Strategic Theme 2

Nuclear Security

Ensuring America's nuclear security

In 2000, the National Nuclear Security Administration (NNSA) was established as a new element within the Department in response to a Congressional mandate to reinvigorate the security posture throughout the nuclear weapons program and to reaffirm the Nation's commitment to maintaining the nuclear deterrence capabilities of the United States. NNSA was chartered to better focus management attention on enhanced security, proactive management practices, and mission focus within the Department's national defense and nonproliferation programs. The Department performs its national security mission involving nuclear weapons and nuclear materials and technology through the NNSA.

Over the next six years, the Department will apply advanced science, engineering, and nuclear technology to help ensure that it meets its national nuclear security strategic goals.

Nuclear Security Challenges

As NNSA continues to drawdown the nuclear weapons stockpile to the lowest levels since the Eisenhower Administration, we must consider the long-term effects of aging and the implications of successive warhead refurbishments which take us further away from the tested designs of the Cold War stockpile. The current nuclear weapons complex is not sufficiently responsive to fix technical problems in the stockpile or to react to potential adverse geopolitical change. Therefore, the nuclear weapons stockpile and the supporting infrastructure must be transformed. The Department is working closely with the Department of Defense to transform the nuclear deterrent to ensure that it can meet the changing technical, geopolitical, and military needs of the future. A second challenge deals with the ever increasing threat of terrorism. The mere acquisition by terrorists or rogue regimes of nuclear and radiological materials which could be used in weapons of mass destruction or in a "dirty bomb" represents a threat to the United States and to international peace and security. Lastly, increasing national security demands necessitate the development of next-generation naval nuclear propulsion technology.

The following strategic goals address these nuclear security challenges.

Nuclear Security Strategic Goals

Goal 2.1 – Nuclear Deterrent

Transform the Nation's nuclear weapons stockpile and supporting infrastructure to be more responsive to the threats of the 21st Century.

Description: In accordance with the policy outlined in the 2001 Nuclear Posture Review, the structure of the U. S. nuclear deterrent will transition from one that relies solely on offensive nuclear forces to one that relies more heavily on capabilities. To that end, NNSA must develop a credible, responsive nuclear weapons infrastructure to facilitate a reduction in the size of the stockpile, to support a greater reliance on deterrence by capability, and to change the way we manage risk. NNSA must furthermore accomplish this transformation of the complex while ensuring the safety, security, and reliability of the stockpile without nuclear testing.

In the 1990s, the Nation established the science-based Stockpile Stewardship Program (SSP) in order for DOE to fulfill its responsibilities for ensuring the safety, security, and reliability of nuclear weapons without nuclear testing. Sophisticated scientific tools and computer-based simulation techniques were developed to ensure the Nation had a means to assess the complex phenomena involved in nuclear weapons. Indeed, for more than a decade, SSP has given us confidence that today's stockpile remains safe, secure, and reliable. Now, transformation of the stockpile and the infrastructure is enabled by the success of the SSP. Tools and expertise developed in that program are being applied to design replacement warheads, to ensure long-term confidence in the stockpile, and to enhance the responsiveness of the complex.

NNSA has developed a preferred planning scenario, which sets out the vision for the nuclear weapons complex of 2030. This scenario comprises four over-arching, long-term implementation strategies, complemented by a near-term commitment to build confidence in the transformation process over the

next 18 months. In addition, NNSA will prepare documentation for a National Environmental Policy Act process that will examine all reasonable alternatives to modernize and consolidate the complex.

Strategies to reach this goal

• In partnership with the Department of Defense, transform the nuclear weapons stockpile by: developing Reliable Replacement Warheads that are safer, more secure, and easier to manufacture and maintain; refurbishing a limited number of legacy-design warheads and ensuring their vitality until they are replaced; and accelerating dismantlement of the Cold War stockpile.

• Transform the current nuclear weapons complex into a modernized, cost-effective complex by: reducing the number of sites, and facilities within sites, that possess large quantities of special nuclear materials; consolidating redundant capabilities; operating science assets as shared user facilities; and designing, building, and operating new facilities in a manner that protects public and worker health and safety and the environment.

• Create a fully integrated and interdependent complex by: implementing uniform and streamlined business practices and processes; using the operating contracts for each site to facilitate the integration and interdependence of the complex; and applying risk-informed decision-making to integrate safety, security, and mission work.

• Drive forward the science and technology base essential for long-term national security by: integrating activities with DOE's Office of Science and other national sponsors; enhancing the Work for Others program; and managing capabilities based on "return on investment" for improving DOE's ability to certify the stockpile.

Goal 2.2 – Weapons of Mass Destruction

Prevent the acquisition of nuclear and radiological materials for use in weapons of mass destruction and in other acts of terrorism.

Description: The Department is committed to detecting, preventing, and reversing the proliferation of nuclear and radiological materials, technology, and expertise. NNSA's nonproliferation work started well before September 11, 2001 and the programs are becoming increasingly global in scope as they strengthen and expand nonproliferation activities outside the territory of the Former Soviet Union. NNSA now works with more than 90 countries to secure nuclear and radioactive materials and halt the production of new fissile material. Additionally, it detects and interdicts illegal trafficking in, or diversion of, nuclear material and proliferation-significant items; destroys surplus weapons-usable materials; strengthens export controls; bolsters nonproliferation regimes; and gives former weapons scientists and technicians an opportunity to make use of their high-technology skills in peaceful endeavors.

While the Department has achieved impressive nonproliferation accomplishments over the past 30 years, DOE nonproliferation programs must continually address and adapt to evolving security concerns. The rapid evolution of nuclear proliferation, in the context of a globalizing world economy, requires the programs to be flexible, creative, and responsive to emerging threats around the world.

NNSA's nonproliferation and threat reduction programs are structured around and integrated with a comprehensive and multi-layered U.S. Government strategy to address the danger that hostile nations or terrorist groups may acquire weapons of mass destruction (WMD) or weapons-usable material, dual-use production technology, or WMD expertise.

Strategies to reach this goal

• Provide technical and policy leadership to the U.S. Government and international community and pursue collaborative efforts with other countries and international organizations to achieve nonproliferation objectives.

• Develop the technologies and expertise to detect the proliferation of nuclear materials.

• Promote next-generation technologies that minimize proliferation risks.

• Provide technical and other appropriate assistance to secure nuclear weapons, special nuclear material, and radiological materials around the world.

• Provide technical and other appropriate assistance to terminate Russian production of plutonium and eliminate surplus fissile materials.

Goal 2.3 – Nuclear Propulsion Plants

Provide safe, militarily effective nuclear propulsion plants to the U.S. Navy.

Description: NNSA, through the Naval Reactors Program, provides the U.S. Navy with safe, militarily effective nuclear propulsion plants, beginning with reactor technology development, continuing through reactor operation, and ending with reactor plant disposal and management of naval spent nuclear fuel pending shipment to a geological repository. Nuclear power enhances warship capability and creates the flexibility needed to sprint anywhere in the world and arrive ready for combat operations. Sustained, high-speed capability enables rapid responses to changing world circumstances and helps the Navy stretch available assets to meet today's worldwide national security commitments.

The Naval Reactors Program ensures the safe operation of reactor plants in operating nuclear-powered submarines and aircraft carriers and fulfills the Navy's requirement for new reactors to meet evolving national defense demands. This program's long-term development work ensures that nuclear propulsion technology provides options to maintain and upgrade current capabilities, as well as meet future threats to U.S. security.

The presence of radiation dictates a careful, measured approach to developing and verifying nuclear technology, components, systems, and processes, and implementing them into existing or future plant designs. Intricate engineering challenges and long lead times to fabricate the massive, complex components require many years of effort before technological advances can be introduced into the fleet. As advances in various functional disciplines coalesce, work is integrated into the technology applicable to a naval nuclear propulsion plant.

Strategies to reach this goal

• Provide operational support and ensure the safety, performance, reliability, and service life for 104 operating reactor plants.

• Develop new technologies, methods, and materials to support reactor plant design for future generations of reactors for submarines and aircraft carriers.

Crosscutting Science Integration

As part of DOE's planning process, several critical areas of technology barriers have been identified that, if overcome through basic research, could greatly enhance NNSA's posture and ability to deliver on its three strategic goals. They are, in a sense, a select set of grand challenges for the science, engineering, and technology communities. Specifically, breakthroughs are required in radiation resistant materials, innovative materials for safeguards and security, nuclear proliferation detection, remote sensing and analysis of radioactive/fissile materials and nuclear weapons, and modeling and simulation. Additionally, there are significant opportunities for crosscutting science "push," that is to say, areas where fields of science hold seemingly broad potential to accelerate innovation in many areas of national nuclear security responsibilities. Significant science opportunities include the design and synthesis of materials exploiting nanoscale understanding; advanced scientific computing research and mathematics; and physics, chemistry, and metallurgy. While these are not exhaustive lists, they represent an initial and ambitious set that offer high potential payoff, thus challenging the science and technology communities to work together in the years ahead.

External Factors

The following external factors could affect the Department's ability to achieve the Nuclear Security theme:

Technology

Technological challenges may occur. The discovery of an insurmountable scientific or engineering obstacle in a stockpile warhead could make it difficult to certify the reliability of the warhead under current policies.

Geopolitical Environment

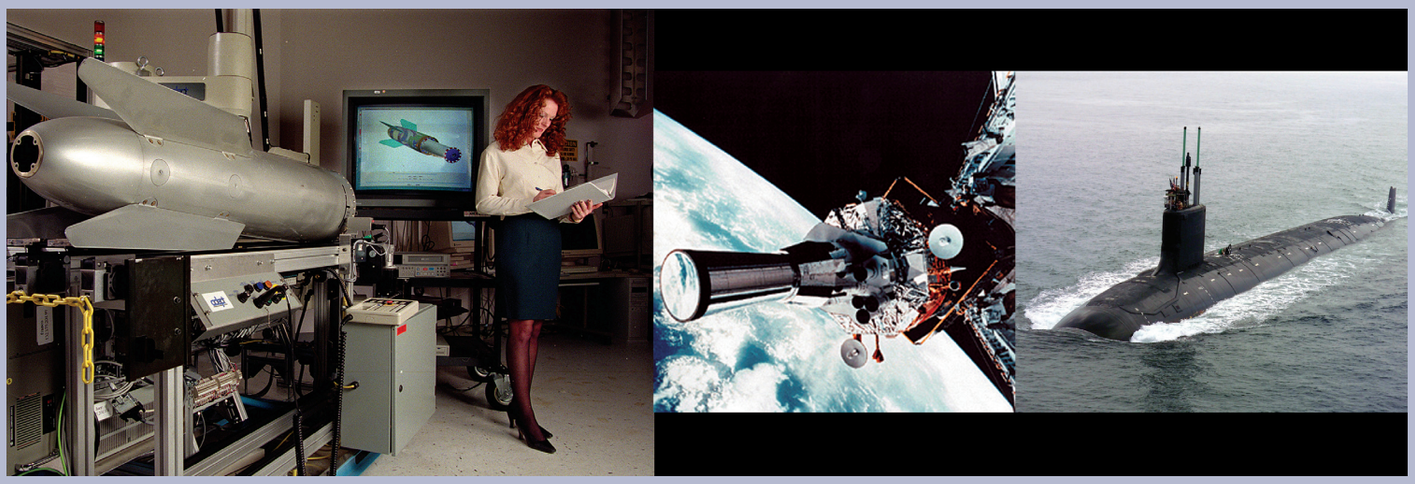
Changes in the nuclear threats or other threats involving weapons of mass destruction could require changes to the Stockpile Stewardship Program.

Cooperation with Russia

Unprecedented cooperation between the United States and Russia has resulted in great strides being made in the elimination and securing of inventories of surplus materials. This close working relationship is necessary for NNSA to continue making progress in this key area of nonproliferation.

Cooperation with Other Countries

DOE's efforts are cooperative; they cannot proceed in the absence of committed engagement from U.S. international partners. NNSA needs international partners to provide access for our technical experts, to engage in good faith negotiations, to share in the expenses involved, and to work to sustain the level of nonproliferation activity after the United States has done its part.

International Atomic Energy Agency (IAEA)

The IAEA is essential to the success of the world's efforts to control nuclear proliferation. It is vital that the IAEA receive needed funding and technical expertise and demonstrate leadership to its member countries to accomplish its mission.