NATIONAL NUCLEAR SECURITY ADMINISTRATION PROGRAMS AND FISCAL YEAR 2012 BUDGET REQUEST

Hearing of the Subcommittee on Strategic Forces
Committee on Armed Services
U.S. Senate

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George H. Miller, Director
Lawrence Livermore National Laboratory

Opening Remarks

Mr. Chairman and Members of the Subcommittee, thank you for your continuing support for the nation's Stockpile Stewardship Program. I am George Miller, Director of the Lawrence Livermore National Laboratory (LLNL). We are one of the Department of Energy's (DOE) National Nuclear Security Administration (NNSA) nuclear design laboratories responsible for helping sustain the safety, security, and effectiveness of our strategic deterrent.

The nation not only depends on the success of our efforts in stockpile stewardship but also leverages the capabilities of the NNSA Laboratories to develop innovative solutions to major 21st century challenges in nuclear security, international and domestic security, and energy and environmental security.

Summary

- I believe that the program outlined in the President's Budget Request for FY2012 provides a measured approach to meeting the mission needs and sustaining the capabilities and deterrent value of the nation's nuclear security enterprise through investments in a skilled, knowledgeable, and able workforce; advanced scientific facilities and production facilities; and a safe, secure, and effective stockpile.

- The tools of stockpile stewardship are being effectively applied to assess and, where necessary, refurbish and sustain our nation's nuclear deterrent. Your investment in "flagship" capabilities in high-performance computing and the National Ignition Facility at LLNL are producing excellent results.

- It is important that we continue to move forward with refurbishing the aging stockpile. The inevitable changes that we detect through our surveillance and assessment programs increase risk with every year and must be mitigated. In particular, it is imperative that we begin the study of options for refurbishing the W78 warhead to address evolving issues identified in the annual assessment of this weapon system.

- High-performance simulations accomplished using the tools available today have demonstrated that still unresolved issues will require exascale-level computing to continue to stay on top of the stockpile concerns and challenges ahead. Achieving exascale computing is a technically challenging endeavor, similar to the effort in the 1990's to develop terascale computing. This new capability will have other positive impacts on our country's national security and competitiveness. I am pleased that a program to initiate this effort is included in the President's Budget Request and strongly urge support for an aggressive research and development effort to create the technologies necessary to achieve and apply exascale computing.

- The science, technology, and engineering capabilities that are the foundation of the Stockpile Stewardship Program and the core capabilities of the NNSA Laboratories have been successfully leveraged to help solve some of the country's most important and urgent issues in defense, energy, and environment.

- The national investment in the Stockpile Stewardship Program has produced impressive science, technology, and engineering capabilities at the NNSA Laboratories that should be carefully nurtured and preserved. However, like all treasures, if these assets are neglected, they and the key personnel that we rely on will disappear very quickly. I believe that they deserve your careful consideration as the country faces both very difficult budget decisions and a challenging future in a dangerous world.

Introduction

I am here to provide my technical assessment of the NNSA weapons program activities as outlined in the President's FY2012 Budget Request and of the ability of our Laboratory to sustain capabilities and fulfill mission requirements. The request reflects the need to deal with an aging stockpile and ensure the long-term health of the nation's nuclear security enterprise by making substantial investments in a skilled workforce, facilities, and life-extension program activities. My testimony will focus on activities at Livermore and the importance of the budgeted investments to allow our Laboratory to accomplish the missions assigned to us. Without a healthy nuclear security enterprise, the nation puts in jeopardy the safety, security, and effectiveness of the nuclear deterrent over the long run as well as the ability of the NNSA Laboratories to apply outstanding science, technology, and engineering to a wide range of important national security challenges.

The nation's nuclear security strategy requires a stable and measured Stockpile Stewardship Program that is supported by the long-term commitment of successive Administrations and Congress with sufficient funding to meet mission requirements. The President's proposed budget increase reverses the declining trend of the last several years and restores funding to a level sufficient to reinvigorate and sustain the nation's program. These investments are urgently needed—in the face of enormous overall budget pressures—in all three major areas of stockpile stewardship: (1) life extension programs,

(2) modernization of facilities and infrastructure, and (3) the science, technology, and engineering base. In my view, delays in providing adequate funding has both immediate, short-term consequences and raise longer-term sustainment issues.

Life Extension Programs

It is very important that we address the specific issues discovered in our aging stockpile through the surveillance program and the review processes supporting our annual assessments before these concerns worsen. The role of any Life Extension Program (LEP) is to fix issues that impact—or will soon impact—overall system effectiveness and take actions that will extend the stockpile life. Failure to address these issues can have immediate and drastic consequences for the viability of the deterrent our national security strategy relies on.

Included in the request is funding for the Life Extension Study of the W78 Air Force Minuteman III ICBM warhead. This effort is vitally needed. $26 million was requested in FY2011 to begin a 6.1 Phase study to identify and evaluate the LEP. I am concerned because the start of the 6.1 Phase study has been delayed. In FY2012, the Administration requested $51 million to continue W78 LEP development in the 6.2/6.2A Phase (feasibility, planning, and costing studies). The official NNSA guidance designates LLNL as the lead nuclear design laboratory for the W78 LEP.

It is important to begin the study activities on the W78 warhead because today it constitutes the majority of the ICBM leg of the triad and it has been deployed on the Minuteman III for more than 31 years. The warhead is currently beyond its planned service life and it will take a 10-year effort to study and then refurbish the necessary systems. We need to address concerns identified in surveillance of W78 units and reported in annual assessments. There are issues with material aging and compatibility, which can impact components within the nuclear explosive package. Los Alamos National Laboratory (LANL) has been monitoring W78 aging characteristics and has assessed that aging “has not affected the safety, reliability, or performance of the W78 to date;” however, “the condition is progressive and beyond current predictive capabilities.” LLNL has concurred with these concerns in our peer review role as part of the annual assessment process. An important function of the study is to evaluate the different approaches available to refurbish the warhead—as were outlined in the Nuclear Posture Review—and assess the impacts of including additional safety and security features.

Modernization of Facilities and Infrastructure

Infrastructure modernization projects account for the largest portion of the proposed budget increase, and two of the projects are particularly high in cost and high in priority: the Chemistry and Metallurgy Research Replacement Nuclear Facility (CMRR) at LANL and a new Uranium Processing Facility (UPF) at the Y-12 Plant in Oak Ridge, Tennessee. I fully support these modernization projects and urge that as the cost baselines are further defined, any cost changes that occur be accommodated without upsetting the overall delicate balance of the Stockpile Stewardship Program.

Science, Technology, and Engineering Base

The FY2012 President's Budget Request for science, technology, and engineering capabilities is, in my view, prudent but constrained and austere: the level of activity will be less than that in FY2007. This level of capability provides the fundamental stockpile stewardship activities that permit surveillance, assessments, experiments, and computer simulations to ensure the aging stockpile and the refurbished weapons are safe, secure, and effective.

Weapons Surveillance. Weapons surveillance activities aim to predict and detect the effects of aging and other stockpile issues. The programmed increase in funding is vitally needed to step up the rate of stockpile surveillance and become more proficient at detecting and predicting potential problems early enough for our smaller complex to take measured action within limited resources. This area has suffered over the last few years and more sophisticated tools are needed to study how aging alters the physical characteristics of weapon materials and how these changes affect weapon effectiveness and safety.

Assessments. The Stockpile Stewardship Program includes a comprehensive set of activities to annually assess each weapon system and to address issues that arise. It is particularly important for processes to actively engage both centers of nuclear design expertise—LLNL and LANL—to provide independent assessments. In all areas of importance, advice from more than one independent source is crucial to the decision making process. Our assessments require rigorous scientific and engineering demonstration and evaluation and are benefiting from the development of Uncertainty Quantification, a methodology that is increasing the rigor of weapon certification and the quality of annual assessments.

Experiments and Simulations. Because we do not perform nuclear tests, simulations are a major tool for providing assessment of the stockpile. These simulations require experimental validation, which in the absence of nuclear testing, is provided by very sophisticated non-nuclear experiments. Through these experiments and simulations, Laboratory scientists and engineers improve their understanding of nuclear weapon performance and exercise the necessary base of specialized skills in support of stockpile stewardship.

There remain several key areas, such as energy balance and boost physics, where we still lack adequate knowledge. Predictive Capability Framework campaigns utilize our advanced stockpile stewardship tools to fill gaps in knowledge about nuclear weapon performance relevant to existing or expected issues about stockpiled weapons. These activities integrate the use of state-of-the-art high-performance computers, high-fidelity simulation models, and data gathered from state-of-the-art experimental facilities. This cutting-edge research provides both the basis for stockpile stewardship and the tools by which the Laboratory experts make judgments about the health, safety, security, and effectiveness of the stockpile.

Overall, LLNL conducts a wide range of experiments in support of the Stockpile Stewardship Program. For example, to enhance weapons surveillance, we developed and

applied state-of-the-art radiographic methods to evaluate the health of the high-explosive system used to initiate weapon detonation. In FY2010 we also conducted important hydrodynamics experiments at the Contained Firing Facility at LLNL and at the Dual-Axis Radiographic Hydrodynamics Test Facility at LANL and many types of experiments to better understand material properties at extreme conditions. These include experiments at the National Ignition Facility.

I will focus on high-performance computing and activities at the National Ignition Facility, which illustrate the outstanding work at our Laboratory in support of stockpile stewardship and the challenging science and technology efforts required for the Stockpile Stewardship Program.

High-Performance Computing and Simulations

Since the Stockpile Stewardship Program began in 1985, the NNSA weapons laboratories—working closely with industry—have made remarkable strides in high-performance computing. Our initial goal was to have a machine that could perform 100 trillion floating point operations per second (teraflops) available within a decade. Through a very concerted effort, the community achieved that goal, which provides the capability projected to be the minimum threshold for initial 3D simulations of weapons performance. With simulations on the 100-teraflops IBM Purple, we observed important phenomena that had never been seen before. We also learned that to accurately simulate these phenomena we needed supercomputers that perform much better and modeling techniques that are significantly more powerful and capable.

Computer technology has since advanced by about a factor of ten (1000 teraflops or 1 petaflops). Currently China leads the world with a 2.5-petaflops machine. The expanding international interest in supercomputing superiority is indicative of the technology's great value in advancing science and technology on many fronts and accelerating product development in industry.

Improved high-performance computing capabilities are to better meet stockpile stewardship challenges. To better understand phenomena in areas such as boost, improvements in both the physics models and resolution are required. Model improvements, in turn, necessitate further advances in computing: 1000-petaflops technology (1 exaflops) is required. Exascale computing is also needed to fully implement Uncertainty Quantification, the formal methodology to increase the rigor of LEP weapon certification and the quality of annual assessments. The methodology requires thousands of three-dimensional weapon simulations to be run to estimate uncertainties. Simulations with today's capability tell us that we need better resolution, better physics models, and the running of many more simulations than possible with today's machines to reach the level of understanding and analysis required to fulfill mission needs.

Sequoia. Through the NNSA ASC program, Livermore and IBM are poised to make the next major advance in supercomputing. Delivery of the 20-petaflops IBM Sequoia is to begin in December 2011. Sequoia's processing speed is equivalent to every person on Earth completing 3 million calculations per second. This nearly-factor-of-ten leapfrog

advance over current capabilities is based on third-generation IBM BlueGene technology. Unclassified science calculations will be performed on Sequoia in 2012, transitioning after these tests to classified use in 2013.

Since 2009, researchers have been using Dawn, a 500-teraflops initial delivery system for Sequoia. All three NNSA Laboratories run cutting-edge weapons science problems on Dawn and use the machine to prepare codes for use on Sequoia. For example, LANL performed the largest ever high-resolution turbulence simulations and uncovered new phenomena related to important open questions. The results are being used to improve physics models under development within Advanced Simulation and Computing. Sandia has been testing and improving the speed at which some of the key algorithms in their large simulation codes will run on Sequoia's 1.6 million processors.

Among other applications, LLNL scientists are developing new tools on Dawn to study complex laser–plasma interactions and to predict and interpret the results of experiments at the National Ignition Facility. More generally, in preparation for Sequoia's arrival, we are making significant progress in the development of algorithms that will run efficiently on the machine's architecture, applications that are tolerant to the many "faults" that can be expected in long runs using over a million processors, tools to analyze and help balance the workload among processors, debugging methodology, and a variety of data visualization and interpretation tools.

Exascale Initiative. I am very pleased to note that the FY2012 President's Budget Request includes $126 million to support start of an exascale initiative in an effort to sustain U.S. leadership in supercomputing to support DOE/NNSA missions. This is a joint effort between NNSA and DOE's Office of Science. The path forward beyond the 20-petaflops IBM Sequoia toward exascale computing offers exciting opportunities to address a wide range of vital national needs, but it presents tremendously difficult technical challenges. We are working with DOE and NNSA leadership, other laboratories, and industry to size and scope the technical work program.

The National Ignition Facility

The National Ignition Facility (NIF) is the world's premier laser facility. Since the facility's dedication in May 2009, NIF with its 192 laser beams has performed exceptionally well. It is proving to be a remarkably reliable and precise system. Citing groundbreaking technical achievement and exemplary project management, the Project Management Institute (PMI) named NIF as the 2010 Project of the Year. PMI honored NIF for "pushing beyond the state of the art" and lauded the effort as "a stellar example of how properly applied project management excellence can bring together global teams to deliver a project of this scale and importance efficiently."

NIF is the focal point for the National Ignition Campaign (NIC). The purpose of NIC is to determine the feasibility of fusion ignition and transition NIF from a construction project to routine experimental operations for weapons and basic science by the end of FY2012. With respect to fusion, NIC has two major goals: execution of DT ignition experiments starting in FY2010 for the purpose of demonstrating ignition and development of a reliable, repeatable ignition platform for weapons physics, basic

science, and energy research by the conclusion of NIC at the end of FY2012. A national program, NIC includes as partnering institutions the three NNSA Laboratories, the University of Rochester Laboratory for Laser Energetics, and General Atomics. The NIC team has established collaborations with the Atomic Weapons Establishment in United Kingdom, Commissariat à l'Energie Atomique in France, Massachusetts Institute of Technology, Lawrence Berkeley National Laboratory, and many others.

The campaign is guided by the NIC Execution Plan (currently, NIC EP Revision 4), which describes the scope, schedule, and budget for the campaign. NIC is an exceedingly complex, frontier science and engineering project. Adjustments to the optimal path forward are made based on information learned from experiments. Accordingly, NIC accomplishments and plans are scrutinized by several external high-level committees: the NNSA Ignition Review Panel chaired by DOE Undersecretary for Science Steve Koonin, the NIC Technical Review Committee chaired by former Oak Ridge National Laboratory Director Al Trivelpiece, and the LLNL Directorate Review Committee chaired by former NNSA Administrator General John Gordon, USAF, Ret. The NIC reviews have been very positive and encouraging.

The Ignition Campaign. There have been a number of important successes at NIF. In the hohlraum energetics campaign, the NIC team demonstrated that the interaction between the laser beams and the target could be satisfactorily controlled and that the conditions necessary to implode the hydrogen fuel could be achieved. Creation of the proper implosion conditions was a major concern of the original National Academies of Science Study that led to the construction of NIF.

We have also demonstrated the integration of all of the subsystems needed for ignition. Cryogenically cooled ignition targets with a layer of solid tritium, hydrogen, and deuterium (THD) have been successfully created and imploded. One shot in particular achieved a record-setting 1.3×10^{14} neutrons in a purposely low-yield configuration.

NIC continues to make excellent progress and the results of implosion experiments are very encouraging. We continue to learn much from the experiments and see no "show stoppers." We are optimistic about success in achieving fusion ignition but mindful that NIC is an extremely challenging undertaking that is at the frontiers of science and technology. Current plans are to complete the current fusion ignition and burn campaign in spring or summer of 2012.

Stockpile Stewardship and Science Experiments. In late February-March 2011, we conducted the most recent series of highly successful campaigns of high-energy-density physics experiments in support of stockpile stewardship on NIF. One campaign focused on radiation transport to gather data to validate the capability of our physics simulation codes to model phenomena very important to weapon performance. Altogether, 16 experiments were performed in 11 shot days. These included the first experiments performed that included diagnostics to provide time-resolved radiographic data. Preliminary comparisons of data taken are in reasonable agreement with pre-shot predictions. A second campaign focused on developing and using a technique for gathering equation-of-state data to characterize the properties of highly compressed (but unheated) materials—in this case, tantalum and carbon. Gathered data from such

experiments are needed for scientific advances that underpin both stockpile stewardship and planetary science. These experiments are important steps on the path toward transforming NIF to a national and international user facility in FY2013.

Nuclear Nonproliferation and Counterterrorism

A key aspect of our nuclear security efforts is applying our expertise in nuclear weapons science and technology, nuclear sensors and detection, and arms control verification technologies to programs in the NNSA Office of Defense Nuclear Nonproliferation. For example, to help secure vulnerable weapons-useable and radiological materials, Livermore-led teams have been recovering radioisotopic thermonuclear generators, which contain highly radioactive heat sources, from remote areas of Russia. Additionally, we are developing advanced technologies to detect nuclear and radiological materials. Two of the technologies received R&D100 Awards, the Oscars of invention, in 2010. Complementing these efforts is a program focused on nuclear counterterrorism.

The Laboratory provides both technical support to ongoing arms control negotiations and technology development. Livermore's underground nuclear explosion monitoring program is a long-standing nonproliferation program that provides the technical underpinning for both the domestic and international monitoring needed to uncover clandestine underground nuclear tests. We couple data from global seismic networks with LLNL's supercomputing capability to interpret the seismic data and model the earth, thereby improving U.S. capability to detect possible proliferation. This program also has strong links to international seismic safety and science engagement activities.

Importance of People and Program Growth to the Health of Stockpile Stewardship

Long-term success in stockpile stewardship fundamentally depends on the quality of people in the program. If the nation is not confident in the expertise and technical judgments of the stewards, the nation will not have confidence in the safety, security, and effectiveness of our nuclear deterrent. The specialized technical skills and expertise required for nuclear weapons work take a long time to develop through hands-on experience and mentoring by our very best. Program stability—based on sustained bi-partisan support and sufficient funding over the long term—is critically important to executing a balanced, integrated Stockpile Stewardship Program. We welcome the support provided by the Administration and Congress on the importance of the NNSA Laboratories' work in maintaining the U.S. nuclear deterrent.

Program Leverage. An important benefit of a strong Stockpile Stewardship Program is that this foundational program enables the NNSA Laboratories to meet broader national security objectives by applying their unique capabilities and multidisciplinary approach to problem solving. With a focus on national security, the NNSA Laboratories are a vital part of the nation's science and technology infrastructure. We partner with non-NNSA components of the Department of Energy, the Department of Defense, the Intelligence Community, the Department of Homeland Security, and many other agencies such as the National Aeronautics and Space Administration and the National Institutes of Health. In particular, nuclear weapons expertise at LLNL is directly applicable to the nuclear security challenges of proliferation and terrorism. Other areas of national defense,

domestic and international security, and energy and environment security also benefit from the Laboratory's broad scientific and technical base and international leadership in areas such as high-performance computing.

These activities also further strengthen our science and technology workforce, add vitality to the Laboratory, and spin new ideas and additional capabilities into and out of the weapons program and other national security programs. Very importantly, they serve as a pipeline to bring top talent to LLNL so that we continue to provide the nation with outstanding stockpile stewards. A broader base of national security programs at the NNSA Laboratories can never be a substitute for a strong Stockpile Stewardship Program. Likewise, these programs are not a distraction from our defining mission and responsibilities to sustain the nation's nuclear deterrent.

Continuing to foster partnerships between Livermore and the broader national security community is a key component of our strategy for helping solve the country's most important problems and sustaining science and technology excellence and intellectual vitality at the Laboratory. I am very concerned about the possibility of drastic reductions in the investments in science and technology broadly across federal departments and agencies in these times of very constrained budgets. Investments in science, technology, and engineering provide an important spark of innovation that is a basis for our country's national security, energy and environmental security, and continuing economic competitiveness.

Leveraging High-Performance Computing. I emphasize the importance of high-performance computing in my testimony because it is a cornerstone of the Stockpile Stewardship Program, a core strength of our Laboratory, and critical to many of our programs for non-weapons-program sponsors. Some of our recent accomplishments provide a sense of the breadth of our high-performance computing activities and the many program areas they support:

- *Support in response to environmental emergencies*. The DOE's National Atmospheric Release Advisory Center (NARAC) at LLNL is providing timely, state-of-the-art, predictions of fallout from the damaged nuclear reactors after the recent earthquake/tsunami in Japan. As the hub of the Department of Homeland Security's Interagency Modeling and Atmospheric Assessment Center (IMAAC), NARAC also provided plume predictions of the fire on the Deepwater Horizon oil platform and forecast the particulates that might be released from surface-oil burns.

- *Persistent surveillance*. Laboratory scientists developed an innovative data-processing "pipeline" designed to help the Department of Defense monitor tens of square kilometers of terrain from the skies and provide combat support by detecting in real time potentially important events in streaming video data.

- *Third-generation conventional munitions*. LLNL is using state-of-the-art engineering codes, advanced design capabilities, and expertise in materials to pursue, with the Department of Defense, development of third-generation munitions that are more effective against precision targets while, at the same time, limiting collateral damage.

This effort represents a superb example of the power of high-performance simulation: a munitions program went from concept to completion of qualification testing in ten months, providing significant advantages to the warfighter.

- *Nuclear test monitoring*. Laboratory seismologists developed improved 3D models of seismic wave travel time, greatly increasing the accuracy with which seismic events can be located and the ability to differentiate earthquakes and nuclear explosions.

- *Cyber security and intelligence support*. Livermore has developed advanced methods for gleaning information from extremely large-scale relational databases (graphs) and analyzing networks together with fast, accurate tools for large-scale text analysis.

- *Microbial detection*. Expertise in bioinformatics enabled Laboratory researchers to develop microbial detection array with 388,000 probes that fit on a glass slide, able to detect or identify more than 2,000 viruses and 900 bacteria within 24 hours.

- *Aerodynamic drag reduction for semi-trailer trucks*. Simulations with LLNL's fluid dynamics codes identified critical drag-reduction regions around semi-trailer trucks, with results verified by full-scale wind tunnel tests. Properly placed drag reduction devices could increase semi-trailer truck fuel efficiency by as much as 12 percent.

- *Award-winning software tools*. Livermore researchers have developed advanced tools—including several R&D100 Award winners—for solving linear equations, debugging and compiling programs, and visualizing extremely large data sets that are made available to and downloaded thousands of times per year by the user community.

- *Fusion energy*. New developments at LLNL in lasers and materials technologies could provide a much shorter path to carbon-free energy.

- *Directed energy*. Laboratory researchers are developing exciting new capabilities in lasers that could have important impacts on national security.

- *Carbon capture*. Laboratory scientists are using supercomputers to design small-molecule catalysts that can be adapted to capture CO_2 from power-plant emissions.

Closing Remarks

Again, I thank the Subcommittee for its continuing support for the nation's Stockpile Stewardship Program and the terrific people at the Lawrence Livermore National Laboratory. As I have stated, I believe that the program outlined in the President's Budget Request for FY2012 provides a measured approach to meeting the mission needs and sustaining the long-term health of the nation's nuclear security enterprise through investment in a skilled workforce, facilities, and the stockpile.

The investments will help us move forward refurbishment programs in response to inevitable changes in aging weapons that require our attention. In particular, initiating the study of the options for refurbishing the W78 warhead is urgently needed.

The heart of our successful Stockpile Stewardship Program is our skilled workforce, who are the current generation of a worthy line of stewards in the service of our nation. I have emphasized the importance of investing in the workforce and the tools that Laboratory scientists and engineers are effectively applying to assess and refurbish the nuclear deterrent. Our accomplishments in the areas of NIF experiments and high-performance computing are particularly noteworthy. In both areas, future opportunities are very exciting, and in particular, I urge that the nation undertake a forceful effort in exascale computing because of its importance to stockpile stewardship and, more broadly, the nation's security and economic future.

With sustained support for the Stockpile Stewardship Program, our Laboratory can best serve the country as a broad-based national security laboratory, developing innovative solutions to major 21st century challenges in nuclear security, international and domestic security, and energy and environmental security.

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Lawrence Livermore National Laboratory

DR. GEORGE H. MILLER
Director
Lawrence Livermore National Laboratory

Ph.D. physics, College of William and Mary (1972)
M.S. physics, College of William and Mary (1969)
B.S. physics, College of William and Mary (1967)

Dr. George H. Miller is the tenth Director of Lawrence Livermore National Laboratory, a position he assumed in March 2006, after a long and distinguished career in national security work at the Laboratory. While serving as Director, Dr. Miller is responsible for the management of the Laboratory and led the institution through its transition in October 2007 to a new management contractor, Lawrence Livermore National Security (LLNS), LLC. Dr. Miller also serves as the President of LLNS.

Throughout his tenure, Dr. Miller has tackled a variety of management and scientific challenges in the interest of national security. For example, under Dr. Miller's leadership as Associate Director for the National Ignition Facility, a new management team was assembled in 1999 with a new project execution plan that put it on track for completion in 2009. Through Dr. Miller's stewardship, this $3.5 billion laser continues to meet its scientific and operational milestones.

Prior to his position at NIF, Dr. Miller provided the leadership to integrate LLNL's national security programs into a cohesive effort to meet U.S. national security objectives of maintaining the U.S. nuclear deterrent without nuclear testing, advance national nonproliferation and arms control goals through the development and application of effective scientific and technical solutions, and support DOD programs.

From 1985 until 1996, Dr. Miller led the Laboratory's nuclear weapons program as a major participant in the development of the Stockpile Stewardship and Management Plan to ensure the safety, security and performance of the nation's nuclear deterrent in the absence of testing. Dr. Miller applied his expertise as a weapons design physicist to assist in the development of the scientific capabilities necessary to maintain the nuclear deterrent without nuclear testing. He developed his scientific management skills as the project leader for the B77 nuclear weapon development and the W84 ground launched cruise missile.

Dr. Miller has represented the Laboratory's national security programs to a wide variety of decision makers in the federal government, including members of the Executive Branch, Departments of Energy and Defense, and the U.S. Congress. In 1989, Dr. Miller provided scientific counsel to Secretary of Energy Admiral James D. Watkins while on a temporary assignment to the Department of Energy as Special Scientific Advisor on Weapons Activities. He provides advice to the Commander of the United States Strategic Command through his membership on the USSTRATCOM Strategic Advisory Group and as Chairman of its Science and Technology Panel.

Dr. Miller holds memberships in the American Physical Society and Sigma Pi Sigma - National Physics Honor Society. He has received awards and honors from the National Science Foundation Graduate Fellowship, Gulf-General Atomics Fellowship, and Sigma Pi Sigma.

Dr. Miller and his wife have two grown children and live in Livermore, California.