Statement of C. Paul Robinson, Director
Sandia National Laboratories

United States House of Representatives
Committee on Armed Services
Subcommittee on Military Procurement
June 12, 2002

INTRODUCTION

Mr. Chairman and distinguished members of the committee, thank you for the opportunity to testify on the efficacy of the Science-Based Stockpile Stewardship Program and related topics. I am Paul Robinson, director of Sandia National Laboratories. Sandia is managed and operated for the National Nuclear Security Administration (NNSA) of the U.S. Department of Energy (DOE) by Sandia Corporation, a subsidiary of the Lockheed Martin Corporation.

Sandia National Laboratories is one of the three NNSA laboratories with research and development responsibility for nuclear weapons. Sandia's unique role is the design, development, qualification, and certification of nearly all of the nonnuclear subsystems of nuclear warheads. Our responsibilities include arming, fuzing, and firing systems; safety, security, and use-control systems; engineering support for production and dismantlement of nuclear weapons; field support to the military; and surveillance and support of weapons in stockpile. We perform substantial work in programs closely related to nuclear weapons, including intelligence, nonproliferation, and treaty verification technologies. As a multi-program national laboratory, Sandia also conducts research and development for DOE's energy and science offices, as well as work for other national security agencies when our special capabilities can make significant contributions.

My statement addresses the topics specified by the subcommittee, including the efficacy of the Science-Based Stockpile Stewardship Program and its future prospects; the adequacy of our current test readiness posture; the value of exercising the nuclear weapon design process; the stockpile annual certification process; and the condition of the nuclear weapons complex infrastructure. In addition, I will comment on the issue of programmatic planning that was raised in the most recent Foster Panel report.[1] I would also like to refer you to the attached appendix, which summarizes some of Sandia's recent accomplishments in the nuclear weapons program and other national security programs. We state our core purpose as "helping our nation secure a peaceful and free world through technology." I believe the accomplishments reported here will convince you that we are "on course" in fulfilling that purpose.

EFFICACY OF SCIENCE-BASED STOCKPILE STEWARDSHIP

Science-based stockpile stewardship was adopted about ten years ago in response to the curtailment of all major warhead development programs and the increasing likelihood of an indefinite moratorium or even permanent ban on underground nuclear testing. With respect to Sandia's stockpile responsibilities, it is my judgment that the Science-Based Stockpile Stewardship Program has met expectations during this last decade. We have developed and improved an array of diagnostic and design tools that are enabling us to meet the enormous challenge placed on us by the loss of nuclear testing and that permit us to fulfill our responsibilities for the stockpile with high confidence and predictability.

However, it is crucial to note that nearly everything Sandia designs and surveils can be tested—and is tested—using nonnuclear processes. We subject our components and subsystems to extensive nonnuclear testing at every stage of development and service life. We have made fair progress during the last decade under the Science-Based Stockpile Stewardship Program in strengthening our testing capabilities, and good progress in advancing our modeling and simulation capabilities to deal with those aspects that cannot be directly tested, such as the effects of hostile radiation fields on our components and systems.

The primary application of nuclear testing for Sandia in the past was to confirm the functionality of nonnuclear weapon components and the warhead as a system when exposed to hostile environments such as the full radiation fluxes and extreme mechanical impulses of fratricide, preemptive strike, or nuclear-armed anti-ballistic missile (ABM) defenses. This is a different purpose than that served by the underground nuclear testing performed by the nuclear design laboratories, Los Alamos and Lawrence Livermore, for development, safety, or confidence testing related to the performance of the nuclear explosive assembly or "physics package."

Perhaps the best example of the efficacy of the new science-based stockpile stewardship tools is Sandia's development and qualification of the MC4380A neutron generator for the W76 Trident warhead. Neutron generators must be designed for ruggedness against severe environments such as acceleration, vibration, high voltage, radiations, and mechanical impulse. In the past, we relied on an iterative design process involving numerous physical tests and whatever modeling tools were practical at the time.

Relying on data from past underground nuclear tests and aboveground simulations using accelerators and reactors, our scientists and engineers have developed large integrated software models that simulate three-dimensional radiation transport and mechanical response. These models allow our designers to visualize the electrical and physical performance of a neutron generator under many combinations of conditions while it is still "on the drawing board." A design engineer can change the model and re-visualize its performance on the computer many times before committing to a physical prototype.

The combination of advanced computational simulations such as these and a comprehensive suite of several kinds of nonnuclear tests made it possible for the first time in the history of the program to qualify a neutron generator design for performance reliability and resistance to hostile radiation effects without underground nuclear testing.

I must note here that, although in the past we would always subject such components to hostile radiation in underground nuclear tests to try to directly evaluate the effects of radiations on their function, such "effects testing" could never be made an ideal test. The underground exposure was itself always a compromise to the anticipated levels of stress that components might be subjected to in wartime. This was because the levels of neutrons, x-rays, and gamma rays were in different proportion to what would be experienced in a space or atmospheric encounter and because the fluxes were always different than the anticipated levels. Thus, the confidence by which we have certified the new neutron generator design—without having had an underground "effects" test—is on a different basis, but not necessarily a lesser basis, than was our past practice.

Sandia also has responsibility for the integrated arming, fuzing, and firing (AF&F) system of the W76-1/Mark-4A life extension program. Science-based design tools will permit us to perform the redesign of this complicated and critical assembly at lower cost and with higher quality than was previously possible. The redesigned unit will combine advanced fuzing options, modern nuclear safety improvements, and enhanced reliability. Moreover, we are incorporating surveillance features into the unit so that its "state of health" can be assessed with minimal intrusion.

Qualification of the new W76-1/Mark-4A AF&F will involve both testing and simulation using tools provided by science-based stockpile stewardship. We must conduct a variety of environmental tests in the laboratory to evaluate the unit's performance under various normal and abnormal conditions. We will perform system flight-tests with de-nuclearized payloads to achieve flight environment conditions that cannot be simulated in the laboratory. Radiation tests using aboveground simulators will provide radiation effects testing for most spectra of concern. Parameters derived from all these categories of tests will be incorporated into computational models that can calculate system performance over a broader and more intense range of conditions.

New modeling and simulation capabilities developed under science-based stockpile stewardship are providing powerful capabilities for life extension programs, and they reduce the total number of physical tests needed over the term of a project. However, it is important to understand that physical testing will not be eliminated by computer simulations. Models never achieve perfection, and nature sometimes has surprises in store that become apparent only during physical tests. Moreover, the fidelity of the computational models themselves must be validated with experimental data. For example, the codes used to model radiation effects for the neutron generator program were validated against experiments performed with aboveground simulators and past underground tests.

For these reasons, science-based stockpile stewardship at Sandia is a program of advanced nonnuclear testing as well as computational modeling. Sandia's Test Capabilities Revitalization Project (an FY 2003 construction item) is important in this regard, as it is essential to modernize our field testing and experimental infrastructure to support warhead qualification, development, surveillance, and model validation.

Definitive evidence of the efficacy of science-based stockpile stewardship will be available when we complete our first full-scale life extension program for a major warhead system. We expect the W76-1/Mark-4A life extension project to enter production in 2007. Several large certification hurdles must be surmounted before production can be authorized. However, I expect that we will be able to meet those challenges with the tools that we have developed and are continuing to improve under science-based stockpile stewardship.

TEST READINESS

In the past thirty years or so, the nuclear weapons program has developed several aboveground experimental facilities in an effort to simulate many of the phenomena of hostile environments as a substitute for underground "nuclear effects testing." The last time Sandia used underground testing for certifying a system against hostile environments was with the W88/Mark 5 program. The six underground radiation tests we conducted for that program were supplemented with more than 1,000 aboveground radiation tests using fifteen different simulators. The available suite of aboveground simulation facilities today, augmented with improved computational models, has allowed us to separately simulate or model most nuclear-weapon radiation spectra.

It must be recognized, however, that our simulation and modeling capabilities have limitations. The extreme radiation fluxes and mechanical impulses of a nuclear detonation cannot be directly simulated. In addition, the physical size of hardware systems that can be tested for complete system response is limited. In the future, ensuring the fidelity of some aspects of our computational models may not be possible without access to nuclear testing.

However, these limitations may or may not prove to be important in the long run, depending on how international nuclear threat environments evolve. Given today's conditions of threat and technology, science-based validation (as opposed to nuclear-testing-based validation) does not, in my opinion, present significant difficulties for Sandia's certification and validation responsibilities. I must caution you, however, that this conclusion applies to Sandia's needs and cannot be directly extrapolated to the role that nuclear testing has played for validating the functioning of the nuclear physics packages, which are designed by either Los Alamos or Lawrence Livermore.

The question of whether three years, one year, or three months is an adequate lead time for conducting an underground nuclear test may be important as it relates to matters of safety, confidence, or perhaps development associated with the nuclear physics package of a warhead. The time required to carry out a test will also depend critically on whether the problem that led to the need to test is one that could affect a large percentage of the stockpile. However, because of Sandia's success in developing an alternative methodology for hostile effects certification, urgent need for testing will no longer be the crucial issue it once was for ensuring performance in hostile environments for the systems for which we are accountable.

EXERCISING THE WEAPON DESIGN PROCESS

Much of the supporting science for stockpile stewardship can be exercised in laboratory investigations, but design skills can only be proved on real products. System life-extension projects serve two purposes: They modernize older systems that need refurbishment, and they exercise the competence of the weapons engineering skills that we require for the future. However, exploratory work on advanced concepts will also be necessary to ensure that our design skills are sufficiently challenged for evolving needs in the nation's nuclear forces.

The nuclear weapons complex has not been engaged in a new system design since 1992. During the past ten years, we have exercised our competencies with a few modification programs, exploratory projects, and subsystem enhancements. Assuming that a new warhead design will not be authorized for the foreseeable future, full-system life extension programs are the only effective vehicle for exercising the design process.

We depend on engineers and scientists who are knowledgeable, experienced, and seasoned in their judgment for making stockpile stewardship succeed. Our confidence in their ability to perform their responsibilities is gained through seeing them succeed with large, complicated, and challenging projects that require them to think through the integration of the many elements of a system into a demonstrable product. Therefore, it is important that the NNSA laboratories continue to offer weapon design work in the form of life extension projects or similar programs on a permanent basis.

I must emphasize that the nuclear weapons program requires an intimate relationship between the laboratories, where designs are created, and the production plants that manufacture the designs. Sandia design engineers work closely with production engineers at the NNSA production agencies and contractors where components are manufactured and warheads are assembled or disassembled. The laboratories are also the appropriate authorities for certifying production plant processes.

The new generation of engineers and scientists who will perform design and production engineering in the decades ahead will not have had the benefit of experience on full-scale weapon development programs. We must find other ways to qualify those people in the future. The life extension projects approved by the Nuclear Weapons Council for the W76 Trident warhead, the B61 bomb, and the W80 cruise missile warhead are important major projects for exercising the design process and the designers.

STOCKPILE ANNUAL CERTIFICATION PROCESS

A major effort of the Science-Based Stockpile Stewardship Program is directed to the annual assessment of the certification basis for nuclear weapons in the stockpile. To perform the assessments that support this annual process, the laboratories conduct reliability and safety investigations and prepare a report for each weapon type in the stockpile. The laboratory directors individually submit their “certification letters” to the Secretaries of Energy and Defense, who in turn integrate the information and formally report the condition of the stockpile to the President.

Assessment Activities at Sandia

Sandia’s responsibility for stockpile annual certification comprises the nonnuclear subsystems that control the operation of a nuclear warhead. Our confidence in the stockpile has always been anchored in the community of experienced engineers and scientists who are expert in the disciplines of stockpile stewardship. Confidence is also maintained through exhaustive nonnuclear tests, a long history of fielded weapons and their data, a careful preventive maintenance and replacement program, chemical analyses, computer modeling, and joint or independent reviews of our work.

We test and model the performance of nonnuclear components and systems in a variety of normal, abnormal, and hostile operational environments. We certify weapon performance under normal operating environments, and we verify that components and systems will retain adequate functionality after exposure to hostile environments. Most normal operational environments of concern for nonnuclear components and systems can be simulated without nuclear explosive tests.

Under the Defense Programs Enhanced Surveillance Campaign, we develop tools and models to measure, qualify, and predict the effects of aging on weapon materials and components and to understand how those effects impact weapon safety and reliability. One enhanced surveillance project uncovered unexpected behavior in desiccants designed to maintain a noncorrosive internal atmosphere in the warhead. Our new understanding of desiccant behavior is guiding the formulation of new desiccants for weapons refurbished under stockpile life extension programs. Another surveillance project discovered problems with newly procured material for replacement o-rings, which we were able to intercept.

Two years ago Sandia introduced non-destructive, acoustic laboratory testing of stronglinks, a major safety component of nuclear warheads, into the core surveillance program. Last year we added a second development from the Enhanced Surveillance Campaign into this core surveillance test equipment that allows us to evaluate the electrical current-carrying capacity of these safety devices. Both of these new tests have allowed us to better predict the useful lifetime of this critical component and enhance our replacement planning strategy.

DoD and DOE/NNSA annually conduct joint flight tests on warheads of each type in the enduring stockpile. Historically, flight tests have uncovered approximately 22 percent of the defects discovered in surveillance databases.

I would like to address the two reports issued by the DOE Inspector General this past year on the surveillance program—one on the testing backlog for flight and laboratory tests, and the other on the significant findings investigation process. The backlog situation was noted by the Foster Panel,[2] and I have referred to this problem in previous years' statements to this committee. While I do not believe that the situation is as dire as some might have suggested, action was necessary on the part of NNSA and the laboratories to improve performance. We are working with the Navy and Air Force to ensure the availability of samples and flight-test vehicles to complete the desired levels of testing. After a hiatus in Air Force cruise missile testing due to missile problems and infrastructure renewal, I am pleased to report that we have begun flight testing again with two successful advanced cruise missile tests, although it will take us several years to catch up with our desired level of testing.

The Foster Report emphasizes that surveillance, assessment, and certification processes for the stockpile should be as rigorous and probing as possible.[3] I am in full agreement that the laboratories should be challenged to improve their processes and adopt the most advanced tools and effective assessment methodologies available. Complacency in this mission space would be inexcusable.

The Foster Report recommends the use of "red teams" within each laboratory and strongly endorses the inter-laboratory peer review function.[4] Sandia has practiced red teaming and peer review successfully for decades. Our Surety Assessment Center is a full-time red team that is organizationally independent of the weapon design groups and which reports directly to the laboratory's executive management. In addition, we engage an independent advisory panel with external members to oversee the activities of the Surety Assessment Center and make recommendations directly to executive management on a semiannual basis. Thus, not only do we have a red team, but we also have a red team for the red team!

Peer review at Sandia follows the same model as the Livermore/Los Alamos competitive arrangement. We have a laboratory in New Mexico that supports development programs assigned to Los Alamos, and we have another laboratory in California adjacent to Lawrence Livermore that supports Livermore weapon programs. The example of peer review with the B61 described in the Foster Report[5] is not a new concept, but is basically how the arrangement works in practice. The California designers peer-review the work of the designers in New Mexico, and vice versa. I assure you, it is not a collegial interaction. It is a formal process that is often quite contentious. Within the past few weeks, I have received peer review reports from groups in California and New Mexico that confirm again to me that Sandia's peer review process is vigorous and robust.

Comments on Section 3144
Regarding Red Teams and Peer Review

The Defense Authorization Bill at Section 3144 would mandate laboratory "red teams" to challenge internal laboratory assessments and to perform inter-laboratory peer reviews. Actually, red teaming and peer reviews have been standard practices between the nuclear weapon laboratories since at least 1956, when the concept of two competing laboratory clusters was fully implemented.

However, the current language of Section 3144 is faulty in many respects. For example, it would require Sandia to peer-review the assessments of the nuclear design laboratories and vice versa. This fails the first requirement of "peer review"—that the participants indeed be peers! Sandia is not competent to peer-review the nuclear explosive systems of Livermore and Los Alamos; and conversely, Livermore and Los Alamos do not have the competence to peer-review the technologies nor the complexities of Sandia's nonnuclear components. But the longstanding arrangement whereby the California design cluster and the New Mexico design cluster peer-review each other avoids that problem, and has proved to be an effective practice.

I am also troubled by the provision requiring that the President and Congress receive each certification letter and report from each laboratory director and the commander of Strategic Command, including the findings and recommendations of all their red teams. Currently, the laboratories' Annual Assessment Reports and directors' letters are included as background information in the package accompanying the joint certification memorandum from the Secretaries of Energy and Defense. But I do not believe that it would be appropriate, as a routine practice, to forward all red-team findings to the President and Congress. Red-team issues are usually very arcane and highly technical. In the vast majority of cases they can—and should—be resolved at the level of the laboratory director.

However, I have always maintained that a minority report from a laboratory director regarding the certification of any warhead should be communicated to Congress and the President as part of any safeguards process associated with a nuclear test ban or moratorium. The Nuclear Weapons Council (a very senior council of Defense and Energy that was created by Congress to oversee nuclear stockpile issues) requires that the laboratories' Annual Assessment Reports be "forwarded unaltered to the Secretaries," so I do not see this as a worrisome issue.

The Secretaries of Energy and Defense have a responsibility to integrate the laboratory directors' findings and provide the President with the "bottom line," and I believe that any president would require that of them. Currently, the Nuclear Weapons Council is tasked to perform that integration function and prepares the Nuclear Stockpile Certification Memorandum (to the President) for signature by the two secretaries.

It is surprising that Section 3144 makes no mention of any role for the Nuclear Weapons Council. Under current law[6] the Nuclear Weapons Council has broad responsibility for oversight of stockpile programs. Some of the requirements that Section 3144 would place on the laboratory directors (i.e., in their reports accompanying certification) are already assigned to the Nuclear Weapons Council by statute. I would be uncomfortable, for example, evaluating the relative merits of various nuclear weapons for a particular military mission, as would be required of me in my annual certification report as currently outlined in Section 3144. However, this (and other responsibilities) are adequately and appropriately discharged by the Nuclear Weapons Council.

I credit the Foster Panel for focusing attention on the importance of the annual certification process, which was originally established by President Clinton in 1995 by directive. The process was also spelled out in the Resolution of Ratification that accompanied the Comprehensive Nuclear Test-Ban Treaty to the Senate. However, because that resolution failed in the Senate vote, that document today has no formal status. I might add that with the failure of the CTBT ratification, there also is no procedural certainty by which the need for a nuclear test would be communicated within either the Executive or the Legislative branches of the U.S. government. Thus, it may perhaps be time to establish annual certification as a statutory requirement with responsibilities carefully defined in law. However, by moving too quickly with the proposed Section 3144 at this time, we may create, at best, a partial fix that will introduce some unintended consequences.

My recommendation would be that the Congress task the Executive branch to work through the Nuclear Weapons Council to perform an end-to-end systems analysis of the annual assessment and certification process and to recommend one or more legislative options. The Nuclear Weapons Council is the cognizant body invested by Congress with authority over stockpile policy matters, and it forms the junction between the NNSA and the Department of Defense. It also possesses current operational knowledge of stockpile management and stewardship. Certainly the Foster Report's recommendations should be important considerations in their deliberations.

INFRASTRUCTURE

I have expressed my concern before this committee (and its counterpart in the Senate) in hearings going back to 1997 over the matter of balance in the Stockpile Stewardship Program. The essential question has always been how to balance the resources needed to support and maintain the deployed stockpile, while also creating new laboratory facilities to partially substitute for the loss of nuclear testing. I believe the Foster Panel is correct with its assessment that:

> The weapons program must be transformed from a decade focused on the scientific building blocks of stockpile stewardship to a focus on meeting DoD's stockpile requirements and restoring the infrastructure necessary to sustain and refurbish the stockpile.[7]

Several studies[8] have concluded that the infrastructure of the nuclear weapons complex has eroded significantly and needs refurbishment. After a decade of aggressive investment in large scientific facilities for science-based stockpile stewardship, it has now become urgent to assess that part of the infrastructure of the nuclear weapons complex that directly supports the stockpile maintenance mission and to make appropriate changes and investments. Specifically, the engineering design and production capabilities of the complex need to be addressed with a prudent plan for realignment and refurbishment. The life extension programs for the W76, W80, and B61 depend on this.

At Sandia, the Microsystems and Engineering Sciences Applications (MESA) complex is crucial to our ability to design, develop, and, if necessary, produce microelectronics and integrated microsystems to support a certifiable stockpile for the future. We are being very careful to phase the development of that facility in a way that it can provide the needed support for various stockpile refurbishments in a timely manner, so that from the start its capabilities will be supportive of the stockpile life-extension schedule.

Like other sites across the NNSA complex, Sandia has a number of aging facilities in need of refurbishment that fall below the level of line-item construction and have been insufficiently supported by general plant projects (GPP) or other infrastructure funding programs. Infrastructure problems at this level are chronically understated and deferred, and they accumulate with the passage of years. Ultimately, this can lead to capability limitations that impair the mission.

NNSA addressed this problem through a Facilities and Infrastructure Initiative that inventoried infrastructure repair and improvement projects across the complex. Congress approved an appropriation request of $200 million in fiscal year 2002 to help bridge the gap for essential infrastructure repairs that were unfunded. However, the effort to restore the NNSA weapons complex will take many years and the total costs are not yet well defined.

It will be important to assign highest priority to those facilities that are essential for the scheduled stockpile refurbishments over the next decades.

At Sandia, we identified approximately $300 million in infrastructure revitalization projects that would be carried out during the course of the next few years. The top priority items on our inventory are sufficiently urgent that failure to fund them would impact weapon program deliverables. A specific example is Sandia's Electromagnetic Test Facility. Its twenty-year-old diagnostic equipment has limited capability to support data acquisition for the development and validation of simulation codes. This modernization project will improve our capability to perform electromagnetic tests to qualify the W76 and W80 in accordance with their life extension plans.

NNSA's Facilities and Infrastructure Initiative will perform a very important service to the Defense Programs mission if it succeeds in restoring the appropriate balance in funding for infrastructure improvements that are critical to sustaining mission capabilities. As currently planned, the initiative will help the nuclear weapons complex deal with long-standing infrastructure challenges. NNSA also needs a more viable decontamination and demolition program to dispose of obsolete facilities. The program must also make a long-term commitment to major renovations and deferred maintenance. Typically, much of this work is deferred to the out-years, usually with no guarantee that adequate funding will be available when it is needed.

It is essential that NNSA's infrastructure initiative be fully funded over many years if we are to restore the capability to adequately support the maintenance and production missions of the Stockpile Stewardship Program. Adequate infrastructure is also a factor in recruiting and retaining the technical talent that is essential for stockpile stewardship.

STOCKPILE STEWARDSHIP PROGRAM PLANNING

The Foster Report criticizes NNSA's long-range planning and budgeting performance, but I believe that significant progress has been achieved. The Defense Programs laboratory directors have worked closely with the NNSA leadership during the last several months to create a multi-year plan to prioritize and integrate programmatic needs within a defensible appropriations profile. The funding levels of the multi-year estimates in this "Future-Years National Security Plan" reflect our consensus estimate of resource requirements under the guidance provided by Presidential directives, DoD requirements, and the Nuclear Posture Review. The plan is a significant milestone inasmuch as NNSA has for the first time achieved a multi-year planning basis agreement with the Administration. With careful management, we believe that NNSA's major deliverables can be completed within the Future-Years National Security Plan schedule and budget profile.

The difficulty of long-range planning and budgeting is compounded by uncertainties that are not under the control of NNSA. The recent Nuclear Posture Review (NPR) and the Treaty of Moscow will reduce operationally deployed nuclear weapons to between 1,700 and 2,200 warheads over the next decade. However, the precise force structure (in terms of warhead types and their readiness status) that we must work toward under the NPR has not yet been defined in detail.

It has been stated that many of the warheads to be removed from the operationally deployed stockpile will be maintained as a "responsive force" in case of a major change in the global threat environment. The intent is to maintain the warheads of the responsive force in a condition that would permit them to be redeployed in a matter of weeks or months but not within days or hours. Consequently, the stewardship requirements for the responsive force are not yet fully defined, although I expect that the warheads will require a level of maintenance and surveillance by the NNSA that is not substantially different from what is required for the active, deployed stockpile.

It is certainly appropriate, as required by Section 1014 of the Defense Authorization Bill, that the Secretaries of Defense and Energy (through the Nuclear Weapons Council) define a Strategic Force Structure Plan that will specify the makeup of the enduring stockpile under the NPR and the Treaty of Moscow, as well as the stewardship expectations of the responsive force. As part of that plan, it will be important to validate the NNSA life extension program schedule against future DoD mission requirements and delivery systems. Under almost any scenario for the NPR implementation, the NNSA laboratories will have a substantial workload of life extension programs for systems that require refurbishment or complete redesign of electronic subsystems and other components. NNSA needs reliable strategic guidance to adequately plan its life extension program schedule and resources. The Defense Programs laboratories will work closely with NNSA to adjust the Future-Years National Security Plan as necessary to prioritize and integrate programmatic needs within a defensible budget.

SUMMARY AND CONCLUSION

With respect to Sandia's stockpile responsibilities, it is my judgment that science-based stockpile stewardship has met expectations during the last decade. The program has succeeded in stimulating the development of powerful new tools and simulation capabilities that are extending our ability to maintain and certify the stockpile. These tools will undoubtedly continue to improve in the years ahead as science-based stockpile stewardship campaigns mature. I fully expect that we will be able to meet our stewardship responsibilities with the tools that we have developed and are improving under science-based stockpile stewardship as we proceed with our system life-extension responsibilities. More definitive evidence of the efficacy of science-based stockpile stewardship should be available when we complete our first full-scale life extension program for a major warhead system.

I commend the Foster Panel for focusing attention on the importance of the annual certification process. It may be appropriate to establish annual certification as a statutory requirement with responsibilities carefully defined in law. However, Section 3144 of the Defense Authorization Bill is flawed in many respects and has not been evaluated from a systems perspective or red-teamed for possible unintended consequences.

My recommendation would be that the Congress task the Executive branch to work through the Nuclear Weapons Council to perform an end-to-end systems analysis of the annual assessment and certification process and to recommend one or more legislative options that can be considered next year. The Nuclear Weapons Council is the body invested by Congress with authority over stockpile policy matters, and it possesses current operational knowledge of stockpile management and stewardship. The recommendations of the Foster Panel should be important considerations in that process.

I strongly concur with the Foster Panel that it is now time to seek a better balance of the programmatic investment in stockpile stewardship to provide stronger support for the engineering design and production missions of NNSA. NNSA faces a series of system life extension programs that will challenge the engineering design and production sectors of the complex in a way that they have not been exercised in the last ten years. With prudent leadership and management, and with your strong support, I believe we can succeed.

Thank you, Mr. Chairman.

APPENDIX

Highlights Of Sandia Accomplishments

Fiscal Year 2001

Major Accomplishments in Weapons Activities

- Sandia completed work to qualify the B61-11 earth-penetrating bomb as meeting all requirements, resulting in its acceptance as a standard stockpile item. We made alterations to enhance the safety and security of all B61 bombs at field locations. In recognizing the efforts of the B61-11 certification team, the Commander-in-Chief of Strategic Command cited the weapon's many advantages over the retired B53-1 bomb.
- Similarly, we concluded a three-year testing and evaluation program resulting in acceptance of the Alt. 342 W87 Life Extension Program warhead for the Air Force by the Nuclear Weapons Council as a standard stockpile item.
- A significant milestone in directed stockpile work in fiscal year 2001 was our progress in redesigning the integrated arming, fuzing, and firing system (AF&F) for the W76 warhead for the Trident missile. We recently completed the redesign of a Joint Test Assembly for the W76, which will be used to periodically assess the conformance of the de-nuclearized version of the actual war-reserve warhead.
- Sandia played a major role on the NNSA's B83 Systems Engineering Group, which completed development of Alt. 355 for the B83 modern strategic bomb. Alt. 355 is a near-term field retrofit kit that incorporates design modifications to certain hardware.
- We completed the Warhead Simulator Package for the Type 3E Trainer for the B61-4 bomb. The Warhead Simulator Package simulates the electrical functionality of the real war-reserve weapon. The new trainer allows military personnel to realistically practice lock/unlock and arming/safing operations without exposing a real nuclear weapon to vulnerabilities. The first production unit of the trainer has been delivered.
- Sandia has major responsibility in nuclear weapon use-control systems, which are designed to allow arming of the warhead by national command authority only. We completed a four-year, full-scale, code management system engineering project, which delivers a significant security enhancement to weapon code operations in Europe. The system enables recoding of nuclear weapons in a fully encrypted manner and greatly simplifies use and logistics.
- We have also achieved many important advances in the science and engineering campaigns that enable our successes in directed stockpile work, including radiation-hardened microelectronics, aboveground experimental physics, and advanced simulation and computation.

Accomplishments in Nuclear Nonproliferation

Preventing the proliferation of nuclear materials or weapons to dangerous regimes or terror groups has become a matter of great urgency. NNSA's role in nonproliferation is acknowledged in its mission statement: "To strengthen United States security through the military application of nuclear energy and by reducing the global threat from terrorism and weapons of mass destruction." Sandia's recent contributions have strengthened this effort.

- As nuclear fuel reprocessing is adopted by more nations, the proliferation risk associated with fissile materials increases. To evaluate the risk, Sandia developed a proliferation analysis methodology for quantifying the proliferation resistance of nuclear power production fuel cycles. The methodology uses the tools of probabilistic risk assessment to identify proliferation pathways for various definitions of proliferators.
- NNSA's "Second Line of Defense" (SLD) program for the security of fissile materials provides consultation to customs agencies to combat trafficking of nuclear material across international borders. In 2001 we assisted twenty-six site surveys performed at Russian airports, seaports, railroad checkpoints, and border crossings to evaluate strategies for minimizing the risk of nuclear proliferation and terrorism. These site surveys included the deployment and acceptance of systems installed at eight Russian Federation State Customs Committee facilities to detect and deter illicit movements of nuclear materials out of Russia. The program has been successful and is growing to include other countries.
- Also with Russia, after four years of negotiation and collaboration with the All Russian Institute of Experimental Physics (VNIIEF), we kicked off a joint facility-to-facility remote monitoring project in June 2001. The project will evaluate advanced fissile material monitoring and communications technologies in a bilateral verification regime.
- Sandia is responsible for satellite-based sensors for detecting nuclear detonations in the atmosphere. We developed a new space-to-ground communication path for monitoring Nuclear Detection System sensors onboard the Department of Defense Global Positioning System (GPS) satellites. The launch of a GPS satellite equipped with the Nuclear Detonation Detection System Analysis Package in January 2001 significantly enhanced the nation's ability to detect nuclear detonations occurring anywhere in the earth's atmosphere.

Contributions to Homeland Security and the War Against Terrorism

Like most Americans, the people of Sandia National Laboratories responded to the atrocities of September 11, 2001, with newfound resolve on both a personal and professional level. As a result of our own strategic planning and the foresight of many sponsors to invest resources toward emerging threats, Sandia was in a position to immediately address some urgent needs. A few examples follow:

- By September 15, a small Sandia team had instrumented the K-9 rescue units at the World Trade Center site to allow the dogs to enter spaces inaccessible to humans while transmitting live video and audio to their handlers. This relatively low-tech but timely adaptation was possible because of previous work we had done for the National Institute of Justice on instrumenting K-9 units for SWAT situations.

- A decontamination formulation developed by Sandia chemists was one of the processes used to help eliminate anthrax in the Hart, Dirksen, and Ford buildings on Capitol Hill, and at contaminated sites in New York and in the Postal Service. Sandia developed the non-toxic formulation as both a foam and a decontamination solution, and we licensed it to two firms for industrial production.
- Sandia engineers worked around-the-clock to modify the "Steel Eagle," air-dropped, unattended ground sensor for deployment in Afghanistan. Originally designed under sponsorship of the Defense Intelligence Agency in the 1990s to identify mobile missile launchers, we modified the system to detect light trucks and armored vehicles. The sensors can be deployed from F-15E, F-16, and Predator unmanned aircraft.
- Sandia National Laboratories has performed research and development on Synthetic Aperture Radar (SAR) since the early 1980s—an activity that grew from roots in nuclear weapon radar fuzing. Unlike more conventional electro-optical (EO) systems, SAR provides a day/night, all-weather imaging capability. In 1985, we became involved in a special-access program for the Department of Defense to develop a SAR for unmanned aircraft. Sandia demonstrated the first real-time, one-foot resolution SAR in 1991. We continued to advance SAR capabilities and technologies under the sponsorship of both DOE and DoD, as well as some corporate partners. As a result of this sustained program of SAR research and development, several state-of-the-art systems have recently been provided to various DoD operational units, either through Sandia directly or by a corporate partner. These systems are deployed in various critical and time-urgent national security missions, including direct support of Joint Forge, Enduring Freedom, and homeland defense activities, and they have earned recognition for their exceptional performance.
- An array of devices invented by explosives experts at Sandia have proved to be effective for safely disarming several types of terrorist bombs. For the past several years, Sandia experts in conventional explosive devices have conducted training for police bomb squads around the country in the techniques for using these devices for safe bomb disablement. The shoe bombs that Richard Reid allegedly tried to detonate onboard a trans-Atlantic flight from Paris to Miami were surgically disabled with one of these advanced bomb-squad tools originally developed at Sandia. That device, which we licensed to industry, has become the primary tool used by bomb squads nationwide to remotely disable handmade terrorist bombs while preserving them for forensic analysis.
- Detecting explosives in vehicles is a major concern at airports, military bases, government facilities, and border crossings. We have developed and successfully tested a prototype vehicle portal that detects minute amounts of common explosives. The system uses a Sandia-patented sample collection and preconcentrator technology that had previously been licensed to industry for use in screening airline passengers for trace amounts of explosives. The Technical Support Working Group and DOE's Office of Safeguards and Security funded this research.
- Sandia is a partner with Argonne National Laboratory in the PROTECT program (Program for Response Options and Technology Enhancements for Chemical/Biological Terrorism), jointly funded by DOE and the Department of Justice. PROTECT's goal is to demonstrate systems to protect against chemical attacks in public facilities, such as subways and airports. For more than a year, a Sandia-designed chemical detector test bed has been operating in the Washington D.C. Metro. The system can rapidly detect the presence of a chemical agent and transmit

readings to an emergency management information system. We successfully completed a demonstration of the PROTECT system at a single station on the Washington Metro. The program has since been funded to accelerate deployment in multiple metro stations. DOE has also been requested to implement a PROTECT system for the Metropolitan Boston Transit Authority.

- Another major worry for homeland security is the potential for acts of sabotage against municipal water supplies. In cooperation with the American Water Works Association Research Foundation and the Environmental Protection Agency, Sandia developed a security risk assessment methodology for city water utilities. This tool has been employed to evaluate security and mitigate risks at several large water utilities. We have used similar methodologies to evaluate risks for other critical infrastructures such as nuclear power-generation plants and chemical storage sites.

WITNESS DISCLOSURE INFORMATION

Witness name: C. Paul Robinson

Capacity in which appearing: Representative of a non-government entity

Name of entity being represented: Sandia National Laboratories (GOCO)

Position held: President and Laboratories Director

Parent organization (managing contractor): Lockheed Martin Corporation

Federal contract: Management and operating contract between Sandia Corporation and U.S. Department of Energy, DE-AC04-94AL85000.

FY2000 cost: $1,540,019,000; negotiated fee: $16,110,000.

FY2001 cost: $1,580,187,000; negotiated fee: $16,300,000.

FY2002 cost: $1,684,552,000; negotiated fee: $17,270,000.

Curriculum Vitae:

Dr. C. Paul Robinson is President of Sandia Corporation and Director of Sandia National Laboratories, with principal sites in Albuquerque, New Mexico and Livermore, California.

Joining Sandia in 1990, Robinson was Director and Vice President before becoming President in 1995.

Ambassador Robinson served as Chief Arms Control Negotiator from 1988–90 and headed the U.S. Delegation to the Nuclear Testing Talks in Geneva. He was appointed by President Ronald Reagan, confirmed by the US Senate, and reappointed by President George Bush. These negotiations produced protocols to the Threshold Test Ban Treaty and the Peaceful Nuclear Explosions Treaty, which were ratified unanimously by the Senate.

From 1985–88, Robinson was Senior Vice President, Principal Scientist, and Board Member of Ebasco Services, Inc., a major engineering and construction firm. He spent most of his early career (1967–85) at Los Alamos National Laboratory, where he led the laboratory's defense programs. He is a longstanding member of the Strategic Advisory Group for the Commander-in-Chief, U.S. Strategic Command. Robinson has served on DoD's Threat Reduction Advisory Committee since 1998. He was Chair of the Presidential Technical Advisory Group on Verification of Warhead Dismantlement and Special Nuclear Materials Controls. He previously served on the Scientific Advisory Group on Effects for the Defense Nuclear Agency, on Defense Science Board studies, and has advised other government agencies.

Dr. Robinson received the Outstanding Public Service Medal from the Joint Chiefs of Staff and was elected to the National Academy of Engineering. He currently serves on several community and educational boards, including the Great Southwest Council of the Boy Scouts of America, the Explora Science Museum, and the Florida State University Research Foundation's Board of Trustees. He is also a trustee of the Kazakhstan Nonproliferation Institute. Robinson holds a B.S. in Physics from Christian Brothers College, a Ph.D. in Physics from Florida State University, and an honorary doctorate from Christian Brothers University.

REFERENCES

[1] John S. Foster, Jr., Chairman, *Expectations for the U.S. Nuclear Stockpile Stewardship Program*, FY 2001 Report to Congress of the Panel to Assess the Reliability, Safety, and Security of the United States nuclear Stockpile, March 15, 2002.

[2] Foster, p. 14.

[3] Foster, p. 14.

[4] Foster, p. 15.

[5] Foster, pp. 15–16.

[6] 10 U.S.C. Sec. 179.

[7] Foster, p. 4.

[8] Nuclear Weapons Complex Reconfiguration Study; Complex 21; Defense Programs Phase I and II Maintenance Studies; Energy Federal Contractor Organization Group Study; Office of Secretary of Defense Program Analysis and Evaluation Review; Stockpile Stewardship Program Thirty-Day Review; DOE Inspector General's Defense Programs Production Facilities Assessment; FY2000 Report to Congress, Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile (Foster Report).