Part II: Infrastructure

A nuclear weapon is both a formidable and sophisticated device as well as the end product of considerable intellectual innovation and financial investment. Since its inception, the U.S. nuclear weapons complex, including national research laboratories and production facilities, has developed and maintained the nuclear weapons that have been part of the U.S. military arsenal since 1945 and has supported nuclear-related research. Beginning in 2000, the National Nuclear Security Administration (NNSA)—an agency within the Department of Energy—has managed the funding, research, maintenance, and security of the nation's nuclear weapons complex. In recent years, however, the changing mission and aging of the nuclear weapons themselves, along with resource constraints, are posing fundamental challenges to the organization and funding of the nuclear weapons complex. To better understand this situation, the Commission requested that experts examine the relevant issues, including overhauling the management and funding structure of the NNSA complex, the mission of the nuclear weapons labs, retaining expertise at the labs and production facilities, and the future physical infrastructure requirements of the complex.

To begin the chapter, Linton Brooks, who is a former NNSA administrator, provides an overview of the complex, which set the stage for the Commission's visit to Lawrence Livermore National Laboratory in September 2008. Since the commissioners did not all have an extensive nuclear infrastructure background, Brooks wrote this overview as a guide to understand the basic structure of the complex, including information on the three national laboratories, the Nevada Test Site, the four production facilities, and a description of plans to transform the complex. In his subsequent paper, Brooks expands on his primer by including a more substantive description of the general functioning and missions of the national laboratories. He broadens the scope by describing the main issues confronting the complex in the near future and includes the minimum requirements to maintain the status quo.

With the objective of providing a current analysis and alternatives for future complex transformation, several experts from the Nuclear Infrastructure expert working group offered their views to the Commission on the organizational problems and financial shortcomings that may affect NNSA and the labs in the future. Linton Brooks provides an in-depth look at the organizational structure and its regulations and bureaucracy, proposing several

alternative models for NNSA's structure. This list of alternatives provided the Commission with insights and options to inform their future recommendations. Building on the theme of "complex transformation," Harold Smith offers a series of managerial and organizational reforms intended to help make NNSA and the labs more functionally efficient and cost-effective. Smith suggests that the weapons labs should be renamed "national security laboratories," and that the President should place them under the supervision of several agencies with a vested interest in their health, including the Departments of Defense, Energy, Homeland Security and the Directorate of National Intelligence. From a financial perspective, author Troy Wade examined the increased security costs at NNSA sites compared to security costs at DOD facilities. Increased costs in operating weapons labs, organizational inefficiencies, and a faltering budget have heightened fears that NNSA will not be able to maintain the country's "second to none" nuclear capabilities in the future, when NNSA is considering upgrading aging facilities as well as building new ones at existing locations. Given current funding difficulties, commissioners faced a quandary: which building and/or renovation projects—if any—should be funded, and in what order? Which should receive priority? In an extensive paper on the subject, Earl Whiteman examines the projects themselves, their funding projections, budgetary concerns, and the very the logic behind the projects.

When the Commission visited Lawrence Livermore National Laboratory in September 2008, it saw that the most obvious and precious resource committed to the weapons complex was the people. The human capital component of the nuclear weapons complex cannot be underestimated: it is the intellectual infrastructure that is responsible for the innovation behind, and upkeep of, the nation's nuclear stockpile. In another short primer for the Commission, Linton Brooks describes the basic challenges that pose a threat to retaining and attracting exceptional science and engineering talent. In a more in-depth look at the issue, Hank Chiles submitted a paper to the Commission that drew heavily from a Defense Science Board (DSB) report on the importance and sustainability of maintaining a skilled nuclear weapons report. To view the executive summary of the DSB report, see the appendix in this volume. With future science and technological advances in mind, Elbridge Colby met with the NNSA Director of the Office of Research and Development for National Security Science and Technology, Dr. Dimitri Kusnezov. Dr. Kusnezov and his team emphasized the powerful implications of developments in the science and technology fields and human capital needs as they relate to nuclear weapons in the coming years. Colby concludes that Congress must strive to maintain, and provide funding for, our "peerless national security science and technology base" in order to counter these future threats.

Physical infrastructure is another critical component of the labs, and production facilities are in danger of falling into serious neglect. In his paper, Robert Barker focuses on the infrastructure needed to support strategic ballistic missiles; he points out that there appears to be a lack of long-term planning and strategic vision for maintaining the health of the nuclear weapons infrastructure, specifically Navy and Air Force delivery systems. In a more specific piece concerned with funding difficulties related to air-delivery infrastructure, Barker examines the future of the nuclear-capable F-35 Joint Strike Fighter. He and the rest of the Nuclear Infrastructure expert working group agree that there is a lack of sustained budgetary support, which poses a real problem for the development of badly needed next generation delivery systems and their respective infrastructure.

In an effort to inform the debate surrounding the controversy between life extension programs for nuclear weapons—the Life Extension Program (LEP) approach—and proceeding with a new nuclear weapons design—Reliable Replacement Warhead (RRW)—Everet Beckner explains the details of each option for the Commission in terms of the infrastructure that would support these efforts. With advantages and disadvantages inherent in both approaches, Beckner leaves aside the controversy and focuses on the physical infrastructure requirements of both options, the possible future changes to stockpile size, the implications for lab personnel, and the building schedule for new NNSA facilities that may affect these options. In a subsequent paper, Thomas Scheber focuses on the definitional uncertainties of the term "new" when used to describe weapons: what is considered a "new" weapon and does the proposed RRW fit this definition?

To close the section, Linton Brooks discusses several additional nuclear infrastructure issues. His brief guide hones in on several important issues such as NNSA complex transformation funding, nuclear test readiness, and the advisability of maintaining all current NNSA labs and productions facilities, while providing options for the Commission to consider in making their final decisions on nuclear infrastructure.

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Primer on the Nuclear Weapons Complex

Linton F. Brooks

Overview

The current Complex consists of eight sites located in seven states. These include the three national laboratories (Los Alamos, Lawrence Livermore and Sandia),[1] the Nevada Test Site, and four production facilities:

- The Pantex plant in Amarillo, Texas.
- The Y-12 plant in Oak Ridge, Tennessee.
- The Kansas City plant.
- The Savannah River Tritium Facility in South Carolina.

Note that there is no production facility for plutonium components (pits). An interim capability is being established at Los Alamos and NNSA proposes that the permanent production capability be established there as well.

The National Laboratories

The three national laboratories (often called the weapons laboratories to distinguish them from other DOE national laboratories) are all multi-purpose, multi-disciplinary facilities with strong basic science and engineering components. Their missions and sizes are:

Los Alamos National Laboratory, Los Alamos, NM

- Function—A multi-program laboratory supporting research (Weapons Design and Physics) and a limited production mission (Pit and Detonator) predominately in national security.

- Number of employees: 6,071
- Budget: $1.5 B

Lawrence Livermore National Laboratory, Livermore, CA

- Function—A multi-disciplinary research and development program supporting the design, development, and certification of the nuclear stockpile (Weapons Design and Physics).
- Number of Employees: 4,477
- Budget: $1.0 B

Sandia National Laboratories, Albuquerque, NM, and Livermore, CA

- Function—Several areas: 1) Nuclear weapons (Nonnuclear Component Design/Production), 2) Nonproliferation and Assessment, and 3) Military Technologies and Applications.
- Number of employees: 4,307
- Budget: $1.2 B

Each laboratory houses major supercomputing facilities. Each has unique, large and expensive research tools such as the National Ignition Facility (Livermore), Microsystems and Engineering Sciences Applications (MESA) (Sandia), or the Dual Axis Radiographic Hydrodynamic Test facility (DAHRT) (Los Alamos. For security reasons NNSA has removed all significant quantities of special nuclear material (plutonium and highly enriched uranium) from Sandia and plans to remove all such material from Livermore by 2014.

The Nevada Test Site

Located 65 miles north of Las Vegas, NV, the Nevada Test Site maintains the capability to conduct underground nuclear testing; conducts high hazard experiments involving nuclear material and high explosives; provides the capability to disposition a damaged nuclear weapon or improvised nuclear device; conducts non-nuclear experiments; and conducts research and training on nuclear safeguards, criticality safety, and emergency response. It also performs significant high-hazard work for other agencies.

- Number of Employees: 2,085
- Budget: $0.2 B

The Production Complex

There are four production plants, each performing unique functions:

Pantex Plant, Amarillo, TX

- Function—Pantex dismantles retired weapons; fabricates high explosive (HE) components and performs HE research and development (R&D); assembles HE, nuclear, and non-nuclear components into nuclear weapons; works on and modifies weapons; performs non-intrusive pit modification; and evaluates and performs surveillance of weapons. It also provides interim plutonium pit storage pending completion of a U.S. capability to eliminate surplus pits.
- Number of employees: 3,309
- Budget: $0.5 B

Y-12 National Security Complex, Oak Ridge, TN

- Function—1) Manufacturing and assessing nuclear-weapon secondaries, cases, and other weapon components, 2) dismantling weapons returned from the stockpile, and 3) providing safe and secure storage and management of uranium. Y-12 also supplies highly-enriched uranium for use in the Navy nuclear reactors for submarine and aircraft carrier propulsion.
- Number of employees: 3,820
- Budget: $0.9 B

Kansas City Plant, Kansas City, MO

- Function—Manufactures and procures non-nuclear weapons components, and evaluates and tests these weapons components. Manufactures classified components for weapons and for the secure transportation system that NNSA maintains. NNSA primary non-nuclear production plant.
- Number of employees: 2,379
- Budget: $0.5 B

Savannah River Site, Aiken, SC

- Function—Three core mission areas: 1) performs loading, unloading, and surveillance of tritium reservoirs, and provides tritium reservoirs to meet the requirements of the Nuclear Weapons Stockpile Plan, 2)

conducts Stockpile Evaluation Program and 3) extracts tritium produced at the Tennessee Valley Authority reactors. Also performs tritium related research and development.
- Number of employees: 1,382
- Budget: $0.3 B

Complex Transformation

NNSA plans to modify weapons complex according to a "preferred alternative" which has been subject to extensive review and public comment. It would maintain all of the existing sites, but would shrink the floor space devoted to weapons work from 35 million square feet to 26 million square feet.

The NNSA approach would consolidate functions (especially at the laboratories) to avoid duplication. Specifically:

- Non-nuclear design and engineering and major environmental testing, now done at all three labs, would be consolidated at Sandia.
- Plutonium work, now done at both Livermore and Los Alamos, would be consolidated in Los Alamos.
- High hazard testing, now done at all three laboratories and the Nevada Test Site, would be consolidated to Nevada.
- New supercomputing platforms would be at Los Alamos and Livermore, rather than all three laboratories.

Both Los Alamos and Livermore would retain nuclear design and engineering responsibilities in order to provide for peer review.

The production complex would be modernized in place, with significant consolidation, especially at Y-12. Several major new nuclear facilities would be built, including a plutonium pit production capability at Los Alamos, a Uranium Processing Facility at Y-12 in Tennessee and a Pit Disassembly and Conversion Facility for eliminating surplus pits (this facility at Savannah River is separate from complex modernization but will compete for funds).

1. Sandia includes two laboratories; a larger facility in New Mexico and a smaller facility adjacent to the Lawrence Livermore National Laboratory in California. Sandia also operates the Tonopah Test Range for flight testing of gravity weapons.

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Minimum Requirements for Maintaining the National Laboratories and the Intellectual Infrastructure

Linton F. Brooks

Summary. The Commission has concluded that the three weapons laboratories are a crucial—perhaps the most crucial—part of the nuclear infrastructure and that their health must be assured. This paper discusses the size, number and activities necessary at the weapons laboratories to ensure their continued health. Although this paper focuses on the laboratories, it is important to recognize that "intellectual infrastructure" includes more than laboratory scientists. A true responsive infrastructure requires development and production engineers at both laboratories and production plants.

How Large Must the Laboratories Be?

There is consensus that the overall capabilities of the laboratories are crucial to the weapons program and to the nation. In their interim report, the Commission noted that

> The Department of Energy's laboratory system provides invaluable support to the nation in three ways. First, it actively maintains the safety, security, reliability and effectiveness of the stockpile over the long term. Second, the system is the wellspring of the talent and tools needed to address a multitude of national problems, such as nonproliferation research, nuclear threat reduction, nuclear forensics, bioterrorism defense, missile defense, countering improvised explosive devices, nuclear energy, and alternative energy options.

> Finally, the system plays an important role in maintaining the intellectual scientific leadership of the United States.

There is, however, no consensus on the minimum total laboratory size needed to preserve those capabilities. NNSA has established a goal of reducing the number of laboratory personnel funded by the weapons program by 30 percent.[1] There is, however, no analytic basis for this reduction. NNSA does not know whether such a reduction would leave the weapons program too large or too small.

The absence of an agreed minimum level for the laboratories raises several dangers. First, the United States could inadvertently reduce laboratory capabilities below some tipping point, after which it would be difficult to design weapons if there is a future requirement to do so (or, less likely, where it would be difficult to continue to maintain an effective Stockpile Stewardship Program). This would remove an important hedge against an uncertain future. Second, in seeking to avoid this outcome, the United States could maintain more capability than needed, thus diverting resources from other important weapons capabilities. Finally, not having some standard for what is required leaves NNSA and the laboratories vulnerable to the charge that we simply seek the largest laboratory complex we can get. A reaction to this belief could be for Congress to reduce laboratory funding in an uncoordinated and unacceptable fashion.

The situation is complicated by the fact that it is not simply the number of people associated with the weapons program that matters, but the maintenance of specific critical skills in a variety of disciplines. In addition, it takes a decade or so beyond earning a Ph.D. in physics (or some other relevant technical field) before laboratory workers take on independent responsibilities for nuclear weapons design or surveillance tasks. Thus, the analysis of requirements is a difficult and complex task.

There has been analysis of some specific areas such as weapons designers and radio-chemists, but we lack any agreed understanding of how many people of what expertise are required. Such an agreed understanding could allow more aggressive attempts to ensure that funding and laboratory assignments are sufficient to maintain an acceptable (though minimal) enduring capability. As the EWG noted in an earlier paper, "the Executive Branch [should] conduct a rigorous study to determine the minimum size (by discipline), that the national laboratories need to maintain and support the weapons program." We reaffirm that recommendation.

An important—and difficult—issue is who should conduct such a study and how it should be managed. While laboratory participation is clearly required, a study conducted by the laboratories without external validation could lack credibility both with Congress and with portions of the

Executive Branch such as the Office of Management and Budget. In EWG paper 3—Nuclear Weapons Personnel Expertise (based on the September 2008 *Defense Science Board Task Force on Nuclear Deterrence Skills*)—the EWG endorsed the following approach:

- The Secretary of Defense, along with the Secretaries of State, Energy, and Homeland Security and the Director of National Intelligence should lead the development of a clear U.S. vision and strategy for nuclear deterrence.
- The Secretary of Defense should then establish nuclear requirements for capabilities, including nuclear competencies, force structure and programs for the next twenty years, using the Nuclear Posture Review (NPR), and should provide requirements for NNSA planning.[2]
- The NNSA Administrator should make development of capabilities and competencies an explicit part of NNSA planning.

This process should include establishing the minimum required size of the weapons program. In one possible model, the Advanced Strategic Computing (ASC) program recently attempted to analyze needs for the entire program. This was driven by continued erosion in funds for that element of the weapons budget. The program assembled a group of outside experts, (including some with little weapons experience but knowledgeable of the business of high-performance computing). The laboratories provided initial recommendations on the numbers of required personnel in various aspects of ASC activity and then the assessing group reviewed their process and results.

Based on this apparently successful experience, NNSA should form a special task force with heavy participation of retired weapons experts to assist in evaluating laboratory proposals for the minimum necessary size for the weapons program. The results should be reviewed (as a form of "sanity check") by non-NNSA entities such as the Defense Science Board or the Strategic Advisory Group (SAG) of the U.S. Strategic Command. Following these reviews, the Secretary of Energy, based on the recommendations of the NNSA Administrator, should formally promulgate these minimum standards. The Congress should require that annual NNSA budget submissions include an assessment of whether the budget as proposed will maintain these minimum capabilities.

It will be important to allow flexibility to make adjustments in both numbers and type of skills as technologies change (new technologies and techniques are developed) and the threat evolves in ways we may not anticipate. Such changes will need to be transparent to the Congress.

One Physics Lab or Two?[3]

Livermore and Los Alamos are design laboratories that each focus on the physics package of nuclear weapons (Sandia, often referred to as an engineering laboratory, concentrates on components outside the physics package). Periodically questions are raised about the need for two physics laboratories. Two separate laboratories provide peer review in the one area—the functioning of the physics package—that we cannot test and where our theoretical understanding remains incomplete. Such peer review will be even more important if, as many expect, the United States ratifies the Comprehensive Test Ban Treaty in the future.

It is, of course, possible to create a form of peer review within a single organization (Sandia National Laboratory has done this, for example). But even if we were convinced that true peer review could exist in a singe organization, the benefits from combining the two physics laboratories are illusory. There are unique facilities at both Los Alamos (plutonium, DAHRT) and Livermore (NIF) that the weapons program requires and that would be prohibitively expensive to duplicate. Thus, a new "single" design laboratory would need to maintain both the California and New Mexico facilities, drastically reducing any anticipated savings. Some efficiencies might accrue from common management, but these are likely to be small and not worth the disruption. This is particularly true because both laboratories are completing a period of transition to new management arrangements after decades of being operated by the University of California. The transition has been turbulent and what both Los Alamos and Livermore need now is stability. The approach set forth above for determining the minimum needed to support the weapons program, is a better approach to eliminating redundancy.

What Must the Laboratories Be Allowed/Required to Do to Maintain Proficiency?

The right number of people with the right skills and educated in the right disciplines is a necessary but not sufficient precondition for maintaining proficiency. Those skills must be exercised. This requires meaningful work that involves the entire nuclear weapons complex, including both the laboratories and the production plants. Just like scientists, development and production engineers need to be exercised if they are to maintain proficiency. Indeed, some argue that these engineers are more important than production facility rebar and concrete in maintaining a responsive infrastructure. Reestablishing production engineering capabilities (if lost) has a long response time. All examinations of the nuclear enterprise have concluded that there is no substitute for real and challenging work in maintaining proficiency. As

the Defense Science Board noted in describing the historic approach to maintaining proficiency:

> The other reality check was the continuous design, development, production, and surveillance cycle for new weapons....The vast majority of the technical people in the nuclear weapons complex were engaged in this cycle. While nuclear testing was supremely important, the vast majority of data collected to assess the quality of the weapons came from non-nuclear product acceptance testing at the production plants and surveillance testing throughout weapon life. Rigorous product testing provided continuous feedback on the competence of the people who designed and produced it. Knowledge and experience in weapons design is the keystone that supports decisions on all other the elements of the mission. **Decisions on how to resolve technical problems in production, surveillance, or dismantlement have to be rooted in a thorough understanding of the design.** [emphasis added][4]

The Bush Administration's approach to implementing the need to maintain proficiency was to proceed with the cost and feasibility study (and, almost certainly—assuming support from Congress—with the ultimate deployment) of the Reliable Replacement Warhead (RRW).[5] This is not the only approach that could be taken. For example, Richard Garwin advocates that:

> Substantial nuclear design and capability should be maintained at the national labs….the system ought to be challenged every five years with a competition for the design of simplified nuclear warheads, including a much broader range of options, such as the total elimination of plutonium from U.S. nuclear weapons.[6]

In his briefing to the Commission, Dr. Garwin suggested that these efforts might lead to prototypes but should not necessarily lead to deployment. It is unclear whether the necessary creativity will be forthcoming from the design and production engineering communities for designs that are not actually planned for production. While Dr. Garwin's solution may have a long term role, the Infrastructure EWG believes it would be preferable to move forward with development of modified designs that can actually be deployed. If it proves infeasible to move forward with an enhanced safety, security, and reliability design for a replacement W76, the recently announced modernization of the B61 bomb should serve as a mechanism for exercising the necessary design and production skills, including those associated with a new plutonium pit.

The Importance of National Leadership

None of the steps implied by the discussion so far will succeed over the long term without support from senior leadership, including the President and

the Secretaries of Defense and Energy. As a recent Defense Science Board report noted:

> **In both the short and long term, retention of the right caliber technical staff for the mission will depend significantly on staff perception of the national importance of the mission and the amount of time they are allowed to spend on the technical aspects of the mission.** A number of staff interviewed perceived the nuclear weapons enterprise as a declining industry. [emphasis in original][7]

The Infrastructure EWG strongly endorses this view, which is also one of the fundamental conclusions of the recent Schlesinger panel.

The Bottom Line

The Commission should consider making the following recommendations to the Congress:

1. That the Congress direct the Administration to conduct a review of the minimum size of the weapons program after the Nuclear Posture Review has established the size of that program, that it require the annual budget submission to indicate whether the budget as proposed will maintain these minimum capabilities, and that it ensure the funding necessary to sustain that program.
2. That the Congress reject any consideration of eliminating one of the existing weapons laboratories.
3. That the Congress support the development of modified designs to ensure the safety, security and reliability of specific U.S. warheads with the intent, inter alia, of maintaining the design and production engineering capabilities of the nuclear weapons enterprise.
4. That the Congress firmly endorse and urge the President and the appropriate cabinet officers to make it clear that the maintenance of an effective nuclear weapons complex, including maintaining a design capability, is an important national goal.

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1. This is *not* the same as reducing the overall laboratory by 30 percent, although it has been misinterpreted as such. NNSA assumes that many of these individuals will remain at the laboratory but will be funded by other programs. This is one aspect of the NNSA attempt to convert the weapons laboratories to national security laboratories. As the EWG made clear in an earlier paper (EWG paper 1—Arrangements for broadening support for the weapons laboratories), NNSA efforts to implement this new approach have thus far been insufficient. Further, it is unclear the degree to which NNSA assumes these individuals could return to the weapons program if required. Some EWG members are skeptical of any concept that assumes these individuals would serve as some form of "nuclear weapons program reserve."
2. Past NPRs have not provided this level of detailed guidance. The forthcoming one needs to do so.

3. The argument in this section was previously made in EWG Paper 12—Miscellaneous Issues for the Commission. It is included here for completeness.
4. *Defense Science Board Task Force on Nuclear Deterrence Skills,* September 2008, page 26.
5. The term "Reliable Replacement Warhead" most appropriately refers to a concept for modifying existing warhead designs to enhance safety and security and improve performance margins and thus reliability. The past Administration planned the initial RRW development as a replacement for some of the W76 warheads on the Trident II submarine launched ballistic missile.
6. Richard L. Garwin, "A Different Kind of Complex: The Future of U.S. Nuclear Weapons and the Nuclear Weapons Enterprise," published on Arms Control Association (http://www.armscontrol.org/act/2008_12/Garwin), page 7.
7. *Defense Science Board Task Force on Nuclear Deterrence Skills,* September 2008, page 25.

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Alternatives to the Current NNSA Model

Linton F. Brooks

Summary. This paper examines alternatives to the current organizational location of NNSA. The primary (but not the only) reason for considering these alternatives is to improve performance of the plants and laboratories by reducing unnecessary and obtrusive DOE/NNSA oversight and regulation.

Background. At their September meeting in Livermore, the Commission was briefed that there are numerous reports of excessive regulation by DOE/NNSA that increases overhead costs and reduces morale and efficiency. In theory, a semi-autonomous NNSA could act to reduce excessive regulation. In practice, this has proven exceptionally difficult. Because attempts to reduce intrusive and excessive oversight and regulation within DOE have been unsuccessful, it may be appropriate to consider different organizational arrangements, including removing NNSA from DOE. The Commission asked the Infrastructure Working Group to consider alternative models that might reduce the burden of regulation and thus reduce the overall cost and increase the overall effectiveness of the weapons program.

Will moving NNSA yield significant improvements? It is important to recognize that we do not *know* that removing NNSA from DOE will actually reduce the regulatory burden on the plants and laboratories. In 2005, a Defense Science Board Task Force examined production at the Pantex plant and concluded that excessive regulation originating outside NNSA but within a risk-averse DOE was raising cost and hampering production. An internal review by NNSA leadership concluded that some of the problems lay within NNSA itself. More recently, there has been anecdotal evidence of NNSA micro-management of the new contract at Lawrence Livermore National Laboratory. Organizational changes may be necessary for reducing

the regulatory burden (see discussion below), but may not be sufficient or even the most important factor.

In 2006 and 2007, NNSA conducted a pilot program exempting the Kansas City Plant from essentially all DOE regulations and making other management changes in oversight. Kansas City was selected for the pilot because it conducts no nuclear operations and thus could depend entirely on commercial standards and the contractor assurance system. An external audit documented $24 million in first year savings and estimated future additional savings of $4 million/year.[1] These savings represent about five percent of the Kansas City annual budget. Extending this approach throughout the complex is feasible, although savings at most other sites would not be as high, assuming no change in regulation of high hazard nuclear operations. If the full five percent could be achieved at Sandia National Laboratory (which conducts no nuclear operations) and roughly half that at all other sites, total potential savings would be about $170 million annually. Savings of this magnitude, even if they can be achieved, may not, by itself, be sufficient to justify the disruption of a major organizational change. This is particularly true because external review revealed that "the success of this cost reduction initiative was made possible only by the direct involvement of the highest level DOE and NNSA executives"[2] and the sustainment of such involvement may prove difficult.

Are there other benefits from a different organization? Even if cost savings do not materialize or are insufficient for justifying an organizational change, there are other potential benefits from a new organizational arrangement. Among those sometimes cited:

- Currently the Department of Defense establishes requirements for nuclear weapons with limited regard for NNSA costs and expects NNSA to fulfill those requirements. If NNSA were within the Department of Defense, DOD would be forced to make tradeoffs between weapons requirements and other strategic capabilities. On the other hand, the weapons program could also be used as a bill payer (as would have been likely during parts of the Bush Administration, given the lack of DOD interest in nuclear weapons during most of the past eight years).
- Oversight and inspections by the Defense Nuclear Facilities Safety Board (DNFSB)[3] is widely believed to contribute to the regulatory burden on NNSA facilities. Legislation moving NNSA facilities out of DOE could remove those facilities from DNFSB cognizance. On the other hand, the DNFSB was established to deal with legitimate safety concerns, many of which remain.
- Although NNSA is under the jurisdiction of the Armed Services Committees for authorization, appropriations are handled by the Energy and Water Appropriations Subcommittees of the House and Senate.

> Having two subcommittees (Energy and Water, and Defense) that provide separate appropriations for DOE and for DOD results in significant inconsistencies that might be eliminated were NNSA removed from DOE.[4]

Finally, the Kansas City experience may understate the value of reducing the regulatory burden, especially at the national laboratories. The staffs of all three weapons laboratories believe that the regulatory burden is excessive. That imposes a significant cost, even if the cost cannot be measured in dollars. The existence of numerous DOE directives of varying utility may not be as important as the overall attitude of those performing Federal oversight. Two broad attitudes are often cited as contributing to excessive regulation. The first is the failure of NNSA and DOE to distinguish between what to do (a government function) and how to do it (a contractor responsibility). This attitude leads to overly prescriptive requirements in both DOE regulations and plant and laboratory management and operations contracts. The second unhelpful attitude is the tendency of the government to respond to problems by imposing new rules that will "guarantee" that the problem does not recur. This is particularly noticeable in the area of security, where it is, in part, driven by the tendency of some in Congress to react very strongly (some would say overreact) to security problems at weapons laboratories.

Can the regulatory burden be reduced without moving NNSA? In principle, as the Kansas City pilot demonstrates, it should be possible to reduce micromanagement within the existing structure. Although NNSA was formed in response to security problems, the Administrator has, in theory, broad authority over all areas of operation, including the power to exempt NNSA from DOE regulations and to substitute NNSA-specific procedures.[5] In practice, however, using the flexibility intended for a separately organized or "semi-autonomous" Administration has proven difficult. Some illustrations:

- During the first term of the Bush Administration, the DOE General Counsel effectively prevented any NNSA actions exempting NNSA from any DOE regulations, arguing any such action required DOE staff concurrence.
- In 2005, the incoming Secretary surveyed senior non-NNSA officials[6] concerning the NNSA Act. All opposed the NNSA Act as written, primarily because it denied them the ability to provide direction to NNSA. This attitude was equally strong among political appointees and within the career staff.
- In 2005, as noted earlier, a Defense Science Board Task Force examined production at the Pantex plant and concluded that excessive regulation originating outside NNSA in a risk-averse DOE was raising cost and hampering production. Although the Task Force specifically attrib-

uted the problem to non-NNSA DOE staff, the department limited its response to an intensive review of internal NNSA procedures.
- The Kansas City pilot described above was delayed because of concerns of non-NNSA offices over exempting Kansas City from regulations for which they had responsibility. Although the initial intention was to extend the pilot to other NNSA sites if successful, it now appears this will not happen because of objections from non-NNSA offices.

Despite excellent working relationships in some areas, implementation of the NNSA Act and maintaining NNSA autonomy require constant, low-level bureaucratic warfare. Some would assert that the NNSA approach has not so much failed as it has never been tried. Improvements in this situation would require both vigorous action by NNSA leadership to shift oversight to a less intrusive approach and a strong, activist Secretary of Energy who wanted to increase NNSA autonomy. The presumptive Secretary of Energy, Steven Chu, is deeply familiar with the DOE laboratory system but has essentially no experience with the nuclear weapons program. His attitude toward NNSA is not known. In addition, audits and reviews by the Government Accountability Office (GAO), DOE Inspector General, and Defense Nuclear Facilities Safety Board add significantly to the regulatory burden and are not under the control of either the Secretary or the Administrator.

Dealing with the question of attitude. A major driver of micromanagement and excessive regulation is the attitude of the Federal workforce. Without changes in attitude, organizational changes will not solve the problem. An attitude that the Federal workforce knows best is reflected in both unreasonable regulations and excessive oversight in implementing them. Moving NNSA is only justified if it assists in changing this attitude. The following steps appear necessary:

- The Administrator must be committed to reducing micromanagement. This should be a condition of both appointment and confirmation.
- The Administrator must have flexibility to issue regulations without being bound by existing DOE regulations or staff. This implies removing NNSA from its current structure within DOE.
- The Administrator should issue no regulations concerning occupational health and safety but should depend on the Occupational Health and Safety Administration (OSHA) for both regulations and oversight. The Kansas City pilot shows this is feasible.
- The Administrator should manage a transition over a three year period to full nuclear regulation by the Nuclear Regulatory Commission. Jurisdiction of the Defense Nuclear Facilities Safety Board and NNSA oversight of nuclear safety should cease at that point.

Under this approach, NNSA would retain security oversight (since there is no logical external body to provide such oversight), oversight of contracting,

and of construction management. Because this revised oversight model should require a smaller Federal force, not all NNSA employees would transfer to the revised organization, wherever it is located. Those to transfer should be selected, in part, based on their understanding and acceptance of the need to reduce Federal micromanagement and on their commitment to the distinction between the government's duty to determine what is to be done and contractor's responsibility to decide how to do it.

Issues with any major organizational change. Some issues must be dealt with if any significant change is to be implemented, especially one removing NNSA from DOE. The first is which functions move with NNSA and which do not. In addition to the weapons program, NNSA is responsible for a large nuclear nonproliferation effort and (at least formally) for the Navy nuclear propulsion program. The nuclear propulsion program has a dual reporting structure to both the Navy and DOE. It requires limited supervision from NNSA, is exempt from most DOE regulations, and has a fifty-year history of exceptionally sound management. Prior to the establishment of NNSA the naval propulsion program reported to the Assistant Secretary for Nuclear Energy; reestablishing that relationship would be easy and is the obvious choice.

What to do with the nonproliferation program is less clear. It could remain within NNSA even if NNSA moves from DOE, could revert to being a separate organization within DOE headed by an Assistant Secretary (as it was prior to the establishment of NNSA), or could be merged with the Defense Threat Reduction Agency, especially if NNSA were shifted to the Department of Defense. Because much (but not all) of the NNSA nonproliferation program involves the national laboratories, it is probably best to retain the program within NNSA, wherever NNSA ends up.

A related issue is the need to identify those functions now being performed by DOE on behalf of NNSA. These include some financial and legal functions, for example. Adequate numbers of people will need to be transferred (or billets authorized) to allow these functions to continue in the separate NNSA.

A third issue involves environmental remediation at NNSA facilities. Under a complex and confusing system, DOE's Office of Environmental Management is responsible for remediation of legacy conditions at NNSA sites (work that is not expected to be complete for another decade) while NNSA is responsible for the environmental consequences of current operations. Because the NNSA Act precludes the Office of Environmental Management from giving direction to NNSA contractors, a parallel chain of command system has been created that is clearly sub-optimal. In 2004, the Administration sought to transfer all environmental responsibilities at NNSA sites to NNSA. Congress rejected this proposal and the second term leadership in DOE elected not to renew it. The current arrangements are too fragile to

work if NNSA is removed from DOE; the obvious solution is to renew the current Administration's 2004 proposal.

A final issue is philosophic. Today, the nation benefits from having two independent voices (Defense and Energy) on technical nuclear issues. Either any future organizational changes should preserve two independent voices by keeping NNSA out of the Department of Defense or the nation should make a conscious decision that the risk of giving up this condition is acceptable.

Not all NNSA problems will be solved by organizational change. Several Experts Working Group (EWG) members believe that NNSA needs greater attention to the inherently Federal functions of program management and strategic planning. Reducing the effort NNSA devotes to oversight may facilitate that greater attention, but it will not create it. There are doubtless many other examples.

Options

Any major change to the current organization will require legislation. One possibility would be to abolish NNSA and return to the integrated DOE organization that existed before 2000. With one exception, the members of the EWG reject this option, believing that the reasons for attempting to provide NNSA with autonomy still pertain.[7] Assuming increased autonomy from DOE to be a goal, the following options are possible:

1. *Strengthen NNSA within DOE.* Under this approach, legislation would clarify the intent of Congress to maximize NNSA's autonomy. It would establish a separate Chief Financial Officer, mandate a separate NNSA budget,[8] mandate that DOE regulations apply to NNSA only if either the Administrator desired them to or the Secretary specifically directed their applicability in each individual case (with a legislative presumption that they would not apply), and allow the Administrator to determine both the timing and scope of inspections by the DOE oversight organization. These changes would allow a determined Administrator to change the oversight model in NNSA. They would also almost certainly increase friction between NNSA and the rest of the Department. They would do nothing to encourage DOD to consider the NNSA costs of its requirements, to reduce the burden imposed by the Defense Nuclear Facilities Safety Board, or to eliminate the inconsistencies incident to having NNSA and DOD dealt with by separate Appropriations subcommittees.
2. *Establish NNSA as an independent agency reporting to the President through the Secretary of Energy, in the same way that the former Arms Control and Disarmament Agency (ACDA) reported through the Secretary of State.*[9]

Under this approach, NNSA would have a completely separate budget, would issue its own regulations, and would establish and operate its own internal oversight organization. It would receive intelligence support from DOE and would remain under the jurisdiction of the DOE Inspector General. The Secretary would provide very broad oversight (similar to that now provided by the NNSA Administrator to Naval Reactors) and would serve as the Cabinet level contact with the White House (for example in National Security Council issues or stockpile certification). This option would remove most internal obstacles to a streamlined oversight process at NNSA sites (although establishing such a process would still require strong action by the NNSA Administrator). Like the previous option, it would not lead DOD to consider the NNSA costs of its requirements. If coupled with a shift to external regulation (discussed above), it could reduce the burden imposed by the Defense Nuclear Facilities Safety Board. Properly implemented, it could also eliminate the inconsistencies inherent in separate Appropriations subcommittees.

3. *Make NNSA a Defense Agency, similar to the Defense Advanced Research Projects Agency.*[10] In this option, NNSA would become a Defense Agency but would be headed by a Senate-confirmed Administrator at the Executive Level III (under secretary equivalent) to ensure adequate influence within OSD. This approach would force tradeoffs involving weapons requirements, leave the Defense Nuclear Facilities Safety Board behind, and lead to the NNSA budget being considered by Defense Appropriations subcommittees along with the rest of DOD. It would allow the Administrator flexibility in establishing an oversight model, since DOD has limited experience with Government Owned, Contractor Operated (GOCO) facilities.[11] On the other hand, DOD periodically (including much of the last eight years) ignores nuclear weapons, giving the topic only minimal senior level attention. Having nuclear weapons within the DOD budget may make it too easy to slight long term needs and to use the weapons program as a bill payer. In addition, there are those who question DOD's ability to properly operate world-class multipurpose laboratories like the weapons laboratories. Finally, this option eliminates the independent voices in the process of annual stockpile certification that come from involving multiple agencies. It is noteworthy that the Defense Science Board considered and rejected this option.[12]
4. *Transfer the production complex to DOD while retaining the weapons laboratories and the Nevada Test Site within NNSA.* This option would be combined with either the option to strengthen NNSA within DOE or the option to establish NNSA as a separate organization reporting to DOE.

It is based on the assumptions that production is more consistent with the DOD mission (DOE has no production facilities except for those associated with the weapons program), that DOD culture is ill-suited to managing national laboratories and that the weapons laboratories benefit from ease of association with the other DOE national laboratories. Thus, the Pantex Plant (weapons assembly), Y-12 National Security Complex (uranium components), Kansas City plant (non-nuclear manufacturing) and Savannah River Tritium Facility would transfer to DOD. The plutonium facilities at Los Alamos conduct both production and research. At least initially, they should remain in NNSA on the assumption that the science is the more important mission.[13] Splitting the production complex from the national laboratories would alleviate the concern that the Experts Working Group has that complex modernization will squeeze out funding for science. This option means the interface between research and production will be more complex, but the interface between production and the military's operations of nuclear weapons would be simpler. It encourages better coordination between weapons production (but not research) and other DOD programs. On the other hand, the greatest perceived problems with the current arrangements (or at least the most vocal concerns) are at the weapons laboratories, which would remain within NNSA/DOE.

5. *Establish NNSA as an independent agency reporting directly to the President, similar to the National Aeronautics and Space Administration.* This option would give the Administrator the maximum flexibility to establish a new oversight model. It could be implemented in a fashion that would eliminate the jurisdiction of the Defense Nuclear Facilities Safety Board and shift the NNSA budget to the Defense Appropriations subcommittees. There is a serious question, however, as to whether the nuclear weapons program is seen as important enough politically to receive adequate White House attention if separated from a cabinet department, especially since the NNSA budget is relatively small for an independent agency. Thus, this may not be a practical option. Further, having no Cabinet officer responsible for nuclear weapons issues will inevitably mean that technical and production issues will be given insufficient consideration in interagency deliberations. Finally, on issues of weapons certification, the views of the Secretary of Defense could overwhelm those of the head of a small independent agency.
6. *Replace NNSA with an independent National Nuclear Weapons Agency reporting to the President through a "Board of Directors" chaired by the Secretary of Defense and including the Secretary of Energy, Secretary of Homeland Security, and Director of National Intelligence.* This option seeks to maintain the advantages of the previous option while providing both oversight and "top

cover" for the weapons program. It was proposed by a Defense Science Board (DSB) Task Force in 2006 but was not seriously considered by either DOD or DOE. The Board of Directors would ensure the "fundamental viability of the enterprise" and that its objectives were "clearly defined and achieved."[14] While the DSB was silent on budgeting, it would appear that the new agency would require a separate budget. Otherwise, it will become a *de facto* sub-agency to whichever department provides its budget.[15] This approach relies on a model that is not well understood and has never been attempted by the Federal government. Taking this much of a risk with something as central to U.S. security as the nuclear weapons program would be a major decision.

The members of the Infrastructure EWG all believe that the present arrangement is not working and that strengthening NNSA within DOE (option 1 above) is unlikely to be enough. Most (but not all) members reject a move to DOD (option 3) as tending to submerge the weapons program in a large department focused elsewhere, risking neglect and underfunding. Most (but not all) members also reject transferring the weapons production complex DOD (option 4) because we believe that integration of production and science will be more, not less, important at low production rates. Finally, we see having NNSA report through a "Board of Directors" (option 6) as unsustainable in the long term. Therefore, the majority of the EWG recommend that NNSA be established as an independent agency reporting to the President either through the Secretary of Energy (option 2) or directly (option 5). Reporting through the Secretary of Energy is preferable, but only if the necessary autonomy can be assured.

Recommendations

The Strategic Posture Commission should recommend the following:

1. *That the Congress amend the NNSA Act to establish NNSA as a fully separate agency reporting to the President through the Secretary of Energy.* The legislation should include the following provisions:
   - That DOE regulations will not apply to NNSA and that the Administrator should issue appropriate regulations without external approval.
   - That the Administrator should issue no regulations concerning occupational health and safety but should depend on the Occupational Health and Safety Administration (OSHA) for both regulations and oversight.
   - That NNSA will be responsible for all environmental management, including legacy remediation, at NNSA sites.

- That the NNSA budget will be administered completely separate from the budget for the Department of Energy. To implement this separation, the NNSA budget should be considered by the defense appropriations subcommittees of the House and Senate Appropriations Committees, thus ensuring both expertise and concern for defense issues.
- That the NNSA Administrator and the Nuclear Regulatory Commission will jointly prepare and implement a plan for a three year transition to NRC regulation throughout the NNSA weapons complex.
- That once the Administrator and the Commission certify to the Congress that this transition is complete, Defense Nuclear Facilities Safety Board jurisdiction over NNSA will cease.
- That the Inspector General of the Department of Energy be assigned a dual position as Inspector General of NNSA with either the Secretary of Energy or the NNSA Administrator empowered to request an investigation by the Inspector General.
- That with the exception of the Inspector General and intelligence support, the new organization be self-contained and not depend for services or support on the rest of DOE.
- That the NNSA Administrator be designated an advisor to the National Security Council and attend NSC meetings when issues under NNSA's responsibility are being discussed. This would be similar to the procedures that applied to the former Director of the Arms Control and Disarmament Agency.[16]
- That the Secretary of Energy will retain his or her responsibilities with respect to stockpile certification and that the Administrator be obligated to provide the Secretary and those members of the DOE staff the Secretary designates with access to all information necessary to aid the Secretary in carrying our his responsibilities.[17]
- That, three years after the effective date of the new changes, the Government Accountability Office (GAO) should formally evaluate whether the necessary independence from DOE has been achieved. If it has not, Congress should consider having NNSA report directly to the President.

2. *That the Senate ensure during confirmation that the next NNSA Administrator and his or her confirmed Deputies are committed to reducing micromanagement, to maintaining the distinction between the government responsibility for deciding what is to be done and the contractor responsibility for deciding how to do it, and to the GOCO model of operations.* To ensure this, the Administrator should commit to a review of all individuals with oversight responsibilities prior to approving them for transfer to the new organization. The Administrator should also commit to reporting to

Congress on the number of positions to be reduced by the changed oversight.[18]

3. *That none of the changes discussed above apply to Naval Reactors, which should retain the current procedures set forth in the NNSA Act.* Congress could specify this policy in the legislation or could return Naval Reactors reporting to the Assistant Secretary for Nuclear Energy. The Director of Naval Reactors should be consulted in deciding which option to mandate.

Risks. The EWG recognizes that there are risks and difficulties with these recommendations. At a time when the nation's focus should be on the fundamental purposes of the weapons program, they could divert Congressional attention to organizational and turf issues. The nation faces a number of nuclear policy issues that will be resolved over the next 1-2 years. Moving forward on organizational change prior to resolving those issues has risks, although delay perpetuates the problem and risks a loss of focus. Disentangling NNSA from DOE is more complex than we suggest.[19] Further, Congressional action could result in changes quite different from those proposed in this paper. In addition, some fear that moving NNSA could lead to funding drying up. Finally, organizational changes can aid and empower leadership but cannot substitute for it. The success of this proposal will depend on sustained leadership from the next NNSA Administrator and Deputy Administrators. But success could make a major improvement in the effectiveness of the nuclear weapons complex and there is no better time than the start of a new Presidential Administration to begin.

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1. J.W. Biber and Associates, Kansas City Site Office Oversight Plan: Assessment of Implementation Cost Savings, January 2008. All costs are in FY 2006 (deescalated) dollars.
2. Ibid., p. 55
3. The DNFSB is a board of Senate-confirmed safety experts that was established in the 1990s to provide oversight of safety in defense-related DOE facilities.
4. The Office of Management and Budget handles the NNSA budget in the National Security Division, separate from the remainder of the Energy Department.
5. Section 3212 (d) of the NNSA Act provides that "The Administrator may establish Administration-specific policies, unless disapproved by the Secretary of Energy."
6. These included the General Counsel, Chief Information Officer, head of Human Resources, Chief of Staff, Chief Financial Officer, heads of Congressional and Public Affairs, and Safeguards Security and Performance Assurance (DOE's internal oversight organization).
7. In a separate paper, the EWG recommends broadening the base of support for the weapons laboratories. We accept that increasing NNSA independence will make this goal more difficult with respect to support from the rest of DOE.
8. The Office of Management and Budget treats the NNSA budget as distinct from that of the rest of DOE, but the Secretary retains—and has occasionally used—the ability to shift funds between the two budgets.
9. Although ACDA reporting through a cabinet office illustrates the relationship proposed in this option, it is important to note that ACDA was a pure policy organization and thus the day to day relationship between State and ACDA may not be an appropriate model.

10. The nuclear weapons program was established outside of DOD to ensure adequate civilian control of nuclear weapons at a time when the Department of Defense (and its predecessors) was dominated by uniformed officers. With the strong civilian control of the modern DOD, this anachronistic issue should not be a bar to a transfer to DOD.
11. Some arsenals operate on the GOCO model, although they do not perform nuclear operations. DOD operates shipyards conducting nuclear work but they are either operated by government employees or privately owned and subject to less prescriptive oversight. Even the legendary strong oversight by Naval Reactors primarily focuses on ensuring contractors follow their own procedures rather than prescribing specific procedures.
12. Report of the Defense Science Board Task Force on Nuclear Capabilities, December 2006, pp. 29-30.
13. The contract with Los Alamos allows the government to break out these facilities for separate management, which would facilitate a future decision to shift the plutonium facilities to DOD.
14. Report of the Defense Science Board Task Force on Nuclear Capabilities, p. 31.
15. This was the experience of the Onsite Inspection Agency established in the 1980s. It was to be under interagency supervision but was funded by DOD. It rapidly became a pure DOD agency and was ultimately absorbed into the Defense Threat Reduction Agency. The parallels are not exact, but they are suggestive.
16. This proposal was not included in the draft of the paper presented to the Commission and is thus not included in the Commission's final report.
17. This will ensure that the Secretary has access to the same information on certification that he has today.
18. As noted above, although the number of Federal employees doing oversight will reduce, some functions now being performed by DOE will need to be established in the separate NNSA.
19. Two obvious examples: NNSA transports all nuclear material for the entire DOE and some NNSA facilities are located within larger DOE sites.

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Arrangements for Broadening Support for the Weapons Laboratories

Harold P. Smith

Introduction: A Precarious Situation

All is not well with the weapons laboratories. If a CEO of an established corporation were to examine the markets available today to LANL, LLNL, and SNL, s/he would be appalled. The laboratories provide and maintain essentially one product that is purchased by NNSA,[1] whose independence of DOE is strained; for DOD, a customer only mildly interested in the product; under an ill-defined policy by a (now) lame duck administration. To make matters worse, appropriations for the product are provided by committees of Congress whose primary interest is directed elsewhere, and although not specifically cited in the FYNSP (Future Years National Security Program), it is widely believed, although unsubstantiated, that the laboratories face a 30% reduction in funding over the next (very) few years. During these years, the new administration will face the largest national deficit in history and the largest recession since 1929. It follows that constant, let alone increased, funding under the present conditions, even if the new administration were so inclined, would not be a high priority and would not receive active consideration anytime soon. The situation is bleak; what to do?

Because nuclear weapons represent, for the foreseeable future, the last line of national defense, in an increasingly fragmented and dangerous world, simple acceptance of the bleak forecast does not seem responsible. A reduction in staff of 30%, in a situation where the government has decided against testing its weapons and must rely, therefore, on the capability of that staff and its resources to maintain the deterrent, is a serious question, deserving

of careful examination.[2] In the interim, however, a significant reduction in staff will adversely affect the pool of talented personnel having the special skills associated with the arcane world of nuclear weapons. Recruitment will be difficult; the best of the younger staff will seek employment elsewhere, and the best of the older staff, some of whom designed the weapons in the present arsenal, will look forward to early retirement and a second career. Morale and, with it, capability will plummet. A better way to maintain the present staff must be found, but where to look?

Because it is widely assumed that a nuclear weapon in the wrong hands is the foremost challenge that the United States faces,[3] one would think that laboratory personnel, facilities, and experience should be forcefully brought to bear and given a wider mandate than just the weapons themselves. Nuclear weapon intelligence, forensics, detection, verification, cooperative reduction, and avoidance of technological surprise are certainly appropriate; even more diverse areas could be considered.[4] These all involve highly sensitive information and require commensurate security, which the laboratories are equipped and administered to handle. Occasionally, such endeavors require careful meetings with foreign nationals. Laboratory personnel are experienced and skilled in this as well. What is lacking is the mandate and support of those agencies having such responsibilities to provide the necessary long-term, significant commitment.

Develop a Strategic Plan

That same (appalled) CEO, before closing the operation, would take a straightforward business approach and develop a strategic plan:

- Define the strategic advantages and disadvantages facing the three laboratories.
- In areas where there are strategic advantages, define the major missions and the customers, who should invest over a long term in laboratory infrastructure and staff.
- Describe the work that would be performed to fulfill those missions.
- Define the infrastructure, both existing and required, that is needed to accomplish the work.
- Systematize, reduce, and properly allocate direct and indirect costs.
- Organize to meet the needs of the potential (and established) customers.

Although such an approach is reminiscent of "your management accepts with enthusiasm, the challenges of a changing market"[5]—just before going out of business, a widely accepted strategic plan is the necessary first step towards justifying broader and sustained support for the weapons laboratories.

Once the three laboratories have developed and coordinated an institutional plan among themselves, the responsibility should shift to NNSA for coordination within all the national laboratories and, most importantly, for obtaining broader support within the federal government and the Congress. It is here that the Commission plays the key role.

Outside Investment Cannot Be at the Margin; Infrastructure Must Be Supported

In the days when nuclear weapons were being designed and tested in a near-continuous process, the laboratories operated under a few, very large contracts, which at the margin, supported WFO (Work for Others) in areas of national interest at relatively low cost to the sponsors. Such work was permitted but not encouraged. Those days are gone. Now, the concept—even the title—of WFO no longer applies. If the weapons laboratories are to become national laboratories, all sponsors must pay their share of the total costs. There should be no work at the margin and there should be no "others"—all sponsors will have to be treated equally.[6]

Laboratory personnel are well aware of the uniqueness of their skills, broadly defined, and are cognizant of those federal agencies that should support national efforts that need those skills. In fact, support from appropriate agencies across the spectrum of needs and capabilities already exists for many groups within the laboratories, but these are small, short-term, disjointed, and funded at the margin. They will remain so unless and until the heads of the potential funding agencies can be convinced to make major, long-term funding commitments, to include investment in infrastructure, in their particular areas of responsibility. Because such a commitment reduces the flexibility of their agency, and because the present arrangements meet their near-term needs at minimal cost, there is little incentive for them to change the mode of operation. Thus, a higher authority will be required and is discussed below.

What is not needed and, in fact, must be avoided is an attempt to mimic the entrepreneurial style of private companies that provide analyses and services to the federal government on a wide variety of subjects and whose modus operandi is assembling a large number of small contracts often based on personal familiarity with mid-level federal officials. While there is nothing inherently wrong with this approach, it is not consistent with the role of a national laboratory, nor would the laboratories be particularly competitive, having high overhead, bureaucratic complexity, and lacking proximity to Washington. In short, the laboratories are unique and must succeed or fail in the broader areas of national interest only to the extent that they can demonstrate the usefulness of their uniqueness.[7] Accordingly, the directors of the weapons laboratories have established the following criteria for seeking support from a broader range of agencies; viz., projects should be:

- "synergistic with the Laboratory mission
- of national importance; and
- done with excellence using unique Laboratory capabilities."[8]

While the Expert Working Group endorses these criteria, it recognizes that enforcement is not an easy matter.

Proper Allocation of Costs

In the era of WFO, assessment of costs to the "others" could be characterized as "collegial." In the new era of broader support, the need for assessment of total costs associated with the expanded responsibilities must be on a more business-like basis.[9]

Agencies cannot be asked—or required—to support major projects at the laboratories unless they can be assured that the funding is properly estimated and allocated. This comes as no surprise to the laboratories. The need is recognized, and procedures are being put in place, but changing long-held cultures takes time, and time is now of the essence.

Reduction of Overhead

Assessment of a fair share to non-NNSA work could not come at a worse time. Overhead rates, which are already high in comparison to the defense industries, will be driven even higher; thus making it more difficult for sponsors to justify to Congress a large and long-term commitment to support laboratory work. Simply put, the current overhead rates must come down, which can be done, but only if there is a sea-change in the managerial culture. In particular, safety and security at any price will have to give way to criteria that includes productivity, a truly difficult task, given the intense public and congressional scrutiny under which the laboratories operate.[10] Fortunately, all three laboratories now have industrial partners. All are experienced in other defense areas in providing safety and security in hazardous environments that seem to be acceptable in the public domain. The partners, with NNSA support, should, therefore, take the lead in reducing the overhead and be willing to defend more balanced security procedures publicly. Federal and congressional support will be both critical and difficult.[11]

Broader Support within the Federal Government

The Department of Energy and NNSA have sought to facilitate broadening support by designating Los Alamos, Livermore, and Sandia as "national security" rather than nuclear weapons laboratories:

> NNSA, its national security laboratories, and the test site have reached a consensus that their future mission is not limited solely to the historic nuclear weapons core mission, but rather is one encompassing the full spectrum of national security interests. The broad range of research and development activities at the NNSA laboratories, which include sensor and detection technology, high-performance computing, microsystems, chemical and biological technology, and explosives science, will continue to ensure that the nation is equipped to deal with technological surprises and anticipate new national security threats.[12]

In essence, NNSA plans to expand the mission of the laboratories to be broader national security facilities, using additional business to maintain laboratory capacity. Although the concept is reasonable, implementation has been minimal and at low level. Major procedural changes and high level support (both addressed herein) are required,[13] and even so, it is not clear that the necessary infrastructural improvements can be supported by this means. Although substantial funding already comes from outside the weapons program, it should be noted that all major improvements in capacity have been funded from within. As the Commission was briefed by the laboratory directors during their September meeting at Livermore, what is required is not a series of small projects but a few, large, sustained efforts that will support capability building; i.e., infrastructure. Such a change will require strong, high level support, and thus far, there has been no indication within DOE to shift funding, no attempt to use the head of DOE's intelligence office to gain new support from the intelligence community, and no indication of any high level effort to engage other cabinet departments. Today, the concept of "national security laboratories" is a concept—and little more.

Examples of Broader Support of Infrastructure

Two examples are given below. A third, assessment of intelligence related to nuclear weapons, is conspicuously absent—for reasons of classification —not because it lacks importance or already has broad, long-term funding.

High-performance computing

The weapons laboratories lead the world in the development and application of high-performance computers (aka, super-computers), which are essential for maintaining the nuclear arsenal. With their graphical capability to display results of enormously complex calculations, high-performance computers are not limited to the world of nuclear weapons.[14] Indeed, they have been and should continue to be applied to a wide variety of challenging technical problems such as understanding global climate change, alternative energy research and medical research (e.g., HIV-AIDS research and designing new

pharmaceuticals.) Over the past four decades, the NNSA laboratories have been at the forefront of conducting the basic research in computational science, developing the computing and networking technology as well as the software and algorithms, and applying high-performance computers to these and other non-weapons "grand challenge" problems. But in an environment where there is no concept of a "depreciating asset," how does one charge other agencies for the development and use of these very expensive high-performance computing environments, or conversely, how will NNSA convince other agencies to help pay for future development?

Nuclear forensics

Because radio-chemistry and related fields were central to measurements required in the testing of nuclear weapons, the laboratories are, by far, the greatest repository of the those skills and equipment. While testing may have come to an end, the need for nuclear forensics has not. If proliferation of fissile material and weapons using fissile material is to be deterred, the United States and its allies must be able to assess the source of interdicted fissile material and the debris from detonated material rapidly and accurately. Furthermore, this capability cannot be minimally funded; it must be well known and exercised if would be proliferators are to be deterred. While there should be no doubt that such work must be supported by those agencies responsible for preventing and containing nuclear proliferation, formal procedures and significant funding for the laboratories have been slow to materialize.

There are alternatives to establishing inter-agency control of funding the weapons laboratories. The first is a series—a very long series—of MOUs between and among NNSA and all the other players. Experience suggests that a workable set of such MOUs is beyond credulity and even if it were possible, would not be in place on a time scale necessary to retaining a vibrant set of weapons laboratories. The Expert Working Group advises against taking this path—as does the Townsend-Kerrick Task Force.[16]

A second alternative is simply to increase the funding for NNSA and to broaden its charter to include the national security health of the laboratories. While the simplicity is admirable, the likelihood of success, given the broad mission areas that extend well beyond NNSA or DOE and given the fiscal turmoil that can expected in the next few years, seems small.

Changes within the Congressional Reporting Structure

It is clear that the appropriation committees that oversee the NNSA budget are focused elsewhere and that the appropriation committees directly concerned with national security should have this task. It is equally clear—even for a congressionally created commission—that a call to reorganize congres-

sional committees, no matter how clarion, will fall on deaf ears. While the call should be made, an alternative should be considered; viz., the transfer of NNSA from DOE to DOD where budgets are overseen by committees directly concerned with national security.[17] Such a suggestion has been studied time and again over the decades and under a variety of rubrics but always with the same result: nuclear weapons should remain with DOE. Nonetheless, times have truly changed, the Cold War is over, and the mission of the weapons laboratories should, by no means, be what it was. Perhaps, the time has come for a change commensurate with the times.

Primary Conclusion

The time is now for a duly constituted congressional commission to redefine the role of nuclear weapons and the complex that supports them. The election of 2008 provides a rare opportunity to recommend changes that could only be implemented in the fluidity that marks the end of an eight-year administration and the beginning of new administration of a different party which will have control of both the executive and congressional branches, and where cabinets and their secretaries, will be looking for new and better ways to manage the responsibilities that they will soon undertake.

There appear to be only two options for maintaining long term investment in the laboratories. One is to assign NNSA responsibility for national security health of the laboratories and to fund NNSA accordingly. A second is NNSA/DOD/DHS/IC formal joint responsibility for laboratory health. This second option needs strong support, coordinated by the NSC, from the senior leadership of DOE, DOD, DHS and Intelligence Community. The latter, while being more complex, offers the better path.

Recommendations

The Expert Working Group believes that the Commission should recommend:

1. That the Executive Branch conduct a rigorous study to determine the minimum size (by discipline), that the national laboratories need to maintain and support the weapons program. Without such an examination, critics may assume the Commission simply wants to expand the laboratory complex.
2. That the Executive Branch establish a formal mechanism for tracking funded sources at the weapons laboratories. It is impossible for the Executive Branch to broaden the base of laboratory support without a mechanism for tracking progress.

3. That the Executive Branch oversee rigorous development of a strategic plan for the "national security laboratories" that defines and costs those areas, including capital investment, where the laboratories can make a unique contribution to the challenges facing the security of the country.
4. That management of projects adhere closely to the concept of GOCO (Government Owned, Contractor Operated).
5. That the indirect costs, including those imposed by NNSA, be carefully examined by the industrial partners and that, in particular, they be assigned the lead in establishing balanced procedures regarding security.
6. That the White House establish an interagency process as discussed above and that the President formally assign the Secretaries of Defense, Energy and Homeland Security and the Director of National Intelligence with joint responsibility for the health of the existing weapons laboratories, re-characterized as national security laboratories. This assignment should be made by Executive Order.

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1. Admittedly, other agencies support work at the laboratories, but such work is small by comparison, disjointed, and supported only at the margin.
2. Examination of the necessary minimal staff is covered in a separate paper.
3. At the first presidential debate of the 2004 campaign, President Bush declared that "the biggest threat facing this country is weapons of mass destruction in the hands of a terrorist network." Schroeder and Stohl in the *San Diego Union,* 11 November 2004.
4. One such is nuclear power. Because there is necessarily a close relationship between the technology of nuclear power and that of nuclear weapons, the three laboratories are uniquely positioned to contribute to certain aspects of the former. For example, some fuel cycles are more resistant to weapon proliferation than others, but only the weapons laboratories are equipped to make such assessments. Funding, in this case, should be provided directly by DOE and remain outside of the NNSA budget.
5. *The Money Game* by Adam Smith (George Goodwin).
6. This point of view is supported by the preliminary remarks of Frances Townsend, co-chair of the Townsend Kerrick Task Force, "Long-term investments from other agencies cannot be achieved if their priorities are always second or third on the list. This finding requires creating a structure for multi-agency decision making (or sponsorship) and eliminating a predetermined "primary" versus "secondary" relationship regarding access to the labs' capabilities." Frances Fragos Townsend, NUCLEAR DETERRENCE SUMMIT, "Ensuring the Science Component of the Weapons Labs is Maintained" December 4, 2008.
7. This point of view is also consistent with Townsend (ibid). See for example:

   "The Labs mission has grown dramatically over the past several decades with too little strategic guidance. Mission creep under the guise of "multidisciplinary big science" has led to lack of clarity regarding unique capabilities. Neither NNSA nor the Labs have been disciplined in ensuring that they focus solely on missions or challenges where they have unique capabilities."

   The Labs' approach is often bottom-up. Lab representatives in DC analyze the environment, determining where the Labs should ask for money. The current process is very opportunistic, not strategic.
8. Report of the February 11-12, 2008, meeting of the Mission Committees of the LANS/LLNS Board of Governors; William J. Perry and Sidney D. Drell, May 19, 2008.
9. Again, the EWG and Townsend (ibid.) are in agreement, "The objective is an "integrated, interdependent enterprise that employs best business practices [italics added] to maximize

efficiency and minimize costs." The existing complex doesn't come anywhere close and will have to be significantly rationalized to survive."

10. See, for example, the article by David Kramer, "DOE officials detail security concerns at labs" *Physics Today*, November 2008, in which congressional statements such as "so 'shocking and so serious' that they couldn't be heard in an open hearing" have to be contrasted with statements by the laboratory directors "that classified information isn't at risk."
11. Some believe that the culture of the Department of Energy overemphasizes regulation and that this overemphasis is so deeply ingrained that the laboratories and the weapons program should be removed from DOE. The Experts Working Group analyzes options for doing so in a separate paper.
12. NNSA Press Release, June 26, 2008.
13. For example, NNSA has no approved way of determining the funding at each laboratory that comes from non-DOE sources and thus is unable to determine either a baseline or progress toward diversification.
14. See, for example, the NNSA Press Release, "NNSA Assisted in Shooting down of Satellite in February." September 30 2008.
15. NNSA Press Release, December 17, 2008.
16. "Work for others or MOUs are likely too limited and too ad hoc to allow for the ideal long-range strategic planning for the S&T enterprise" Townsend (ibid).
17. This question is analyzed in more detail in a separate paper and is noted here only for completeness.

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Security Concerns at NNSA Sites

Troy E. Wade II

Issue

Security costs at NNSA sites are consuming one out of every five dollars appropriated for NNSA. Costs for protecting nuclear weapons and category 1 nuclear material have dramatically increased over the past few years.

Problem

What has caused this situation; will it continue; what are NNSA security costs in relation to DOD security costs for similar levels of protection; what is the recommendation(s) to the commission?

Discussion

Figure 1 is a curve that captures the escalation of security costs within NNSA since 9/11. The chart comes from an official briefing of the security office in NNSA concerning the out-year budgets. Note the significant escalation in costs in 2003 associated with compliance with the 2003 design basis threat (DBT). The DBT is a classified standard threat, which defines an attacker's capabilities. The significant escalation in costs is associated with compliance with the 2005 version of the design basis threat. I have indications that at Savannah River, the costs associated with upgrading and improving the Wackenhut Services Inc. security force at that location in order to comply with the plan for compliance with the 2005 DBT this year (the first NNSA site to do so) cost an additional $63m over and above costs for the preceding year. I have long believed that the requirement for all NNSA sites to meet an arbitrary, and yet "one-size-fits-all" threat was unrealistic in that it did not

allow any site to take any advantage of the unique characteristics of that site. I have argued, for example, that it was not realistic to not allow the Nevada Test Site security force to take advantage of the fact that it was surrounded by the Nellis AFB bombing and gunnery range which is full of sensors of all kinds. I am advised that, effective in August of this year, a new policy for protection of nuclear weapons and materials, officially called the "graded security protection policy," which replaces the DBT, has been approved, and that all sites have been asked to provide vulnerability assessments based on that new policy. Out-year budget projections will now be based on the adaptation of that policy, which is a giant step forward in developing realistic threats and designing protection against those threats.

Table 1 depicts security costs across the complex in 2008 measured against requirements for 2009, as well as the differences between the program request and the president's budget for each location. This chart and these costs came from a briefing given by the Office of Defense Nuclear Security (the NNSA security office) to Bill Ostendorf in October. All of these costs are in the budget category in the security portion of the overall NNSA budget. These costs all were developed before the decision was made to move from a generic design basis threat to graded security protection. None-the-less, it captures the continued escalation of security costs and the increasing delta between the program request and the president's budget. Think of the difference there clearly will be in money appropriated versus what shows as the president's budget.

Figure 2 is a pie chart showing the results of a comparability study done to look at where all the money appropriated goes. Note that this chart shows an average for all NNSA sites. What it shows is that only about .50 of each dollar (base labor plus overtime) goes to actual security. The balance goes to all of the other categories identified in the pie chart. One of the obvious problems is that all NNSA sites have different cost structures and contracts; some security contractors are prime contracts to the government while others are sub-contracts to the operating contractor or to the laboratory. These different contracting methods result in different cost models that vary site to site, in some cases quite dramatically. Another very important fact is that, in most cases, a large percentage of the budget tied to labor costs is subject to collective bargaining agreements wherein the labor rates exceed established escalation rates.

Members of the infrastructure EWG as well as members of the commission have asked about comparing NNSA costs with DOD costs. There are so many differences; DOD protects nuclear weapons but not any categories of nuclear material; DOD security forces are all active-duty military, etc., quickly lead one to the conclusion that not only is one trying to compare apples to oranges but is closer to comparing apples to bricks. It is clear that

the recent NNSA decision to use "graded security protection" does bring NNSA more in line with the policies for protection of nuclear weapons used by the DOD and also by the United Kingdom.

Comparability of security costs at NNSA sites probably can only be accomplished by moving toward a single security contractor at each NNSA site, and adapting the same cost model (as much as site labor agreements would allow) at each site. Moving to a single security contractor would be consistent with moving toward a single M&O contractor at all NNSA sites, but probably neither can be done independent of the other. In other words, if a decision is made to select a single M&O contractor to operate a smaller, consolidated group of NNSA sites, a decision to move to a single security contractor at those sites could be made at that time.

Summary

Costs for security of nuclear weapons and nuclear materials (particularly category 1) have escalated at all NNSA sites since the 9/11/2001 terrorist event. Recent efforts to develop a more reasonable threat model present the opportunity to reduce security costs at each affected site. Attention to development of more uniform cost models across the NNSA complex would clearly add to further reductions in cost.

A detailed examination of differences in security costs from site to site, i.e. looking at union agreements and benefits, might lead to identification of additional cost reduction possibilities.

Recommendation

Any significant reduction of security cost within NNSA will clearly be a function of exactly what NNSA looks like in the next decade. Since the definition of NNSA's future is a major consideration of the commission, I recommend that this working group report to the commission that it has examined security costs, but will make no specific recommendations pending the commission's decision(s) on how the weapons program itself should be organized and implemented over the next decade or so.

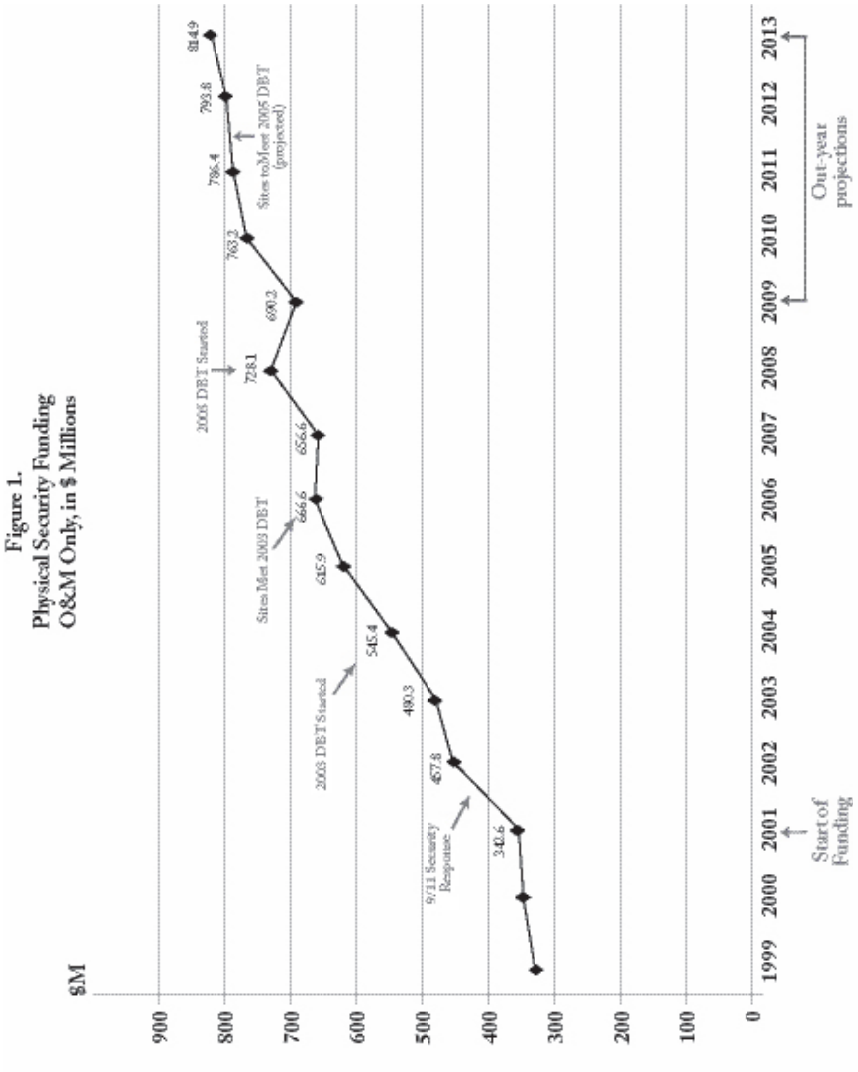


Figure 1.
Physical Security Funding
O&M Only, in $ Millions
$M
900
800
700
600
500
400
300
200
100
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Start of Funding
Out-year projections
340.6
457.8
480.3
545.4
645.9
666.6
656.6
728.1
690.2
763.2
786.4
793.8
814.9
9/11 Security Response
2005 DBT Started
Sites Met 2005 DBT
2005 DBT Started
Sites to Meet 2005 DBT (projected)

Source: NNSA

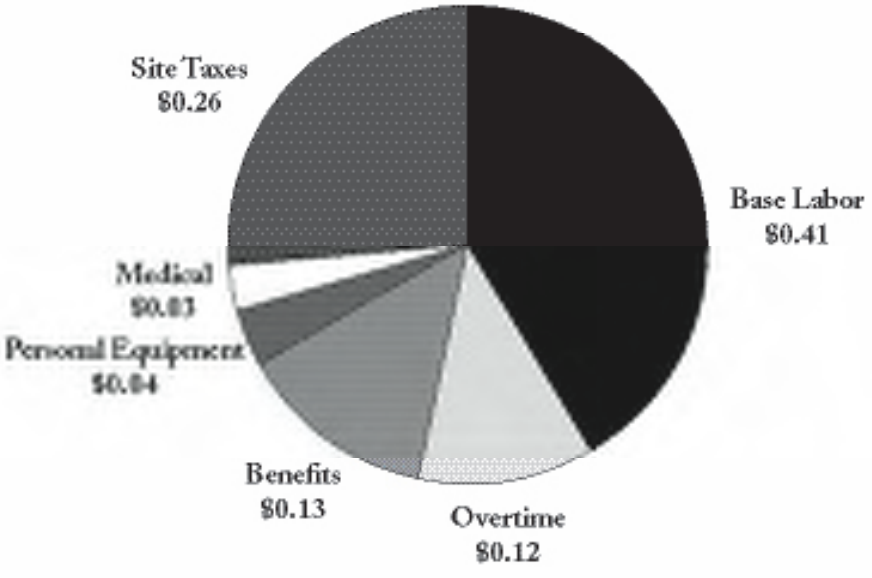
Table 1. FY2009 Funding Challenges

Defense Nuclear Security				
FY 2009 Funding (O&M)				
($ in thousands)				
Site	**FY08 Approp.**	**Base Program Requests**	**President's Budget**	**Delta**
Headquarters	38,471	24,923	23,484	(1,439)
Kansas City	10,748	12,069	10,843	(1,226)
Los Alamos	107,866	117,518	105,203	(12,315)
Lawrence Livermore	95,475	91,300	91,031	(269)
Service Center	7,731	8,859	7,759	(1,100)
Nevada Test Site	78,814	112,734	96,434	(16,300)
Pantex	150,679	149,709	125,397	(24,312)
Sandia	67,883	73,841	68,244	(5,597)
Savannah River	10,842	13,180	12,420	(760)
Y-12	159,614	190,202	149,402	(40,800)
Subtotal, Operating	728,123	794,335	690,217	(104,118)
Construction	71,110	84,973	47,111	(37,862)
TOTAL	799,233	879,308	737,328	(141,980)

Source: NNSA

- Full FY2009 site requests included infrastructure investment and additional security staff shortfalls
- Site budget FY2009 requests reflected what resources they believed were needed to implement 2005 DBT and maintain effective program —$104M delta
- Suspending 2005 DBT implementation and critically reviewing work scope helped sites remain within President's FY09 Budget

Figure 2
2006 Comparability Study
SecurityDollar - All NNSA Sites Average



25

Issues and Questions Associated with New Major NNSA Nuclear Facilities

Earl Whiteman

Introduction

NNSA is considering four new nuclear facilities to support the nuclear weapons complex. Three of these facilities are major initiatives covered in the NNSA Complex Transformation program, and are a portion of the Preferred Alternative for the recently completed Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement. These four facilities are:

- A plutonium facility at Los Alamos (the Chemistry and Metallurgical Research Replacement—Nuclear Facility (CMRR-NF)) that supports LANL plutonium activities, including pit production,
- A uranium processing facility (UPF) at Y-12 that replaces the old Manhattan Project era uranium facilities that supports all enriched uranium component fabrication, processing, and assembly,
- An underground storage facility at Pantex that would allow all weapon and SNM storage at Pantex to be consolidated within the Zone 12 weapons assembly zone, and allow the closure of the Zone 4 weapons and material storage area, and
- A Pit Disassembly and Conversion Facility (PDCF) at Savannah River (not covered as part of the Complex Transformation program) for disassembling excess plutonium pits (currently stored at Pantex) and converting the plutonium into an oxide as feed material for the Mixed Oxide Fuel Fabrication Facility currently being constructed at Savannah River.

The purpose of this paper is to describe the NNSA plans for the proposed projects, alternatives to the NNSA plans, questions that the Commission should consider relative to the projects, and recommendations that should be presented to the Commission for their consideration.

According to the FY2009 NNSA budget request, the funding requests for these projects are both large and uncertain. For the CMRR-NF, no total project estimate is provided[1] (budget amounts for FY2014 and beyond are labeled as "TBD"), but the amounts shown through FY2013 total greater than $1 billion. The UPF is shown to have a "Preliminary Cost Range" of $1.4–3.5 billion. The PDCF appears to have a more complete design, and its current estimate is $2.4–3.2 billion. There is no cost estimate available for the underground storage facility at Pantex, and due to the perceived uncertainty and unlikelihood of NNSA moving forward on this facility in the near term, it will not be discussed further in this report.

The annual amounts (in millions of dollars) for these projects shown in the FY2009 NNSA budget request are:

	FY2008	FY2009	FY2010	FY2011	FY2012
PDCF	$68.7	$119.0	$243.1	$323.1	$317.4
UPF	38.6	96.2	117.0	188.0	281.0
CMRR-NF	81.1	108.2	172.0	225.0	250.0

The share of the NNSA Weapons Activities budget devoted to the three projects grows from 3.0% in FY2008 to 11.6% in FY2012.[2] Given NNSA's historical problems in the management of nuclear facility construction to meet cost and schedule commitments, these cost estimates (even with the large uncertainty ranges) should be considered extremely uncertain. At their present estimated costs, they would be among the largest construction projects attempted by the nuclear weapons program in the past 25 years (the National Ignition Facility being the other greater than $1 billion facility during this time period).

The Los Alamos CMRR-NF Background and Justification

The U.S. does not today have modern plutonium facilities sufficient to support all aspects of its nuclear weapons R&D and production programs. The CMRR-NF would fill this gap, and provide the U.S. a full set of plutonium capabilities, including plutonium chemistry, materials science, and metallurgy, as well as pit surveillance and plutonium process development. Pit production (at low rates) occurs in an existing facility, the PF-4 at TA-55. Though CMRR-NF supports plutonium pit production, its primary purpose is to replace an aging laboratory facility (the CMR facility) and to enable closure of the Livermore plutonium facility to provide modern laboratory

space for the nuclear weapons laboratories to support all plutonium programs, including pit production. This new plutonium facility is highly controversial, and has been publicly tied to plutonium pit production for stockpile augmentation or modernization.

According to 2008 NNSA Complex Transformation documentation,

> Los Alamos National Laboratory would provide a consolidated plutonium research, development, and manufacturing capability within TA-55 enabled by construction and operation of the Chemistry and Metallurgy Research Replacement—Nuclear Facility (CMRR-NF). … Until completion of a new Nuclear Posture Review in 2009 or later, the capacity at Los Alamos would be limited to a maximum of 20 pits per year.[3]

With the decision to close the Rocky Flats Plant in 1992, DOE was left with no capability to produce, disassemble, or assess plutonium pits in the U.S. stockpile. DOE established at Los Alamos during the 1990's a pit surveillance capability, a limited (up to about 20 per year) pit production capability, and a limited capability to dismantle and disposition old plutonium pits. DOE addressed this mission in a 1996 Stockpile Stewardship and Management Programmatic Environmental Impact Statement. The Record of Decision for that statement said that:

> DOE's decision is to reestablish the pit fabrication capability, at a small capacity, at LANL. …Should a larger pit fabrication capacity be required in the future, appropriate environmental and siting analysis would be performed at that time.[4]

The LANL plutonium program has several major program objectives:

- To conduct actinide R&D by Los Alamos and (after closure of its facility in 2012) Livermore scientists,
- To fabricate plutonium-238 heat sources for NASA and other national programs,
- To produce stockpile pits to replace pits lost in destructive surveillance testing to avoid drawing down the stockpile for programs where there are no replacement pits in storage (principally the W88 warhead),
- To assess plutonium pits from all stockpile weapon systems to assure continued reliable and safe performance,
- To maintain production competence for nuclear weapons plutonium pits,
- To provide a small production capacity to meet unforeseen production requirements, and
- To serve as a test bed for new production and process technologies that might be used in a new plutonium facility.

Los Alamos is today meeting all of these major objectives in its existing facilities (including the aging CMR).

The information needed to justify proceeding with a new production facility relates to the projected operational life of plutonium pits, and the stockpile size that a new plutonium facility should support. Pit lifetime is important because it is technically possible to "reuse" plutonium pits in refurbished and (to a limited extent) redesigned nuclear weapons in order to avoid the manufacture of new plutonium pits if there is sufficient life expectancy remaining for the older pits. This ability contributes to both stockpile refurbishment and a stockpile reconstitution capability. An aggressive program of pit reuse could significantly reduce the demand for new plutonium pits, and could reduce the size of needed pit production facilities without compromising national security objectives.

The weapons laboratories have made considerable progress in the past ten years in answering the question of pit life expectancy. In a November, 2006 statement, NNSA announced that weapons laboratories studies assessed that plutonium pits for most nuclear weapons have minimum lifetimes of at least 85 years. NNSA further noted that the scientific process used in the assessment had been peer reviewed by the JASON panel, which concluded that most plutonium pit types have credible lifetimes of at least 100 years.[5]

Stockpile size is the other major uncertainty affecting plutonium facility plans. With an assumption that pits would need to be "remanufactured" on average every 30-50 years because of pit aging or weapon replacement (such as an RRW), a production capacity of 20-30 per year is needed for every one thousand units in the U.S. stockpile (also assuming that additional "reconstitution capacity" is not desired). The present facilities at Los Alamos can produce about 20 pits per year (relying on the aging CMR facility). Modest upgrades to the existing PF-4/TA-55 facility combined with a new CMRR-NF to replace CMR could fabricate up to about 80 pits per year.

In its 2008 decision, NNSA continues to reflect considerable uncertainty about the future demand for plutonium pits. In fact, it defers making a final decision about pit production capacity (beyond the 20 unit per year capacity in place today) until better guidance (in the form of a 2009 Nuclear Posture Review) is available about stockpile size and mix.

Despite the uncertainties about future production requirements, NNSA has committed to move forward with the new CMRR-NF at Los Alamos, and it "believes that the plutonium R&D and surveillance capabilities provided by a new CMRR-NF at Los Alamos are required whether or not the United States ever builds another plutonium pit."[6] This commitment contains considerable uncertainty about budgetary decisions, however. NNSA is reflecting in its current decision that the projected demand for plutonium pits should not be the driving factor for proceeding with a new plutonium

facility at Los Alamos. Plutonium work at Los Alamos is currently performed in two facilities, an all purpose plutonium facility initially occupied in 1978 (the PF-4 in TA-55) that is in good physical condition, and the much older facility (the CMR, circa 1952) that is not constructed or operable to current safety standards.

NNSA cannot accomplish its plutonium R&D and production programs without the capabilities currently residing in the CMR. The Defense Nuclear Facility Safety Board has criticized NNSA for continuing to perform plutonium work in the aging CMR, and, because of pressure from the DNFSB (and because NNSA thought it was the right thing to do), NNSA committed in 1999 to "manage the existing CMR Building to a planned end of life in or around 2010."[7] The CMR had been temporarily closed during the 1990's at least twice because of safety concerns. Though significant upgrades were made to CMR safety systems at that time, there were limits to the amount of upgrades possible with the 50-year-old facility. With funding and schedule delays for CMRR-NF, the CMR must now remain operational well into the next decade.

Before deciding to proceed with the Los Alamos CMRR-NF, NNSA considered relocating its plutonium missions from Los Alamos (including the work performed at the Livermore plutonium facility) to other possible locations including Savannah River, Y-12, Pantex, and the Nevada Test Site. NNSA looked at the costs and risks for each of these sites. Remaining at Los Alamos was the lowest cost and risk approach.

NNSA also considered consolidating all of its plutonium and highly enriched uranium work at a single site, or combining these two missions with the Pantex weapons assembly mission at a single site. Savannah River, Y-12, Pantex, the Nevada Test Site, and Los Alamos were considered for this single consolidated nuclear site (called the Consolidated Nuclear Production Center). This level of consolidation had been previously recommended by a panel of the Secretary of Energy Advisory Board in 2006 because of perceived cost and security benefits.

Both the relocation and consolidation of nuclear operations were considered in the recently completed Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement (SPEIS). The preferred alternative for the final SPEIS indicates that neither relocation nor consolidation is the desired approach.

The estimated cost of the CMRR-NF is large and uncertain (no total project estimate is provided in the NNSA FY2009 budget request; budget amounts for FY2014 and beyond are labeled as "TBD"). The budget requests shown through FY2013 total greater than $1 billion. NNSA has indicated in comments to a draft version of this report that the current estimate for CMRR-NF is $1.7-2.7 billion. On the present schedule, funding would increase

significantly in FY2010 to support project construction. This project, the UPF, and the PDCF (both discussed below) would need significant construction funding beginning in FY2010.

The Uranium Processing Facility Background and Justification

The Y-12 Plant near Oak Ridge, Tennessee, is one of the original facilities constructed to support the Manhattan Project. Y-12 facilities, originally constructed to house uranium separation capabilities, were converted in the early 1950's into facilities for the manufacture of highly enriched uranium secondaries and related components. Complete nuclear weapons secondaries and cases are assembled at Y-12 from these components. Y-12 continues to perform its production and assembly missions in these World War II era facilities.

As with the CMR facility at Los Alamos, the Defense Nuclear Facility Safety Board has been very critical of the continued use of these aging facilities for the highly enriched uranium mission. In fact, NNSA management has indicated that it might prioritize the UPF ahead of the CMRR-NF because of these safety concerns.[8] In addition, as security requirements for nuclear weapons program facilities have been made more stringent (in particular after 9-11), the ability to economically secure the sprawling complex of Y-12 enriched uranium facilities has become increasingly difficult and expensive.

For all of these reasons, NNSA has decided in the Preferred Alternative to the SPEIS that:

> Y-12 National Security Complex would continue as the uranium center producing components and canned subassemblies, and conducting surveillance and dismantlement. NNSA has completed construction of the Highly Enriched Uranium Materials Facility (HEUMF) and will consolidate highly enriched uranium storage in that facility. NNSA would build a Uranium Processing Facility (UPF) at Y-12 in order to provide a smaller and modern highly-enriched uranium production capability to replace existing 50-year old facilities.[9]

NNSA says that constructing the UPF at Y-12 would result in a:

- 90% reduction in the Y-12 high security area,
- 60% reduction in the Y-12 nuclear operations footprint, and
- 50% reduction in the total Y-12 building footprint.[10]

In addition, there continues to be a support mission for the U.S. naval reactors program at Y-12 as HEU is taken from dismantled nuclear weapons and processed to an appropriate form for use by the naval reactors fuel fabrication facilities. HEU is also stored for the naval reactors program at Y-12 (a new

$500 million facility for the storage of all weapons program and naval reactors HEU is nearing completion at Y-12). The UPF will also support storage and down blending of HEU from international nonproliferation programs.

The estimated cost of the UPF is large and uncertain (preliminary cost range of $1.4—3.5 billion). NNSA is pursuing design-only for this project with FY2008 funding of about $40 million. On the present schedule, funding would increase significantly in FY2010 to support project completion by the end of FY2018. This project, the CMRR-NF, and the PDCF (discussed below) would all need significant construction funding beginning in FY2010. NNSA has stated that the UPF would reduce the annual operating costs of Y-12 by approximately 37%.[11] Presumably, a large fraction of these savings are due to reduced security costs. NNSA has not stated how these projected savings were independently verified. Assuming this level of savings is possible, for the requested FY2009 Y-12 budget of about $860 million, annual savings of about $320 million would result, whether the UPF is built at Y-12 or another site. The old facilities vacated at Y-12 due to UPF construction will require significant D&D funding; this funding will be required whether UPF is built at Y-12 or another site.

The issues for NNSA to face relative to new uranium processing facilities are: where should it be built, and how big should it be? It could be an easy decision to build new uranium facilities at Oak Ridge because of the long history of uranium work in the region, the strong technical base in the regional workforce, and the (unambiguously) strong political support for the work. In addition, multiple analyses by NNSA have determined that retaining uranium operations at Oak Ridge is the lowest cost and risk alternative. Relocating the uranium mission also requires that a downsized version of the recently completed uranium storage facility (HEUMF) be duplicated at the new site. Mission relocation also has significant "transition" costs. However, questions remain about the long term viability of maintaining uranium operations competency at very low workload levels (which are likely for the long term) at a site geographically distant from other portions of the nuclear weapons complex (the West Texas–New Mexico locus). Building the several billion dollar UPF at Y-12 essentially commits the nuclear weapons program to that site for the foreseeable future. NNSA has chosen to remain in Oak Ridge.

NNSA has said in the past that complex consolidation is an important objective, and significant consolidation has been accomplished over the past 15 years (several sites have been closed). A long term vision that involves consolidation of nuclear weapons complex missions to one or a few sites as the program decreases in size would be inconsistent with building a multi-billion dollar long term facility at Oak Ridge. However, consolidating uranium operations with one of the other long term nuclear weapons sites is

more expensive over the next decade. An independent assessment by the Institute for Defense Analysis concluded that the cost savings from relocating the Y-12 Plant missions would not cancel the added costs of relocation until about 2040 due to the long construction and transition time. IDA concluded that collocation of the Y-12 mission with another NNSA site would save an additional $142 million per year (in addition to the $320 million from facility downsizing).[12]

In contrast to the CMRR-NF at Los Alamos, the justification for the UPF at Y-12 is tied primarily to the need for production capability and capacity. In the Preferred Alternative, NNSA considered a UPF sized to manufacture 125 secondaries per year with the ability to increase this output to 200 per year through multiple shifts or an extended work week. NNSA has indicated in its comments to a draft version of this report that its current planning assumes a UPF capacity of about 80 units per year.

The UPF is configured as a standalone production facility based on the historical approach to nuclear weapons component production. An alternative approach to stockpile management based on principles more relevant to a smaller U.S. nuclear weapons stockpile might result in a smaller and less expensive facility. For example, the historical approach to component production is to configure and qualify a production process for individual nuclear weapons components, and to control quality of the manufactured parts through control of this process. Process qualification and control were an integral part of overall weapons quality, and contributed significantly to the size and cost of production facilities. For very small production rates (as planned for the nuclear weapons program), an alternative approach that did not rely on dedicated and controlled production processes might allow for a significantly smaller production facility (that is also more flexible to changing requirements).

The life expectancy of nuclear weapons secondaries is somewhat less than that for plutonium pits, and varies depending on the special materials assembled into the so-called canned subassemblies. With an assumption that secondaries (and the full canned subassemblies) would need to be "remanufactured" on average every 20-30 years because of weapon aging or weapon replacement (such as an RRW), a production capacity of 30-50 per year is needed for every one thousand units in the U.S. stockpile (again, assuming that additional "reconstitution capacity" is not desired). A strategy of secondary reuse analogous to that discussed for pit reuse might significantly reduce the necessary capacity for the UPF without compromising national security objectives. The present aging facilities at Y-12 were originally sized to manufacture well over 1000 units per year, though new safety- and security-driven operating practices limit their capacity today to a few hundred per year.

The Pit Disassembly and Conversion Facility Background and Justification

Well over 10,000 nuclear weapons have been dismantled at Pantex over the past 15 years. The plutonium pits from these weapons remain in storage at Pantex. During the Cold War, the pits from these weapons would have been returned to the Rocky Flats Plant where the plutonium would have been extracted and reprocessed for use in new nuclear weapons production. At least 1000 pits per year were processed in this manner at Rocky Flats during the decade of the 1980's. With Rocky Flats ceasing operations at about the same time that major stockpile reductions began through weapons dismantlement at Pantex, the Zone 4 storage area at Pantex became the only feasible storage site for plutonium pits from this dismantlement until a new facility was available to disposition the pits.

The pits currently stored at Pantex are destined to be shipped to Savannah River to be processed in a new Pit Disassembly and Conversion Facility (PDCF). When the PDCF begins operations, at least 1000 pits per year are planned to be shipped from Pantex to Savannah River for disposition. The PDCF would complete its current operational mission in 10-15 years, although its mission would be extended if additional plutonium is declared excess to national security needs. PDCF construction and startup is currently uncertain due to funding uncertainties, but the startup date is likely no earlier than 2020.

During the 1990's, DOE separated the plutonium disposition activities from the nuclear weapons program with a separate program and budget within what is now NNSA. At the time, there was considerable work with Russia in developing joint programs for the disposition of excess plutonium and highly enriched uranium, and there was a desire to maintain separation between the U.S. nuclear weapons program and the new disposition program. Thirty-four thousand kilograms of plutonium were officially declared excess to the U.S. nuclear weapons program (a like amount was declared by Russia), and U.S. facilities were planned to disposition the U.S. material.

Significant program delays occurred because of delays in reaching a final agreement between the U.S. and Russia. Finally,

> In 2007, the U.S. and Russian governments agreed on a framework for a technically and financially credible Russian plutonium disposition program based on the irradiation of plutonium as MOX fuel in fast reactors. When implemented, it will enable the U.S. and Russia to meet their commitments under a 2000 agreement to dispose of a combined total of 68 metric tons of surplus weapon-grade plutonium—enough material for approximately 17,000 nuclear weapons.[13]

In the U.S., two major facilities are currently planned, the Pit Disassembly and Conversion Facility (PDCF) and the Mixed Oxide Fuel Fabrication

Facility (MFFF), both to be constructed at Savannah River. The MFFF is under construction, and not funded by the nuclear weapons program. Pits from Pantex would be shipped to the PDCF where they would be disassembled and the extracted plutonium converted into a plutonium oxide feed material. The plutonium oxide feed would be converted into mixed oxide (MOX) fuel suitable for burning in U.S. light water reactors at the MFFF. Contracts and schedules have been negotiated with U.S. commercial nuclear power operators for use of the MOX fuel.

The current cost estimate for the PDCF is a "preliminary cost range of $2.4–3.2 billion. According to the FY2009 NNSA budget request, the PDCF design was 65% complete as of February, 2008.

For various reasons, including the late approval of the agreement with Russia, the two projects do not today have compatible schedules. The MFFF is on schedule to begin receiving plutonium oxide feed materials in 2016. However, the PDCF has been delayed several times, and is now projected to begin providing feed materials in the 2019-2022 timeframe.

Congressional action on the FY2008 budget moved the PDCF out of the NNSA nonproliferation budget and into the NNSA nuclear weapons program budget. The result of the Congressional action was to put the PDCF in competition with other nuclear weapons program budget items and to push NNSA to pursue other technical approaches for providing the plutonium oxide feed material, thus eliminating the need for the PDCF.

To date, NNSA has moved to close the gap in feed material availability by committing Los Alamos to provide initial feed material to the MFFF from its ARIES process, a development capability at PF-4/TA-55 that initially developed and demonstrated the technology for the PDCF process. In addition, NNSA has gained commitments from another DOE program at Savannah River (the DOE Environmental Management [EM] program) to provide material from EM facilities at Savannah River. Through these measures, most of the gap between MFFF need and PDCF ability has been closed.

These measures, however, beg the question that if these other approaches can provide material for a few years, why can they not provide all of the feed material needs and negate the need for building the PDCF? This is particularly the case since the PDCF mission could be only 10-15 years in duration. The Los Alamos facility could be asked to continue operating its development equipment a few more years, the Savannah River EM facilities could be configured to continue providing the material, and/or equipment could be installed at a facility at the Nevada Test Site. NNSA appears to be looking at all of these options, singly or in combination, and could propose elimination of the PDCF.

Conclusions and Questions

NNSA has a severe problem in trying to fund all of these major construction projects at a time when the overall downward pressures on the total NNSA budget are expected to increase, and, as noted earlier, these facilities increase their share of the Weapons Activities budget from 3% to 11.6% (without further project cost increases). In addition, if NNSA does fund one or more of these projects, the internal tradeoffs that must occur will necessarily involve reductions in other aspects of the NNSA program that are themselves facing shortfalls. In particular, there is concern that cuts would occur in those NNSA programs that support the intellectual infrastructure of the nuclear weapons program (both at the laboratories for scientific expertise, and at the laboratories and plants for development and production engineering expertise).

There are a number of questions to consider when making recommendations regarding the proposed NNSA projects.

First, does the project directly contribute to support of the stockpile? Both CMRR-NF and the UPF directly contribute to stockpile support, and both are needed irrespective of future stockpile levels. Stockpile levels do, however, influence the needed size and capabilities of the two facilities, in particular the UPF. The PDCF does not contribute to stockpile support other than by allowing the eventual closure of the Zone 4 storage area at Pantex.

Does the project contribute to the support of the long term intellectual infrastructure of the nuclear weapons program? Since all of these projects would compete with programs that maintain the intellectual infrastructure, it would be beneficial if the project itself (when completed) also contributed to the intellectual infrastructure. Of the projects, the CMRR-NF most clearly makes a direct contribution. It assures that there is a complete long term capability for Los Alamos and Livermore to conduct R&D involving SNM (in addition to contributing to the pit production mission), and provides the U.S. a complete set of required plutonium capabilities.

Are the size, scope, and cost of the projects influenced by the future size of the nuclear weapons stockpile? Because of the uncertainties in the size of the nuclear weapons stockpile for the coming decades, projects that are relatively independent of stockpile size might be prioritized over projects that are strongly dependent on stockpile size. The UPF at Y-12 is the only project whose size, scope, and cost is influenced by stockpile size, i.e. the greater the size of the stockpile, the larger the needed production capacity of UPF. This is true in spite of the fact that at very low production rates (80 per year for the UPF), facility size becomes less dependent on production rate. An alternative approach to stockpile management and associated production process qualification might also yield a smaller more flexible UPF.

Are pit and secondary component reuse viable options for support of the stockpile, and for influencing the needed capacity for pit and secondary production? Nuclear tests and subsequent development work has shown pit reuse to be feasible for some weapon applications. Preliminary studies indicate that secondary reuse could also be feasible for some weapon applications. The new computer simulation tools have given the NNSA laboratories enhanced methods for assessing the feasibility of nuclear component reuse. In addition, enhanced nondestructive evaluation techniques show great promise to provide the NNSA with viable tools to select the best nuclear components for reuse applications.

Is consolidation of the nuclear weapons complex an important or necessary NNSA objective? NNSA has said in the past that complex consolidation is an important objective, and significant consolidation has been accomplished over the past 15 years (several sites have been closed). Today, NNSA has determined that the downsizing of existing sites rather than closure of sites is the preferred approach, though the CMRR-NF contributes to consolidation by allowing the plutonium facility at Livermore to be closed. The UPF at Y-12 would be counter to complex consolidation and would commit the U.S. to remaining at Y-12 over the next several decades.

Facility and mission consolidation and resulting site closures introduce greater near term costs and risks to the nuclear weapons program, however long term program vitality requires continued consolidation as the stockpile and program continue to decrease. Spreading a smaller and smaller program over geographically dispersed sites creates concerns about the ability to maintain nuclear weapons competence. A multi-billion dollar investment at Y-12 is counter to consolidation of work.

How should NNSA prioritize safety of its nuclear facilities against other program objectives? The CMRR-NF and the UPF are needed to replace old nuclear facilities. Both NNSA and the Defense Nuclear Facilities Safety Board have said that it is unacceptable to continue nuclear operations in these older facilities because of safety concerns, and that new replacement facilities must be constructed. The high cost of these facilities requires very difficult decisions in a time of severe budget limitations. NNSA has not decided which facility it would prioritize to be first from a safety standpoint, but has indicated it may support the UPF as the first project.

How should NNSA prioritize security construction projects that help control the high cost of securing and operating nuclear facilities[14] against other program objectives? The UPF is expected to significantly reduce the security and other costs of operating the Y-12 Plant. However, achieving these cost savings at Y-12 requires the expenditure of significant construction funds at a time of severe budget limitations (a trade-off between scientists and concrete). Also, security cost savings are difficult because they are primarily in the form of manpower reductions, which are always hard to capture; and, the

requirements associated with the Design Basis Threat have tended to increase regularly with time and thereby to call for more and better security arrangements, and to override projected savings.

Are there other alternative approaches that might significantly reduce the size, or negate the need for the new facility? For the PDCF, it appears to be possible to avoid the large facility construction expenditure through the modification and use of existing facilities at Los Alamos and/or Savannah River. There does not appear to be a realistic alternative to the CMRR-NF if long term plutonium capabilities are to be maintained. The UPF also appears to be a necessary facility to replace the aging Y-12 facilities, though there remain questions of the size (and cost) of the facility to be constructed (dependent on stockpile size and required "reconstitution capacity"), and the location of the facility (should consolidation objectives be continued).

Is reconstitution or surge capacity needed in future nuclear production facility plans? In the past, an added capacity factor was generally added to nuclear weapons production facilities to provide an ability to rapidly respond to unanticipated problems or increased requirements. Today, non-deployed stockpile systems and plutonium pits from dismantled weapons, i.e. pit reuse, are major components of a reconstitution strategy, and allow most production sites to avoid excess facilities and equipment for reconstitution or surge. However, excess capacity as reconstitution or problem resolution insurance may be built into plans for uranium facilities. This excess capacity would increase security and maintenance costs of the resulting facilities. It is not clear what the added capacity factor for reconstitution is for the UPF. If a clear policy required no surge or reconstitution capacity, it might be possible to further reduce the size and costs of the UPF.

Recommendations

Recommendation 1: Because the maintenance of nuclear weapons competency and the restoration of plutonium capabilities must take precedence over other competing interests, it is recommended that the CMRR-NF be the number one priority NNSA nuclear construction project.

Recommendation 2: A smaller sized, reconfigured, and less costly UPF should be constructed, but the schedule should be delayed.

- Even with UPF on its present schedule, Y-12 facilities will need to operate for an additional 10-15 years. Delay of the UPF could extend Y-12 facility operations by an additional 5-10 years.
- Before committing to the construction of the UPF, more detailed and independent engineering studies should be performed in order to minimize its size and cost. External and independent resources should be provided to enable accomplishment of this objective. An independent

assessment of projected cost savings through the construction of UPF at Y-12 or another site should also be performed.
- Major maintenance projects for existing Y-12 facilities should be funded to alleviate UPF schedule delays.
- A UPF schedule delay allows major decisions on the size and nature of the U.S. nuclear weapons stockpile to occur before committing to a location for the UPF.
- A UPF schedule delay also allows continued work to demonstrate the feasibility of secondary reuse, and to allow a reuse strategy to influence needed secondary production capacity.
- CMR facility safety concerns are at least as serious as Y-12 uranium facility safety concerns, and a short term loss of plutonium capabilities due to safety problems may be more serious to program objectives than a short term loss of enriched uranium capabilities.
- The UPF should proceed after these steps have been accomplished in order to realize security and operating cost savings.

Recommendation 3: A strategy of continued site and facility consolidation should be adopted by NNSA as the nuclear weapons stockpile continues to decrease:

- Enables the maintenance of critical skills and competencies.
- Enables efficiencies through work consolidation.
- Allows indirect and support costs to be reduced.

Recommendation 4: NNSA should exclude contingency facility and process capacity for reconstitution or other purposes from the UPF and other nuclear construction projects. In doing this, the nuclear weapons program would be accepting the added risk of production capacity limiting the ability to respond to future problems. In seeking a minimum sized and lowest cost facility, process capacity and equipment contingencies should be minimized.

Recommendation 5: The PDCF should not proceed and alternative approaches should be pursued using existing nuclear facilities at Savannah River and Los Alamos.

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1. Per FY2009 NNSA Budget Request, page 298, "Initial estimates place the revised TPC above $2,000,000,000. A final cost estimate will be established when the Nuclear Facilities performance baseline is established at C-2 [a milestone in the DOE project approval system], which is estimated to occur during FY 2010."
2. The numerator for the percentages is taken from the various project data sheets in the FY2009 NNSA Budget Request. The denominator for the percentages is taken from pages 71-72 of the NNSA FY2009 Budget Request.
3. NNSA Final Complex Transformation Supplemental Programmatic Environmental Impact Statement, Summary, dated October, 2008, page S-72.
4. Record of Decision: PEIS for Stockpile Stewardship and Management (DOE/EIS-0236), December, 1996, pages 33-34.

5. "Studies Show Plutonium Degradation in U.S. Nuclear Weapons Will Not Affect Reliability Soon," NNSA Press Release, dated November 29, 2006.
6. The quotation comes from comments provided by NNSA to an initial draft version of this report.
7. Department of Energy FY2009 Congressional Budget Request, National Nuclear Security Administration, dated February, 2008, page 300.
8. Based on comments provided by NNSA at the Nuclear Infrastructure Working Group September 9, 2008 meeting.
9. NNSA Final Complex Transformation Supplemental Programmatic Environmental Impact Statement, Summary, dated October, 2008, page S-72.
10. Y-12 Plant fact sheet provided as public information at public hearings for Complex Transformation Supplemental Programmatic Environmental Impact Statement.
11. Department of Energy FY2009 Congressional Budget Request, National Nuclear Security Administration, dated February, 2008, page 288.
12. From a briefing provided by David Hunter of IDA to the Nuclear Infrastructure Working Group at its September 9, 2008 meeting.
13. Department of Energy FY2009 Congressional Budget Request, National Nuclear Security Administration, dated February, 2008, page 22.
14. It appears that the security projects are for the sole purpose of reducing costs. The level of necessary security is being satisfied today in existing facilities, albeit at higher costs.

26

The Weapons Laboratories

Linton F. Brooks

The intellectual infrastructure is the most critical part of the nuclear weapons infrastructure and the three weapons laboratories—Los Alamos, Lawrence Livermore, and Sandia—are the most critical element of the intellectual infrastructure. These laboratories are vital to the United States in three ways. First, they are crucial to maintaining the safety, security, reliability and effectiveness of the stockpile over the long term. Although nuclear weapons have existed for over sixty years, weapons science was an empirical science for much of that period. Nuclear weapons are exceptionally complex, involving temperatures higher than the sun and times measured in nanoseconds. Understanding these weapons from first principles requires a broad, diverse and deep set of scientific skills, along with complex experimental tools and some of the fastest and most powerful computers in the world.

Second, because of their unique staff and remarkable experimental and computational tools, the laboratories contribute to other national security challenges, such as nonproliferation research, nuclear threat reduction, nuclear forensics, countering bioterrorism, ballistic missile defense, countering improvised explosive devices, research on nuclear energy and alternative energy sources, and assisting the intelligence community with advanced technology and analysis of foreign programs. Virtually all of this work grows out of expertise developed in nuclear weapons programs. At the same time, these new challenges enrich the laboratories' ability to continue to advance that program.

Finally, the weapons laboratories play an important role in maintaining U.S. scientific leadership. Laboratory scientific excellence is widely recognized, as evidenced by the large number of R&D100 awards received annually. The multi-disciplinary nature of laboratory research, combined with large scale research tools such as the National Ignition Facility and with

supercomputers that have advanced ten-million fold over the past 15 years, allows research that is unmatched in the United States. Academic research cannot operate on the scale comparable to the weapons laboratories and industry has largely abandoned basic research in the physical sciences.

Maintaining this excellence requires the continued ability to attract top science and engineering talent by providing challenging research on important national problems. It also requires sustained investment in maintaining laboratory capability, especially in the unique experimental tools and facilities that are a hallmark of the weapons laboratories. Finally, it requires projects that exercise the full range of laboratory skills on important real-world problems. In the weapons area, this includes projects that exercise design skills, for example by enhancing surety and safety under a more robust life extension program while further reducing the likelihood of needing to conduct underground nuclear testing. The Reliable Replacement Warhead would be one way of exercising these skills.

27

Future Disruptive Technologies: Meeting with DOE/NNSA on the Future of Disruptive Technologies

Elbridge Colby

I visited DOE/NNSA this afternoon to meet with Dimitri Kusnezov, Director of the Office of Research and Development for National Security Science and Technology, and several of his deputies to discuss transformational developments in science and technology that may have an impact on U.S. national security. The session yielded several recommendations and I plan to return for a subsequent briefing that includes greater detail on some of the technological possibilities.

The common view among the NNSA personnel was that the coming decades will likely see transformational developments in science and technology, especially in the fields of materials science, fusion energy, sensor technology, the handling of large data sets, and new organizing principles for understanding physical phenomena (along the lines seen in the introduction of quark theory, for instance).

- Dr. Kusnezov and his team particularly emphasized the possibilities latent in the combination of increasing computing power (even factoring in the exhaustion of Moore's Law) with the increasing ability to manipulate materials—yielding the capability to model and design materials from the atomic level up with maximal efficiency. This will likely have significant consequences for the military field.
- Fusion technologies, the feasibility of which the participants expected to be clear within several years, were also discussed; the ease with which such fusion capabilities could be put to nuclear use was a particular focus.

- Sensor technology, including pervasive sensor technologies, was also discussed as a possible breakthrough area, with emphasis on its possibilities for use undersea and as a nuclear detector.

Though the NNSA personnel emphasized that the specific contours of these developments cannot be predicted with any real confidence, there was general agreement that rapid and discontinuous developments were highly likely in several key fields, and that the proliferation of massively destructive technologies in particular is effectively inevitable. One participant quipped that there "are no secrets any longer" in the nuclear field. The ramifications of this reality are apparently the subject of some research at the National Labs.

A major focus of all the participants was serious dissatisfaction with a perceived decline in the commitment of the U.S. Government to sustaining a top-quality national security science and technology base. This pertains particularly to the National Labs, where stockpile stewardship and related tasks are perceived to be too mundane either to prompt the kinds of research and innovation the Labs produced in previous decades or to draw new generations of top-flight talent. (Congressional prohibition of any work related to "new" nuclear weapons was cited as a particularly deadening policy on innovation.) Participants emphasized that the very non-linearity, ambiguity, and unpredictability of the future national security technological landscape requires having a peerless national security science and technology base—and that support for this is currently lacking, in large part because of a combination of neglect and distaste for nuclear weapons work at the political level.

The participants urged incorporation of the principle of "technological responsiveness"—the ability of the United States to stay ahead of and respond effectively to its competitors in the national security S&T fields—as part of the U.S. strategic posture. A crucial component of the U.S. deterrent, in other words, is our unmatched national security S&T capability—both as a deterrent/dissuasive/cost-imposing tool and as a responsive one.

Recommendations

In light of this testimony, the Commission might consider:

- *Emphasizing the principles of "technological responsiveness" and "peerless national security science and technological capabilities" into our formal strategic posture.* This might take the form of highlighting the importance of our S&T prowess in meeting our strategic goals to deter, dissuade, and impose costs on other countries considering hostile courses, as well as in responding effectively to such behavior.

- *Encouraging the Congress to provide sustained, substantial funding for the National Labs to undertake basic research and analysis on a broad array of national security-related science and technology problems,* rather than an overweening focus on stewardship and maintenance alone.
- *Encouraging the Congress to loosen restrictions on innovative nuclear-related national security research.*

28

Strategic Ballistic Missile Infrastructure

Robert B. Barker

The infrastructure that supports two thirds of the strategic deterrent triad, the Navy's Submarine Launched Ballistic Missile (SLBM) and the Air Force's Intercontinental Ballistic missile (ICBM), is in trouble. There are now no new missile development programs planned for more than a decade. There is no comprehensive, funded, program plan designed to preserve this infrastructure. While both Navy and Air Force systems are now undergoing life extension programs, these efforts do not significantly exercise the design and system engineering infrastructure and while they do involve some production, keeping that capability alive for now, this too, with the possible exception of missile motor production, will soon come to a close.

Industry is uniformly emphatic that expertise can only be maintained by funded programs for which the skills are necessary. The skills that are being exercised today for nuclear-capable deterrent forces are almost exclusively related to the less demanding sustainment of the systems first deployed many years ago.

In the not too distant future, the infrastructure unique to strategic missiles will not be available for any new programs or to respond to major problems, should they develop, in deployed systems. Any reconstitution of capability will take years and will inevitably be accompanied by schedule slips and cost overruns. As strategic forces are drawn down in numbers, it has been hypothesized that a responsive infrastructure would provide a hedge against surprise. No one could use responsive to describe the capability that will result from the path upon which strategic missile infrastructure now finds itself.

The need for special efforts to sustain key components of the large diameter ballistic missile infrastructure was recognized as early as 1990 in

a Defense Science Board report. Periodically since, and as recently as 2008, Defense advisory committees have continued to warn of the inevitability of the demise of large diameter ballistic missile system infrastructure absent a carefully planned and funded program to prevent it. No infrastructure preservation plan has been developed. Very recently the Navy and Air Force have identified their concerns regarding infrastructure health. These documents are the basis of what follows.

This paper is a companion piece to Hank Chiles' paper entitled "Nuclear Weapons Personnel Expertise" that addresses nuclear weapon system personnel expertise, since personnel competence may arguably be the most critical element of infrastructure. The brick and mortar of laboratories and production facilities and the hardware and software that are necessary for design, engineering, and production are ultimately useless without the skilled people needed for them to function reliably. Without staff competent to operate these facilities and capabilities they will become inoperable. Because of this interrelationship some repetition of the message of "Nuclear Weapons Personnel Expertise" is inevitable.

The 1990 Defense Science Board study, in recognition of the then anticipated, unprecedented, more than decade-long cessation in modernization of strategic missile systems, recommended in their report Research & Development Strategy for the 1990s "pre-prototype" development in 13 areas, four of which related directly to strategic ballistic missile infrastructure: reentry systems, propulsion, guidance, and hardened electronics. These efforts were recognized as unique to strategic applications and would not likely be supported by tactical force programs, and would not be supported by the commercial sector.

The Strategic Air Command endorsed the program in the early 1990s. Both the Air Force and the Navy were requested to provide $25M/yr for each of reentry systems, guidance, and hardened electronics development, and $40M/yr for propulsion development (the larger amount was judged to be necessary because of the significant costs associated with large-scale rocket motor facilities). Collectively, these efforts became known as "Application Programs" and have continued to receive endorsement from U.S. Strategic Command (STRATCOM) and approval from OSD. However, these programs have hardly ever been fully funded by the Services (even in then-year dollars let alone 1992 buying power) in the years since and their funding is now in rapid decline.

The consequences of neglect can be found in the 2008 Service reports mentioned earlier.

The Department of the Air Force submitted a Congressionally-mandated report on ICBM infrastructure to the Appropriations Committees of the Congress on October 14, 2008. It states, in part (emphasis added):

> The 2006 ICBM Industrial Base Study conducted by the ICBM Long-Range Requirements Planning Steering Group **forecasts a decline in development, production, and sustainment skills** as current life extension efforts conclude. The findings of the study were threefold: First, at completion of the current ICBM modernization efforts, the first of which concludes in 2009, **large portions of the workforce will retire, be moved to other work within companies, or go to new jobs elsewhere resulting in a risk those skills will not be recoverable.** Second, to maintain, sustain, and modernize the ICBM system to 2030, sufficient resources are required to preserve the production and development capabilities for unique ICBM capabilities. Furthermore, significant risk exists, which is quantifiable in terms of cost, schedule, and capability, relative to having capabilities available to develop and produce a follow-on land based strategic deterrent unless the skills and capabilities are preserved during the period between the current production efforts coming to a close and the development of a new system. **Lastly a risk exists that companies with specific skill sets may choose to exit the ICBM industry due to lack of business.**

The following conclusion of Navy Strategic Systems Programs was part of its recent submittal to the ongoing Office of the Secretary of Defense Solid Rocket Motor Study.

> **The large solid rocket motor manufacturing capability of the United States has been on the decline for nearly two decades. Further decline is anticipated as a majority of the current production for other government customers is ending.**

Possibly the most dramatic portrayal of the state of infrastructure is the information included in a briefing prepared by the ICBM SPO, Col. Allan Netzer in 2005. The presentation, entitled "ICBM Industrial Base Skills Assessment," prepared in conjunction with the ICBM industrial base contractors, presents a dire picture of skills in the areas of propulsion, guidance, and re-entry, exactly the areas in which the 1990 DSB study called for special efforts to retain unique infrastructure capabilities. While charts from the briefing explicitly address the loss of personnel skills, they fully reflect the negative impact upon the facilities and equipment infrastructure that these personnel maintained and exercised. The data were gathered in 2004–2005. Each chart displays the then expected annual funding level of each of the Application Programs mentioned previously that were notably less than the $40 Million per year recommended for Propulsion and the $25 Million each for Guidance and Reentry. The charts also identified other Strategic Programs that were also expected to contribute to necessary competence. The charts' bottom line is the resulting "stop light" assessment of competence by skill area, essentially all going rapidly from yellow to red during the period FY'05 to FY'18. These charts were included in the paper provided to the Commission but were unable to be reproduced in this volume for technical

reasons. They can be seen in a March 2006 DSB Report titled "Future Strategic Strike Skills" on pages 24, 25, and 26. The DSB Report can be found at http://www.acq.osd.mil/dsb/reports/2006-03-Skills_Report.pdf.

Since 2005 some relevant new programs have come into existence. In other areas funding has disappeared. Strategic Rocket Propulsion has benefitted by some recent renewed interest and funding in the ICBM Dem/Val line. Contributing to the challenge is the fact that there is no current funding to support the Technology for Sustainment of Strategic Systems (TSSS) effort. In addition, the Navy's Strategic Propulsion Applications Program (SPAP) is currently not funded.

Guidance, navigation and control (GN&C) application technologies and skills are important to supporting sustainment/life extension efforts of both ICBM and SLBM systems. There is a moderate level of work in these areas and promising technologies are being evaluated. Scalability of common technologies and cost reduction are major thrusts. However, some difficulty has been encountered in sustaining a viable path to strategic radiation hardening, as demonstrated by the lack of funding in the Navy's Radiation Hardened Electronics application line.

There is some work in the Conventional Prompt Global Strike (CPGS) arena that can be applied to legacy strategic systems, but it does not replace the necessary level of effort in this area.

Even taking into account these programs the net result is captured starkly in additional quotes from the Air Force Report to Congress:

- "The Air Force FY2009 Unfunded Requirements List (URL) quantifies near–term sustainability issues. The current, planned ICBM funding is insufficient to sustain the Minuteman III to 2030 and to sustain an industrial base qualified to develop a follow-on system."
- "Within the FYDP the Guidance, Propulsion, and Safety Enhanced Re-Entry Vehicle production programs will end, resulting in a loss of production skills."
- "An increased production capability risk will be assumed for future modernization or for sustainment issues when they arise. Therefore, confidence is low to medium that these capabilities will be available."
- Specifically, for Propulsion, the Report summarizes: "The overall risk based on data collected from the ICBM community indicates a significantly growing reconstitution concern in the next 3 to 5 years (Post Propulsion Replacement Program (PRP) production)."
- For Guidance the Report summarizes: "With completion of the GRP (Guidance Replacement Program) in 2009 the skill sets and associated risk in production, materials component suppliers, and production facilities is assessed as moderate to high."

For Reentry Vehicles the Report summarizes: "However, no program is developing and producing a complete ballistic reentry vehicle or contributing substantially to the domestic industrial base. Furthermore, domestic static testing capability of the extreme environments experienced by RVs is limited. While numerically sufficient, the current inventory of RVs will require some sustainment activity and development of technologies limited primarily to materials to support through 2030, therefore the overall risk is assessed as moderate to high."

The Report's overall summary: "The risk of retaining the skills base for development, production, materials, component suppliers, and facilities is moderate to high."

Subsequent to the release of the Air Force Report, the Air Force has decided to seek funding for low-rate production of MMIII solid rocket motors in its FY 2010-2015 FYDP. If funded, as their Report indicates, the risk for motor production skills may be reduced to moderate.

While the Air Force Report explicitly addresses only ICBM infrastructure, the assessment is drawn from essentially the same industrial base that supports the Navy, and must be assumed to apply equally. Similar to the Air Force, the Navy has funded continuing limited TRIDENT II (D5) motor production through the FY10-15 FYDP.

The remedy for the situation has been articulated in several recent reports.

As the Air Force Report to Congress makes clear, the recommendations from earlier assessments have not been adequately implemented.

The recently completed Defense Science Report on Nuclear Deterrent Skills (http://www.acq.osd.mil/dsb/reports/2008-09-NDS.pdf) includes the recommendation:

> The Secretary of the Air Force and Secretary of the Navy should fund advanced development programs to technically evaluate potential replacement systems to maintain and renew necessary skills in anticipation of the end-of-life of U.S. nuclear-capable delivery systems.

The 2006 Report of the Threat Reduction Advisory Committee, "An Evaluation of DoD's Responsive Infrastructure for Strategic Strike" concluded:

> The strategic forces infrastructure can only be healthy, and its health can only be assessed realistically, if it is actually doing something—doing actual work in some profile along the continuum of exploratory development engineering development, prototype fabrication, and perhaps limited serial production. The current low level of effort on new or modified strategic strike systems is insufficient both to maintain the health of the infrastructure and to provide strategic options for the nation.

The 2006 Defense Science Board Report on Future Strategic Strike Skills noted:

Finding #3

The strategic strike area most at risk today is ballistic missiles:

- Current skills may not be able to cope with unanticipated failures requiring analysis, testing, and redesign;
- A large number of skilled military, civil service, and contractor personnel are nearing retirement;
- Design skills are rapidly disappearing, both for major redesigns of current systems and for the design of new strategic systems; and
- Applications programs are necessary, but not sufficient to maintain skills; moreover, they have never been funded at the required levels.

Recommendations

- Ballistic missile program offices should devote resources to the transfer of critical knowledge and skills to early career personnel in industry.
- The Secretary of Defense should direct the Navy and the Air Force—absent near-term systems development—to fund advanced development (subsystem design, system prototype development, and testing) to support next-generation system development (which will also restore and maintain the skills base).
- The Secretary of Defense should ensure that the Navy and Air Force Applications Programs are fully funded at the STRATCOM SAGs originally-recommended levels to address critical areas not supported fully by advanced development.

The Infrastructure EWG strongly endorses these recommendations. We believe that the President and the Congress must not allow the large diameter ballistic missile infrastructure to simply fade away without a clear and concrete decision. A decision to allow the infrastructure to die and depend upon possible resurrection at some future date, with the attendant risks and costs is one option. A decision to preserve the unique technologies critical to infrastructure sustainment, will, according to the best advice available, require the funding of development programs, without necessarily a commitment to full scale production, but certainly including the industrial base in full evaluation of production issues and the evaluation of reliability via a testing program. As an initial step the Air Force and Navy should be tasked to redo the Air Force assessment excerpted in the above charts in order to identify and prioritize those areas of infrastructure in greatest need of programmatic effort.

29

F-35—Preserving Nuclear Air-delivery Infrastructure

Robert B. Barker

The current funding structure, contrary to earlier expectations, for a nuclear capable F-35 Block IV raises serious questions about the nation's commitment to preserve extended deterrence in the form of forward based non-strategic nuclear capable aircraft in the US and allied inventories.

The US nuclear deterrent has always included air delivered nuclear capability and today incorporates strategic aircraft, the B-52 and B-2; non-strategic aircraft, the F-16 and F-15 (and includes some European nations' Tornado aircraft as part of extended deterrence); and cruise missiles, the TLAM-N and ALCM.

With the exception of the B-2, all of these systems are several decades old and, except for the ageless B-52, are scheduled for retirement in the next decade. The Next Generation Bomber (NGB) purportedly will incorporate nuclear delivery capability in its basic design and is not discussed here.

The F-35, Joint Strike Fighter, has been advertised for a decade as preserving the option for nuclear delivery that would include nuclear capability in Block IV design and production for aircraft scheduled for delivery in 2016. This schedule would preserve non-strategic nuclear air-delivery as the F-16 and F-15 are retired, and very importantly preserve the option for extended deterrence via forward basing in NATO. Some NATO nations have expressed interest in F-35 procurement as their nuclear capable Tornados face retirement as early as 2013.

However the DoD FY 2010 budget includes no funding for nuclear capability for the F-35 Block IV. The Air Force now states that it expects nuclear capability funding to be initiated in FY12 POM, with the expectation of a 2016 IOC. The basis for the Air Force's claim that a 2016 IOC can be met

with funding only being initiated in the FY12 POM is unknown. A serious consequence of the decision is that F-35 contractors now are not funded to engage in technical discussions with NNSA's Laboratories to even evaluate the technical impact on F-35 design of adding nuclear capability. The current B61 nuclear bomb Life Extension Program Phase 6.2/6.2A study will go forward with less than ideal communications with the designers of the only non-strategic aircraft that would remain to carry it.

The non-strategic aircraft infrastructure in general is very healthy, unlike the industrial base that is required to support large diameter ballistic missiles (See paper #10). Commercial and tactical aircraft demand has kept the industry vibrant and technologically current. The only missing infrastructure factors when one considers nuclear capable non-strategic aircraft are the exercise of incorporating nuclear survivability (survival against nuclear weapon effects) and incorporating nuclear surety (ensuring that the safety, security, and control requirements for nuclear weapon carriage are met at all times). The F-35 will not incorporate a nuclear survivability requirement similar to that of the F-15 and F-16 so this issue is not discussed in what follows.

Historically, adding nuclear survivability and surety after basic design of a delivery system has incurred much larger costs than would have been required if nuclear requirements had been considered initially. In fact, at times, the cost differential was big enough that policy plans for nuclear capability were abandoned. Some have even suggested that program office actions to defer a decision to incorporate nuclear capability, and thus inevitably incurring high cost, was a back door path to dictating policy.

Today, the situation may be different. Modern digital technology may allow nuclear surety to be "added" to an otherwise non-nuclear capable aircraft platform at reasonable cost. While aircraft pose some different challenges, a late 1990's Navy study developed a system that could enable an otherwise non-nuclear capable submarine to be made capable of TLAM-N delivery using man-portable equipment and meet all nuclear surety requirements.

Explicit in the concept of "added" aircraft nuclear capability is that design features of the nuclear weapon carried may assume some of the surety burden previously imposed on the delivery platform. The concepts behind this vision are, however, so far conceptual and cannot be established with adequate confidence without technical experts from NNSA and DoD contractors exploring implementation on a real system. Such a prospect was in the offing with the prospect for simultaneous undertaking of engineering nuclear capability for the F-35 Block IV and the B61 nuclear bomb Life Extension Program Phase 6.2/6.2A study.

The Air Force decision to delay nuclear capability funding for the F-35 has been a major setback. The delay is worrisome not only because of the limitation on time to explore the technical aspects of nuclear surety, but because

any changes from historic Air Force nuclear surety procedures will involve time-consuming scrutiny by experts from all sides to assure that confidence in surety has not been compromised by new technology. Current Air Force nuclear surety requirements are based on the limitations of 1950's technology and have been ingrained in 50 years since. In many ways, the philosophical re-evaluation of the adequacy of surety, involving new nuclear design concepts and new approaches to hardware and software implementation in the delivery platform, may be even more time-consuming than the evaluation of the technical aspects.

The Infrastructure EWG recommends that the Air Force be directed to reprogram funding to initiate F-35 contractor participation with NNSA in the evaluation of nuclear surety concepts for a nuclear capable F-35 Block IV.

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Stockpile Alternatives from Life Extension Program (LEP) to Reliable Replacement Warhead (RRW)

Everet Beckner

This paper explores the value trade-offs in two current approaches for maintaining a safe, secure, and reliable nuclear weapon stockpile into the future. The two approaches are: (a) to extend the life of an existing weapon by selective parts replacement and recertification (the LEP approach); or (b) to replace an existing weapon with a new design, with improved design features and predictability (the RRW approach). In addition to examining the technological advantages of the two approaches, we will also consider the challenges of providing and maintaining the production infrastructure to support either approach, as well as the way in which the nuclear design community is impacted (positively or negatively) in terms of maintaining the critical technical skills of the designers and the stockpile stewards.

The Present Situation with the Stockpile

Under current plans, the United States plans to maintain seven warhead types in the active stockpile:

- Two submarine-carried SLBM warheads, the W76 and the higher yield W88. Because production of the W88 was terminated earlier than originally planned, there are relatively few of them compared to the number of W76's originally manufactured.

- Two ICBM warheads, the W78 (initially deployed on the Minuteman III missile) and the W87 (developed for Peacekeeper but now deployed on the Minuteman III). The warheads have similar military characteristics.
- Two bombs, the B61 and B83. The B61 is actually a family of bombs, some designed for tactical use and deployed in Europe. The Secretary of Defense has told NATO that the tactical B61s will undergo life extension and improvements.
- One cruise missile warhead, the W80.

Details of the Two Approaches to Stockpile Maintenance

- LEP is the approach whereby the life of an existing weapon system is extended by remanufacturing the original design using duplicated parts, wherever possible, while making modest changes to accommodate the realities of manufacturing limitations imposed by changes in environmental laws, availability of materials, etc. As a part of such a program, the weapon also undergoes a renewal of its certification that it satisfies the DoD military system requirements. An ongoing example of this approach to stockpile life extension is the LEP which has just reached FPU (first production unit) on the W76 Trident warhead, designated the W76-1. Other weapons presently being considered for possible LEP remanufacturing are: the B61 bomb and the W78 ICBM warhead. Both have been identified as having aging problems which are developing with either the nuclear package or with one or more electrical components.
- RRW is the approach whereby an existing weapon is replaced in the stockpile by a newly designed, newly manufactured weapon, that exploits the opportunity to optimize the design around performance margins, predictability, and specialized security features rather than "yield-to-weight," which was the primary consideration in the designs in the present stockpile. Although it is not inherent in the concept, as a matter of policy the current Administration mandated that these replacement designs would not have new military characteristics. RRW designs were recently developed for consideration as a possible 2nd block replacement for the W76, but Congress has so far not appropriated funds to do detailed design and cost estimating.

Critical Differences, Advantages, and Disadvantages of the Two Approaches

- LEP solutions to extending the life of an existing weapon are straightforward and feasible for every weapon design in the present stock-

pile, unless for some reason the pit needs to be replaced. In that case, two solutions are possible: 1. Pit re-use, in which pits from a retired weapon system are substituted into the LEP design, when possible; or, 2. Manufacture of new pits, with the expectation that production rates will be limited by the rates obtainable from the limited capacity of the plutonium manufacturing facility at LANL. All the other parts for an LEP program can generally be expected to be "manufacturable," including the manufacture of new secondaries at the Y12 Plant, new electronic components at the Kansas City Plant, new neutron generators at Sandia, and new gas reservoirs at the Savannah River Plant. LEP production rates will probably be determined by the assembly rates which can be achieved at the Pantex Plant, since it is also executing a large dismantlement program over the next 10–15 years. The exception to this rule would occur if a new pit had to be manufactured for the primary, in which case the output rate for the full system would be determined by the rate of production of pits at LANL.

- RRW solutions to maintaining the stockpile tend to be very weapon specific and, in every case, very dependent on the design of the new primary. If the approach is to design and manufacture a new pit, the production rate will necessarily be slow and the cost will be high, but the design can thereby be truly optimized for higher margins against uncertainties and for higher designed-in security features. If the approach is to re-use an existing pit (from a previously retired weapon), then the total program is less expensive, probably can result in a higher production rate, and will probably be at least marginally sub-optimized. To date, for a variety of reasons, Congress has been unwilling to authorize any RRW work beyond preliminary design studies.
- Recently, the concept of "secondary re-use" (replacing a set of troubled secondaries on one weapon system with excess secondaries from another weapon system, retired or otherwise available) has been advanced as an option deserving consideration. Secondary re-use offers as a way of limiting the cost of manufacturing LEPs or RRWs, as well as limiting the size and scope of HEU manufacturing facilities that need to be replaced at the Y12 Plant. It is not likely that this approach could be broadly applied, but it might be a useful strategy in certain weapon systems. For now, it is simply too soon to tell what the impact of this strategy will be.

In Terms of Providing Early Answers to the Value Trade-off Questions Raised in the First Paragraph of This Paper, We Can Say the Following

- RRW designs can be expected to yield more complete warhead solutions to technical questions than LEP solutions, though they will be more expensive; and
- RRW designs offer a better way of sustaining the intellectual vigor of the design community than LEP solutions; but
- RRW designs, especially those involving a new pit, will require a more extensive and expensive manufacturing complex than LEP solutions.

More specifically, the concerns of the nuclear design community are very strong regarding intellectual vigor and the difficulties of maintaining a competent design community over the long term if, in fact, there is little or no work for them to do other than maintain a stockpile of old weapons.

Near-Term Stockpile Activities Underway or Contemplated

- The W76 LEP (W76-1) is underway and is expected to be completed on at least 600 weapons in the next 4-5 years, with many hundred additional unmodified W76-0s available for spares for perhaps 20 years. Later in this paper, the time required to manufacture the secondaries for the W76-1 is found to be important, since that requirement is at least partially responsible for keeping operations ongoing in Y12's nuclear facilities, which are generally considered to be too old for continued use.
- In addition to strategic forces requirements, the tactical forces requirements will dictate that the B61 remain in the stockpile to satisfy NATO commitments, until a B61-LEP or an RRW/bomb is completed to replace the present B61. Several aging problems are dictating that this weapon system undergo refurbishment or replacement in the next 10 or so years if it is to remain in the stockpile.
- Aging problems known to be developing in the W78 will soon require: (a) an LEP; or (b) an RRW designed for a reentry vehicle[1]; or (c) retirement of the W78 with the W87 taking its place. Later in this paper, we assume the solution can probably be (c).
- The W88 and the W87 can probably remain in the stockpile, if desired, without modification for at least another 15 years.

- Unless the Air Force eliminates the B-2 as a nuclear carrier, the B83 can probably remain in the stockpile without modification for at least another 15 years, if desired.

One concludes from these statements that for at least the next 15 years the critical nuclear weapons issue is: what must be done (LEP or RRW) to keep the B61 (or a replacement) in service well into the 21st century. This is the obvious LEP vs RRW trade-off that needs a more thorough examination than it has received to date. Since there is not enough known at this time about the technical arguments of LEP vs RRW for this weapon, we will explore below only the manufacturing considerations.

Ramifications of These Conclusions on the NNSA Strategy on the Two Big Nuclear Construction Projects Requiring Decisions Soon: CMRR-NF and UPF

Chemistry and Metallurgy Research Replacement—Nuclear Facility (CMRR-NF). CMRR-NF is a proposed new nuclear facility at LANL, primarily devoted to plutonium and intended to replace an existing facility, the Chemical and Metallurgy Research (CMR) facility, which is roughly 50 years old and a serious safety concern for both NNSA and the Defense Nuclear Facility Safety Board (DNFSB). It would be used to support manufacturing of plutonium components (pits), but in a support role rather than as the manufacturing site itself. Production of pits would continue in PF-4 at LANL, but rates would be raised from around 20 pits per year from present facilities to 50-80 per year if CMRR-NF is available. Thus, production, *per se*, is not the driving need for construction of CMRR-NF. Rather, it is the need to replace CMR, which is judged by all to be well past the time when it should have been closed. The cost to complete design and to construct CMRR-NF is believed to be between $1.5 billion and $3 billion, with 8 years +/- required after design is completed. The cost issue is complicated by the fact that not only is the cost very hard to fit into the flat or declining NNSA budget, it is highly unlikely that the NNSA can be confident that the cost of such a large and complex nuclear facility can be controlled against the unrelenting pressures of safety and security regulations and orders.

Uranium Processing Facility (UPF). UPF is a proposed new nuclear facility at the Y12 Plant, intended to replace existing facilities used to manufacture HEU parts and to assemble/disassemble nuclear secondaries. The major facility to be replaced is building 9212, which dates back to the Manhattan project. Both NNSA and the DNFSB are committed to closing the old HEU manufacturing facilities at Y12 as soon as replacement facilities can be built. Unfortunately, this project suffers from the same uncertainty as CMRR-NF in terms of cost and schedule control. It appears that UPF will cost somewhere

between $2.5 billion and $3.5 billion, and therefore will seriously impact other elements of the budget which will have to be reduced in order to make way for this project.

UPF carries another uncertainty, that being the required scope of the project. As is obvious to all, the stockpile that requires support by the Y12 Plant is now expected to be much smaller than when the UPF design was started. Whereas the project must still be able to do all the manufacturing processes originally envisioned, it is not required to support the original production rates and NNSA assumes much of its workload will be related to dismantlement. It appears that NNSA is having a lot of difficulty getting this "scope" definition under control.

Timing Is Everything

In the previous section, we described the two most pressing needs in the NNSA weapons complex for critical facilities to support LEP or RRW manufacturing activities for the stockpile for the next 20-40 years, namely CMRR-NF and UPF. However, since they are large and very expensive nuclear facilities, and since neither has yet entered final design, let alone construction, a significant doubt exists that they will be designed and built at the proper size and scope to support the smaller stockpile that will probably exist by the time the construction projects are completed. Simply stated, the Infrastructure EWG is concerned that the significant costs entailed in the completion of these two facilities will come at the cost of critical technical personnel and support programs when, in fact, many of the LEP (or RRW) manufacturing requirements will have been met before the big facilities can be completed and brought into operation.

Here is the picture that emerges from our present understanding of the manufacturing needs of the stockpile for the next 10+ years:

- If the W76 LEP (which has just achieved FPU) can be manufactured at the rate of at least 100/yr, the first 600 units can be completed by the end of FY2014. Present expectations are for higher rates of production.
- If the decision is made to manufacture a B61 LEP (being informally referred to as the B61-12), and if that development program can be completed by 2014 (certainly a reasonable amount of time), then a few hundred B61-12's could also be manufactured by the end of FY2020.
- Since the secondaries for both the W76-1 and the B61 LEP will have to be manufactured in existing facilities in this scenario (since UPF cannot be expected to be completed and brought into operation much

before 2020), UPF is not required to support either of these LEP's unless the schedule for one or both of them is delayed.
- Similarly, since neither the W76 nor the B61 LEP require new pits, CMRR-NF is not obviously required before 2020.
- This means that a major portion of the presently identified stockpile manufacturing activities will be completed before either CMRR-NF or UPF can be completed. This is true, however, only if both CMR at LANL and the 9212 complex at Y12 can be kept in operation until 2020.
- It follows from these arguments that, from the standpoint of the stockpile, NNSA should be able to delay both CMRR-NF and UPF long enough to get the scope of both projects adjusted for the smaller stockpile manufacturing needs that will likely require support after 2020.

On the other hand, if the safety/security concerns regarding the B61 LEP are viewed as substantial and as requiring development of an RRW replacement for the B61, then the story changes considerably.

- If the decision to move forward with an RRW replacement for the B61 was made within the next two years, the significant change from the prior analysis would be the requirement to manufacture a few hundred new pits before approximately 2020. If we could complete the development program for the RRW within 5 years of starting it (assumed to start in 2011 and to be ready for manufacture in 2016 in this scenario), then we could reasonably plan to manufacture 25-40 pits per year at LANL in PF-4 (without CMRR-NF completed) or 60-80 per year (with CMRR-NF operational). This would specify completion of 100-200 RRW B61s by the end of 2020, rather than as many as 600 B61 LEPs estimated earlier.
- There is no reason in this scenario not to complete manufacture of all the secondaries required for the B61/RRW prior to 2020 in existing facilities at Y12, since it would be possible in the same way that it appeared to be possible in the all-LEP scenario described previously.

Finally, one additional development could significantly alter the analysis in this paper. When the concept of an RRW was first devised, the Nuclear Weapons Council approved proceeding with an RRW as a complement to the existing W76/LEP. The W76 is the most numerous warhead in the stockpile. It dominates the sea-based leg of the U.S. deterrent and thus represents a very high fraction of survivable U.S. warheads deployed on a day to day basis. It is also the only U.S. strategic warhead for which there is no backup. These considerations led the Nuclear Weapons Council to advocate a future sea-based force that was a mixture of W76 LEP (now in progress), W88 (existing but a relatively small fraction of the sea based deterrent) and the proposed W76/RRW. Were the upcoming Nuclear Posture Review to reaffirm this deci-

sion, and were the Congress to approve resumption of the W76/RRW design effort, then the considerations noted above for the B61/RRW would apply to the W76/RRW. It would not be possible to simultaneously manufacture new pits for both the B81 and W76, except by stretching out both programs for an unacceptably long period.

Conclusions Regarding LEP and/or RRW Manufacturing Requirements

- For the stockpile modifications envisioned for the next 15 years, only the B61 poses a significant new program requirement. This relies on the present stockpile assessment that the W88, W87 and B83 do not require modifications or upgrading until the mid-2020s. Also, it assumes that the W80 is retired, rather than being modified or repaired, and that the W78 is retired and replaced by W87's. However, if the decision was made to retain either the W80 or the W78 in the stockpile for many years, a few hundred could be manufactured as LEPs in the next 15 years without making a significant demand on nuclear manufacturing facilities.
- If the B61 plan is executed soon as an LEP (the B61-12), then neither CMRR-NF nor UPF can be available, and the program would be completed by 2020 in existing facilities at Y12, if they can continue to operate until then.
- If the B61 plan is executed as an RRW, and if it could be authorized by 2011, then: (a) UPF is not required for the program; while (b) CMRR-NF could help provide for completion of the program by approximately 2023, rather than by 2026 if CMRR-NF is not available.
- This analysis does not contemplate a serious attempt to use an existing pit for the B61 RRW, rather than a new pit. That option would seem to be open for consideration, and if selected for the program would eliminate all the manufacturing arguments for CMRR-NF unless the Congress reconsiders and approves an RRW in lieu of some portion of the W76 LEP.

Other Considerations

- It is likely that an LEP or an RRW for both the W88 and the W87 will be required by the mid-2020s. At this time, it is not obvious that the same statement would be made for the B83. Furthermore, considering the details of the weapon designs for the W88 and the W87, it is not at all obvious that either would need a new pit in order to stay in the

stockpile. The W87 is not likely to need a new secondary, while the W88 probably will.

- So, looking out as far as 2030, at this time it appears that the B61 RRW option is the only weapon which could require manufacture of new pits. Several weapon modifications (LEPs) will require new secondaries, but UPF is not available, and thus not required until after 2020. If, in fact, the present manufacturing facilities at Y12 are declared prior to 2020 to be unfit for further use, the B61-12 (or B61/RRW) could not be completed until UPF was completed and brought into operation.
- A significant issue is now obvious: a serious effort needs to be devoted by NNSA to assuring operation of present manufacturing facilities (Bldg. 9912, etc.) at Y12 until all the secondaries are manufactured to satisfy the W76-1 and the B61-12 (or B61/RRW) needs. It would appear that the W76-1 program needs are not the issue. Rather, the B61-12 (or B61/RRW) program needs to be defined and the secondary design finalized so that secondaries for that program can be manufactured as soon as possible. If NNSA decides that this program cannot be supported in existing facilities, since they would likely require operations until at least 2020, then UPF construction should proceed as first priority with the expectation that operations there might be underway by 2017-2018.

Final Conclusions

- The main justification for NNSA to urgently seek to complete both CMRR-NF and UPF follows from the broadly held view that the U.S. nuclear weapon program should not continue to rely on old, out-of-date, and out-of-compliance nuclear facilities at LANL and Y12. In the case of the LANL facilities, they primarily limit the weapon surveillance and R&D programs. In the case of Y12, they limit the HEU manufacturing capability as well as assembly/disassembly of secondaries. In both cases, they limit the vitality of the weapons support program and the associated technical staff.
- However, upon scrutinizing the manufacturing requirements associated with future LEP or RRW programs, it appears to the Infrastructure EWG that NNSA should not rush to complete both the UPF and the CMRR -NF facilities at the earliest possible date, as they are now planning to do, but should take the time to re-scope them for the reduced stockpile requirements that are now becoming obvious. This will surely save some construction money and will also make it possible to protect a larger budget for the Stockpile Stewardship

Program and thereby retain a more competent staff for all elements of the weapon program.

- There is a strong concern on the part of the design community, which the Infrastructure EWG endorses, that irrespective of the details of the nuclear facilities required to maintain the stockpile there is an even greater problem that must be addressed. That problem is the widely held view that there must be important and useful work for nuclear designers to do if that community is to remain technically viable over the next several decades and thereby maintain for the country its "second to none" nuclear weapon capability. The Infrastructure Experts Working Group is preparing a separate paper on this subject.

Recommendations for Actions by the Commission

- Suggest to NNSA that they re-examine the urgency to construct replacement facilities for both CMR at LANL and the 9212 HEU Complex at the Y12 Plant. This re-examination should take into consideration the likely reduction in stockpile size now being developed by DoD as well as the fact that the W76 LEP will be, and the B61 LEP probably can be, completed in existing facilities before the new nuclear facilities can be expected to be completed. We would expect this re-examination to show that the replacement facilities (CMRR-NF and UPF) can be smaller than presently planned and can be scheduled to be constructed sequentially rather than simultaneously, which will free up funds to more adequately support critical human capital requirements of the NNSA Nuclear Weapons Program.
- Following the above review, provide input to Congress supporting these two construction projects, though with scope, schedule, and costs adjusted to reflect the probable U.S. stockpile needs of the 21st century.
- By combining input from the Nuclear Infrastructure Working Group with input from other working groups, develop a firm position on the relationship between the technical health of the weapon design community and the stockpile requirements, particularly within the context of RRW vs LEP as the long-term strategy for maintaining the nation's nuclear capabilities as well as the stockpile.

1. The RRW proposed as a replacement for the W76 was designed to be suitable as a replacement for the W78. As noted above, Congress recently denied funds to continue working on this design.

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What's New?—Use and Misuse of the Term "New"

Thomas Scheber

The adjective "new" is often used imprecisely in debates over nuclear weapon issues. "New" can be used to communicate many different aspects of the noun it modifies (e.g., something recently produced, different than previous versions, or having no precedent). When the precise usage is not specified, the various meanings of "new" can cloud an issue rather than help clarify it.

Take, for example, a situation that occurred in 1995 when administration officials initiated a modification to an existing nuclear gravity bomb (the B61-7) to serve as an interim earth-penetrating weapon. (The resultant modified nuclear weapon is the current B61 Mod 11 nuclear earth penetrator that can be carried on B-2 aircraft.)

A national debate ensued over the proposed modification as journalists and technical experts heatedly debated whether the modification to the B61-7 represented a "new" warhead. Some critics of developing the B61 Mod 11 earth penetrating weapon argued that it would be a *new* warhead. These critics held the view that pursuing any *new* nuclear weapon would be inconsistent with the spirit of U.S. obligations under Article VI of the Nuclear Nonproliferation Treaty. Thus, critics attempted to frame the debate within the semantics of the term *new*.[1]

In the case of the B61 modification, the U.S. took an existing (*not new*) warhead, put it in a different (*new*) configuration as an earth penetrating weapon, deployed it on the same (*not new*) delivery systems (B-2 aircraft), to achieve weapon effects on deep underground targets comparable (but *not new*) to effects from an older, higher yield gravity bomb that was to be retired. The comparable (*not new*) effects on the same (not new) targets were achieved

in a somewhat different (*new?*) manner. Is there any wonder why there was confusion over whether the term new was appropriate for this program?

The proposed modification to the B61-7 was implemented. Fielding the B-61 Mod 11 enabled the U.S. to retire all B53 warheads—old multi-megaton warheads that lacked modern safety and security features—without degrading military effectiveness.

Is the Reliable Replacement Warhead (RRW) New?

One question that is often asked is whether RRW concepts will lead to a "new" nuclear warhead. For RRW concepts, the discussion over a term as imprecise as new can be as unhelpful as during the debate over the B61 Mod 11.

Specificity Helps

Perhaps a more straightforward approach is to clarify which aspects of RRW should be considered *new* (and in what way) and which do not meet any of the definitions of *new*.

For the RRW, the category, *not new,* seems to apply to the following:

- The U.S. is developing replacement warheads that are to be carried on existing (*not new*) weapon delivery systems.
- RRW warheads for existing weapon delivery systems are being developed to accomplish the same (*not new*) missions as the warheads they will replace.
- Existing weapons armed with RRW warheads will provide comparable (*not new*) weapon effects on targets.

The category, *new,* seems appropriate for the following:

- *All* components required for RRWs will be *newly produced.* (Of course, *some* newly produced components are required for warhead refurbishment programs.)
- The precise configuration of RRW warheads will be *different* from any previous nuclear warheads in the U.S. stockpile. For example, RRWs will not contain some hazardous materials currently in the warheads that they will replace.
- RRWs will be inherently *safer and more secure* in the event that unauthorized intruders gain access to a weapon or that the weapons are involved in accidents.

Congress Creates Its Own Definition

Congress has legislated a definition of *new* as the term applies to nuclear weapon activities. The congressional definition of *new* may be useful in calling attention to specific kinds of activities. However, it is not useful for distinguishing the potential benefits and drawbacks between things that may or may not be *new*. For example, according to the criteria in the law, the RRW would be considered a "new nuclear weapon." However, the law allows exemptions from being called *new* which seem to apply to the purpose of the RRW program.[2] (Attachment 1 provides an excerpt from the Public Law 107-314 that defines *new*.)

A Final Caution

In the drafting of the commission's final report, writers should be aware of the loaded meaning of *new* and the potential for obfuscation of issues. A blanket rejection of anything *new* could block future modifications and technology advancements that help make the stockpile smaller, safer, more secure, and more adaptable to meet emerging needs.

Attachment 1

Excerpt from: PUBLIC LAW 107–314—DEC. 2, 2002, THE BOB STUMP NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2003 (pages 277-278 of 306)

SEC. 3143. REQUIREMENTS FOR SPECIFIC REQUEST FOR NEW OR MODIFIED NUCLEAR WEAPONS.

(a) REQUIREMENT FOR REQUEST FOR FUNDS FOR DEVELOPMENT.—

(1) In any fiscal year after fiscal year 2002 in which the Secretary of Energy plans to carry out activities described in paragraph

(2) relating to the development of a new nuclear weapon or modified nuclear weapon, the Secretary shall specifically request funds for such activities in the budget of the President for that fiscal year under section 1105(a) of title 31, United States Code.

(2) The activities described in this paragraph are as follows:

(A) The conduct, or provision for conduct, of research and development which could lead to the production of a new nuclear weapon by the United States.

(B) The conduct, or provision for conduct, of engineering or manufacturing to carry out the production of a new nuclear weapon by the United States.

(C) The conduct, or provision for conduct, of research and development which could lead to the production of a modified nuclear weapon by the United States.

(D) The conduct, or provision for conduct, of engineering or manufacturing to carry out the production of a modified nuclear weapon by the United States.

(b) BUDGET REQUEST FORMAT.—The Secretary shall include in a request for funds under subsection (a) the following:

(1) In the case of funds for activities described in subparagraph

(A) or (C) of subsection (a)(2), a single dedicated line item for all such activities for new nuclear weapons or modified nuclear weapons that are in phase 1, 2, or 2A or phase 6.1, 6.2, or 6.2A (as the case may be), or any concept work prior to phase 1 or 6.1 (as the case may be), of the nuclear weapons acquisition process.

(2) In the case of funds for activities described in subparagraph

(B) or (D) of subsection (a)(2), a dedicated line item for each such activity for a new nuclear weapon or modified nuclear weapon that is in phase 3 or higher or phase 6.3 or higher (as the case may be) of the nuclear weapons acquisition process.

(c) EXCEPTION.—Subsection (a) shall not apply to funds for purposes of conducting, or providing for the conduct of, research and development, or manufacturing and engineering, determined by the Secretary to be necessary—

(1) for the nuclear weapons life extension program;

(2) to modify an existing nuclear weapon solely to address safety or reliability concerns; or

(3) to address proliferation concerns.

(d) DEFINITIONS.—In this section:

(1) The term "life extension program" means the program to repair or replace non-nuclear components, or to modify the pit or canned subassembly, of nuclear weapons that are in the nuclear weapons stockpile on the date of the enactment of this Act in order to assure that such nuclear weapons retain the ability to meet the military requirements applicable to such nuclear weapons when first placed in the nuclear weapons stockpile.

(2) The term "modified nuclear weapon" means a nuclear weapon that contains a pit or canned subassembly, either of which—

(A) is in the nuclear weapons stockpile as of the date of the enactment of this Act; and

(B) is being modified in order to meet a military requirement that is other than the military requirements applicable to such nuclear weapon when first placed in the nuclear weapons stockpile.

(3) The term "new nuclear weapon" means a nuclear weapon that contains a pit or canned subassembly, either of which is neither—

(A) in the nuclear weapons stockpile on the date of the enactment of this Act; nor

(B) in production as of that date.

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1. In the October 1997 Congressional Research Service report, "Nuclear Weapons Production Capability Issues," CRS analyst, Jon Medalia, documented this controversy in the following way: "No definition is possible for two terms that appear throughout this [CRS] report, *new weapon* and weapons maintenance, because the terms are themselves weapons in a struggle over the role and future of nuclear weapons. The debate over the definitions, which masquerades as a matter of semantics, cloaks this larger struggle. … a spectrum of activities might or might not, depending on one's point of view, produce a *new weapon* … those who would de-legitimize the use of nuclear weapons, shrink the stockpile, and abolish these weapons as soon as possible, … use n*ew weapon* inclusively in hopes that broadening the list of new weapon activities will narrow the scope of U.S. weapons activities." [emphasis added]
2. Public law calls for budget submissions to distinguish between what is new and not new for nuclear warhead activities. Public Law 107-314, section 3143, requires budget requests for warhead activities for "new" or "modified" nuclear warheads to be explicitly called out. The definition of new in the law clearly applies to the RRW. However, Section 3143 allows for exceptions and that reporting "shall not apply to funds for purposes of conducting, or providing for the conduct of, research and development, or manufacturing and engineering, determined by the Secretary [of Energy] to be necessary—(1) for the nuclear weapon life extension program; (2) to modify an existing nuclear weapon solely to address safety or reliability concerns; or (3) to address proliferation concerns."

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Miscellaneous Issues for the Commission

Linton F. Brooks

Summary. Several issues have been raised by Commissioners or identified by the Infrastructure Experts Working Group (EWG) that do not require additional analysis but that may deserve brief mention in the Commission's final report. This paper summarizes a number of these issues as an aid to the Commission in determining what to include in that report. It is designed to allow rapid decision on issues to include in the report. There is no significance to the order in which issues are presented.

NNSA Funding Levels

Background. A major concern of the Infrastructure Experts Working Group is that the NNSA plan to fund complex transformation through management efficiencies may fail for two reasons. First, the savings may not materialize. Second, most current plans for management improvements and shifting weapons laboratory costs to non-weapons accounts, while commendable, involve only relatively small sums; there have been no proposals that would lead to major cost savings. NNSA's plans are further complicated by the near certainty that the costs of complex transformation and especially of construction of major nuclear facilities will rise. The history of DOE/NNSA nuclear facility construction shows major cost growth, often exacerbated by Congressional funding decisions. NNSA has worked hard to understand this issue but may not be able to solve it. The EWG fears that cost growth of new nuclear facilities and insufficient savings from efficiency improvements could (and probably will) lead to underfunding the weapons labs, especially in basic science.

Options. The Infrastructure EWG is preparing papers looking at phasing the construction of major nuclear facilities in an effort to fund transformation within projected budgets. Such phasing carries production and safety risks. The Commission could, therefore, call for an increase in NNSA funding to allow complex transformation to proceed as soon as possible. Current (FY07) weapons program funding is only 43% of the Reagan peak and 58% of the average funding from 1962-1993. On the other hand, it is unclear whether Congress will support increased funding even if the Commission recommends it. Indeed, recommending more funding for nuclear weapons could discredit the Commission's report. The following options are available:

- Remain silent on the issue.
- Call for increased funding of $200-300 million/year for complex transformation.
- Stress the importance of predictable funding (much cost growth is the result of Congressional inconsistency in funding).
- Note the consequences of attempting complex transformation within steady budgets but make no explicit recommendation.

Acceptability to Congress of Complex Transformation if There Are No Major Savings

Background. Some in Congress assume that reductions in the nuclear weapons stockpile should lead to comparable reductions in the weapons complex. They fail to recognize that much of the complex is necessary regardless of stockpile size. Without major cost savings or the closure of a major facility, some in Congress may oppose complex transformation. The Commission may wish to use its prestige to head off this outcome.

Options. The Commission could (1) remain silent on the issue or (2) include words similar to the following at an appropriate place in the report:

> The Commission firmly believes that the U.S. nuclear weapons stockpile should shrink and that the nuclear weapons complex should be sized for this smaller stockpile. The Commission has spent considerable time seeking to determine the most cost-effective way to approach complex maintenance and transformation and to minimize the retention of unnecessary capabilities. In this regard, we applaud the ongoing NNSA efforts to eliminate and consolidate duplicate capabilities. We note, however, that the expectation that complex transformation will lead to major cost savings or the closure of a major facility is unrealistic.

Nuclear Test Readiness

Background. Although the Administration sought to establish a standard of retaining the ability to resume underground nuclear testing within 18 months, Congress has been unwilling to fund this level of readiness. NNSA now says it can resume testing in 24 months, but test readiness tends to be a low priority for both NNSA and the laboratories. Test readiness costs are small but tend to be underfunded by NNSA and cut on the Hill. There is no consensus (in the Administration or in Congress) on the importance of test readiness. A Commission endorsement of the importance of maintaining readiness to resume underground nuclear testing, if such a step became necessary, might increase support.

Options. The Commission could:

- Remain silent on the issue.
- Call for maintaining test readiness as a safeguard if the Comprehensive Test Ban Treaty is ratified (test readiness was one of the safeguards proposed by the Clinton administration when it submitted the CTBT for ratification).
- Stress the importance of maintaining test readiness in any case.[1]

Base Closure Commission Approach

Background. There are periodic calls, including in Congress, for establishing the NNSA analogue of the Department of Defense Base Realignment and Closure Commission (BRAC). A BRAC approach is inappropriate for NNSA because all NNSA sites are one of a kind. The one exception is the two physics laboratories, Los Alamos and Livermore. These facilities, however, provide indispensable peer review and each contains unique, major, and expensive diagnostic facilities (NIF, DAHRT).

Options. The Commission could (1) remain silent on the issue or (2) include words similar to the following at an appropriate place in the report:

> The Commission is aware of periodic suggestions for establishing a DOE/NNSA analogue of the Department of Defense Base Realignment and Closure Commission (BRAC). We believe that a BRAC approach is inappropriate for NNSA because all NNSA sites are one of a kind. The one exception is the two physics laboratories, Los Alamos and Livermore. These facilities, however, provide indispensable peer review and each contains unique, major, and expensive diagnostic facilities (NIF, DAHRT).

One Physics Lab or Two?

Background. Livermore and Los Alamos both focus on the physics package of nuclear weapons (Sandia is the engineering laboratory and concentrates on components outside the physics package). Periodically, questions are raised about the need for two physics laboratories (Senator Nelson of the SASC Strategic Forces subcommittee raised this briefly when he met with the Commission). Two separate laboratories provide peer review in the one area—the physics package—that we cannot test and where our theoretical understanding remains incomplete. Further, there are unique facilities at both Los Alamos (plutonium, DAHRT) and Livermore (NIF) that the weapons program requires and that would be prohibitively expensive to duplicate.

Options. The Commission could (1) remain silent on the issue or (2) include words similar to the following at an appropriate place in the report:

> The Commission is aware of periodic questions about the need for maintaining both Lawrence Livermore and Los Alamos National Laboratories, since both focus on the physics package of nuclear weapons. In our view, keeping both laboratories is essential. Two separate laboratories provide peer review in the one area—the physics package—that we cannot test and where our theoretical understanding remains incomplete. Further, there are unique facilities at both Los Alamos (plutonium, DAHRT) and Livermore (NIF) that the program requires and that would be prohibitively expensive to duplicate.

Annual Certification of the Stockpile

Background. It is generally acknowledged that no responsibility of the Directors of the weapons laboratories is as important as their involvement in the annual certification process. At their meeting in Livermore, the Commission heard the Directors express concern that concluded that the present fee and evaluation structure took no notice of certification or its importance. The Directors fear that, over time, the parent corporations operating the laboratories could form the erroneous impression that certification is not important to the government.

It would be inappropriate to assign any variable fee to the certification process. The Directors' independent assessment is crucial (indeed, Congress mandates that their letters be transmitted to Congress unaltered to help ensure independence). Assigning a fee could appear to be a government evaluation of the Directors' certification, which would compromise the crucial independence of the process. At the same time, formal recognition of the continuing importance of certification may be important enough to warrant inclusion in the Commission's report.

Options. The Commission could (1) remain silent on the issue or (2) include words similar to the following at an appropriate place in the report:

> No responsibility of the Directors of the weapons laboratories is as important as their involvement in the annual certification process. Despite this, the existing laboratory fee and evaluation structure takes no notice of certification or its importance. Over time, this could lead to the erroneous impression that certification is not important to the government. NNSA should find an appropriate, formal way to recognize the importance of the process. This should not involve assigning a fee to certification, however. Doing so could appear to be a government evaluation of the Directors' certification, which would compromise the crucial independence of the process.

Verification of Elimination of Nuclear Weapons

Background. In the Interim report, the Commission made the following finding:

Four senior statesmen have urged that the nation work towards the global elimination of nuclear weapons. It is clear that the goal of zero nuclear weapons is extremely difficult to attain and would require a fundamental transformation of the world political order. If, however, the new administration accepts their proposal as a long-term goal, there are steps that could be taken in the next few years that would be consistent with such a goal and, at the same time, consistent with maintaining and even increasing our security. Some of our recommendations will deal with such steps.

One area in which additional work is required to evaluate the feasibility of elimination of nuclear weapons is verification. The NNSA weapons laboratories are uniquely qualified to carry out research in this area.

Options. The Commission could (1) remain silent on the issue or (2) in their discussion of near term steps relating to elimination, recommend significant new R&D funding on verification. Any amount is arbitrary, but dedicated funding of perhaps $100 million might send an appropriate signal.

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1. In choosing among these alternatives, the Commission should recall the view of Livermore Director George Miller that a formal test readiness program is unnecessary. His argument that, given that the holes for emplacing devices already exist, we can test if we need to. Neither the EWG nor NNSA fully agree with this conclusion.