment operators to develop a simple mechanical device to accomplish this. It can be readily attached to the back of a tanker truck. When bumped from the rear by the patrol vehicle, the device would cause the trailer braking system to lose air pressure automatically locking the trailer brakes. A prototype was demonstrated in Oakland in late November 2001, and testing at high speeds was conducted at the Nevada Test Site in February and March 2002. We are currently developing a portable remote-controlled system and working with the California Highway Patrol and a major California trucking company on implementing a field trial program.

RDT&E WITHIN THE DEPARTMENT OF HOMELAND SECURITY

Securing the U.S. homeland is a formidable undertaking, particularly in light of declared terrorist intentions to acquire and potentially to use weapons of mass destruction against us. Bold steps by the nation are needed including the creation of a Department of Homeland Security. Bold steps are also needed to effectively align RDT&E to meet today's WMD challenges and tomorrow's threats. As the President recently said, "History …teaches us that critical security challenges require clear lines of responsibility and the unified effort of the U.S. Government." To this end, I offer the following observations about the science and technology (S&T) element of the Department of Homeland Security.

Science and technology is a key "weapon" in the U.S. arsenal against terrorism—it is critical to this effort. However, many of the S&T challenges that must be met—whether to protect U.S. borders, counter a WMD terrorist attack, protect critical U.S. infrastructure, or improve data mining and analysis of intelligence information—are extremely difficult. They require the efforts of the nation's best technical talent and the involvement of the entire relevant national S&T community. Since the problem space is large and fiscal resources are always limited, thoughtful prioritization of threats, potential solutions, and RDT&E investments are necessary.

A Center for Homeland Security RDT&E. An appropriate degree of central coordination is essential to ensure that all the needed WMD S&T elements are being addressed, without unnecessary duplication of effort, and that best use is made of the nation's technical and fiscal resources. As Governor Ridge recently testified (June 25), there needs to be "one unit…that deals with research and development, science and technology" and provides "strategic direction for homeland security research and development."

As we understand it, this unit would provide overall RDT&E program management and facilitate interagency coordination. It would assist users in implementing new capabilities and evaluating their effectiveness. In addition, it would work with experts, whether located at government laboratories, universities, or industry, to define the appropriate portfolio of advanced technologies and concepts for the department to pursue. These efforts would include defining systems architectures and requirements for development programs based on threat assessments, vulnerabilities, and user needs and, from these, component specifications. Clearly such a function would need a sustained level of funding for adequate staff with required expertise and facilities to carry out these activities as well as some portion of the technical RDT&E program.

The highly successful BASIS program that I discussed provides an example how such a unit or center would be expected to structure a major program effort for the Department of Homeland Security—first establishing a clear top-level objective; ensuring that a systems-level approach is taken; fostering close interactions between technology developers, commercial producers, and users; testing and evaluating new systems; and helping in the transfer of operations to customers or their contractors.

Our experience is that to succeed the center should:

- Have a mission-oriented, problem-solving focus and structure, with technical and organizational agility and the ability to integrate multiple technical disciplines.
- Work closely with the end users at the national, regional and local levels.
- Be a recognized leader in RDT&E, prototyping, and implementation of technologies and systems to counter WMD terrorism.
- Be managed by leaders with the ability and credibility to interact effectively at top levels of government.
- Provide a "critical mass" of top scientists and engineers, with long-term ability to attract, retain, and effectively use technical talent.
- Have extensive and effective connectivity with the broad homeland security community (Intelligence Community, other national labs, government agencies, industry, universities, operational entities).

Center Location. The Administration has made clear that they would like to develop a center at the Lawrence Livermore National Laboratory. As stated in the White House press release on June 18, 2002, "The President's legislation …has in mind a system where there will be a substantial facility based at Lawrence Livermore that will be a Department of Homeland Security facility, and it will manage a R&D and science and technology program related to homeland security that will occur in many different places, in many different national laboratories." General John Gordon, testifying before Congress as NNSA Administrator, voiced support for the concept of locating the Department of Homeland Security's main research facility at LLNL with satellite centers of excellence elsewhere.

A center at Livermore would benefit from Lawrence Livermore's multidisciplinary capabilities and those at the adjacent Sandia National Laboratories (California). Our existing mission responsibilities and demonstrated track record of working with a wide range of partners and bringing technologies from concept to prototype development make Lawrence Livermore a suitable choice for the center's location. We are honored to have the designated center here and we will manage whatever implementation hurdles emerge. Also, very importantly, I believe Livermore has the ability to meet its homeland security objectives while continuing to meet its many other important programmatic commitments, especially those relating to the nuclear defense posture of the nation.

One strong advantage of locating the center at Livermore is the Laboratory's proximity to important assets—potential major partners in RDT&E and commercialization as well as key customers for homeland security. The San Francisco Bay Area is home to three international airports, two seaports, an FBI field office, Customs and INS headquarters, Silicon Valley, area biotechnology firms and health-care providers, mass transit and rail systems, and high-visibility targets (e.g., Golden Gate Bridge). In addition, as part of University of California, LLNL has close ties with the

many UC campuses in the area (Berkeley, San Francisco, Davis, and Santa Cruz) as well as Stanford University (and associated medical schools). Examples of almost every aspect of the homeland security equation are just minutes away from Livermore.

The Need for Partnerships. I firmly support Governor Ridge and Dr. Marburger as to the need for a center for homeland security S&T. According to Dr. John Marburger, the President's Science Advisor, one of the functions of this center would be to represent science to the rest of the department. Very important will be the need for effective partnerships between this center and other key members of the homeland security RDT&E community with satellite centers of excellence. The long-standing partnership of the three NNSA laboratories—LLNL, LANL, and SNL—and the Nevada Test Site, which has successfully focused for decades on national security issues, can be extraordinarily useful to homeland security. There are other DOE national laboratories and research facilities as well with special expertise and capabilities that should be part of the team.

The center for homeland security RDT&E would also need to facilitate effective partnerships with the Department of Health and Human Services (DHHS) and its system of laboratories, especially to feed in new DNA signatures, assay protocols, and detection technologies developed by the NNSA laboratories and others for DHHS validation and dissemination to the public health community. Likewise, the center would need to draw on private industry, especially in the field of information technology, and on universities for their special expertise, integrating these S&T contributions into robust, responsive system architectures for homeland security.

CLOSING REMARKS

In its efforts to combat terrorism and ensure homeland security, the nation can build on an attribute that has made the United States the world leader that it is—the remarkable capability of the American people to focus extraordinary energy on achieving important objectives in a time of need. Establishing a Department of Homeland Security can fundamentally change for the better the nation's approach to preventing terrorist attacks on the United States, reducing the nation's vulnerability to terrorism, and managing the aftermath of any attack.

As the Administration and many leaders in Congress have already stated, to succeed the new department will need to pursue a sustained RDT&E program—particularly related to chemical, biological, radiological and nuclear threats—that is prioritized to meet prudently established objectives. These threats are significant and will grow more sophisticated over time. At Livermore, we are fully committed to this long-term national security endeavor to improve homeland security and are well positioned to provide effective RDT&E support to the department. LLNL brings to the Department of Homeland Security relevant existing mission responsibilities and programs, experience working with a wide range of research partners and users, and a track record of taking technologies from concept to prototype development and deployment.